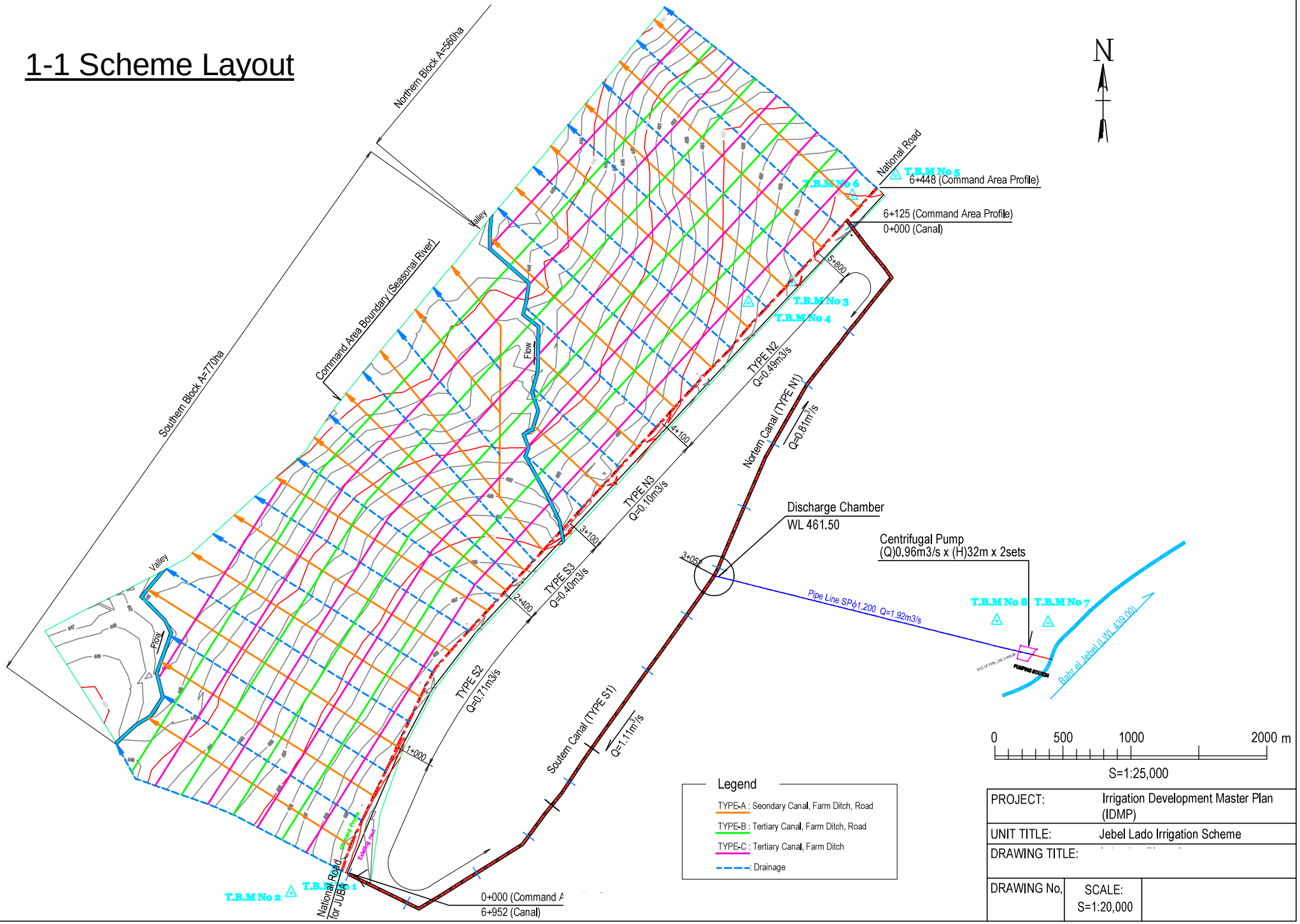
APPENDIX - 2

DRAWINGS

List of Drawings: Jebel Lado Irrigation Scheme

No.	Name of Drawing	Sheet
1. Irrigation Plan		
1-1	Scheme Layout	1
2. Pump Station		
2-1	Pump Station	1
2-2	Discharge Chamber	1
3. Main Irrigation Canal (Northern Canal)		
3-1	Profile of Northern Canal	1
3-2	Typical Cross Section of Northern Canal	1
3-3,3-4	Cross Section of Northern Canal (1/2) - (2/2)	2
4. Main Irrigation Canal (Southern Canal)		
4-1	Profile of Southern Canal	1
4-2	Typical Cross Section of Southern Canal	1
4-3, 4-4	Cross Section of Southern Canal (1/2) - (2/2)	2
5. Secondary Canal and Drainage Canal		
5-1	Typical Cross Section of Command Area	1
5-2	Typical Cross Section of Drainage Canal	1
6. Road Crossing Structure		
6-1	Road Crossing	1
	Total	14

1-1 Scheme Layout

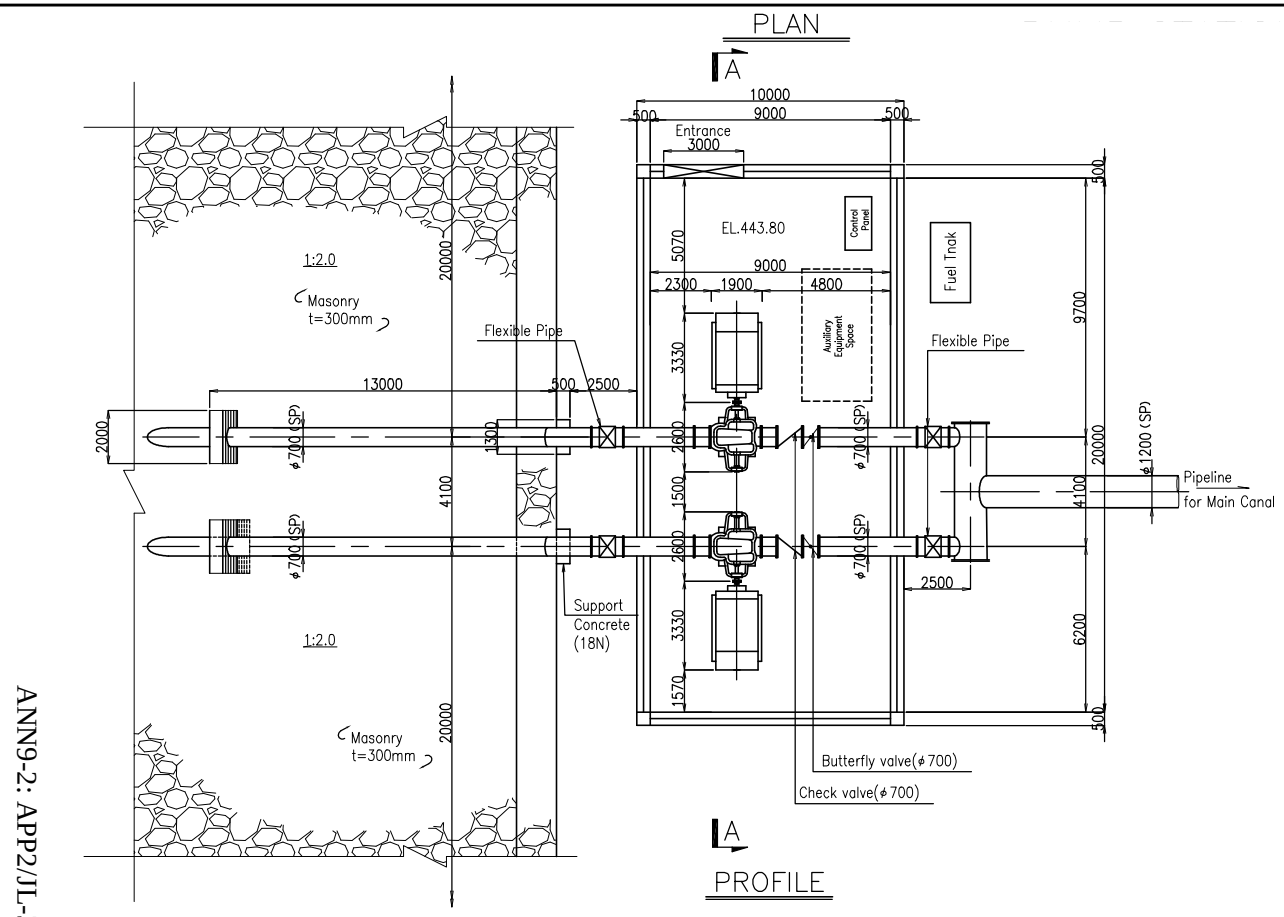


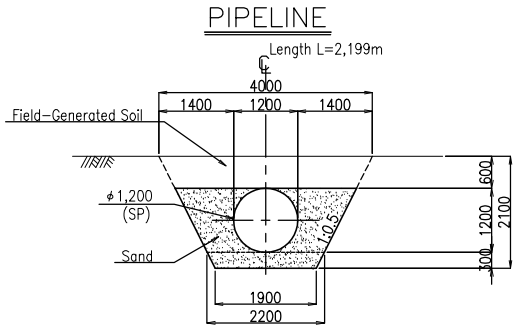
PROJECT:	Irrigation Development Master Plan (IDMP)
UNIT TITLE:	Jebel Lado Irrigation Scheme
DRAWING TITLE:	
DRAWING No.	SCALE: S=1:20,000

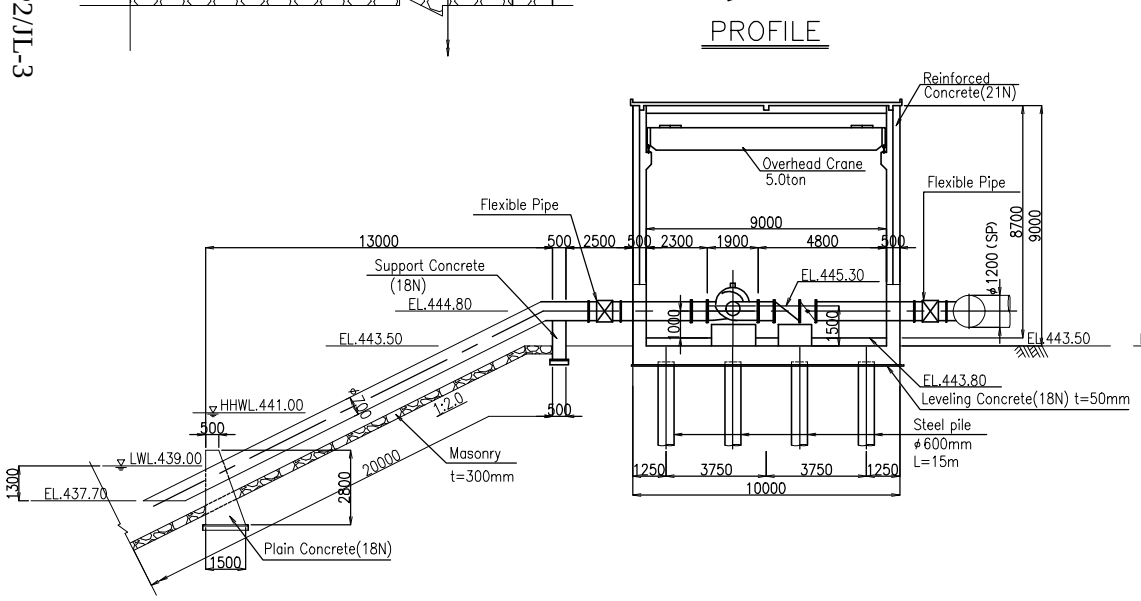
ANN9-2: APP2/JL-2

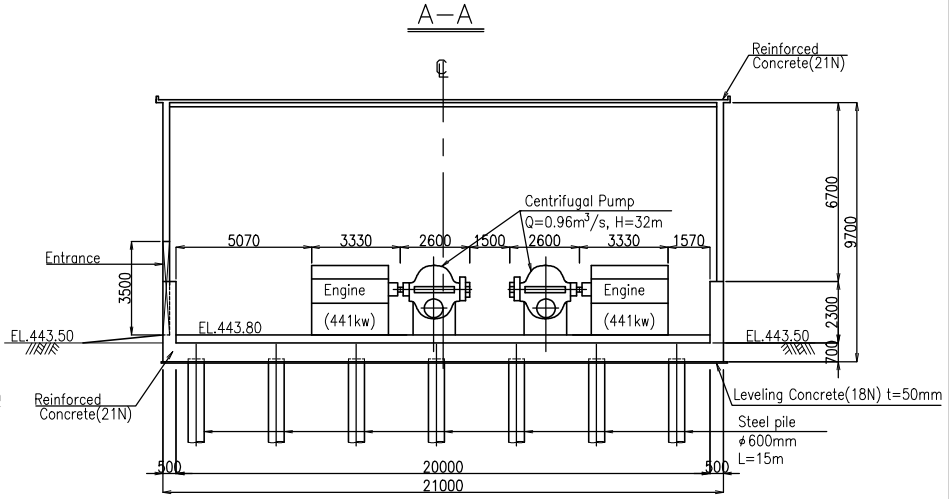
2-1 Pump Station

ANN9-2: APP2/JL-3





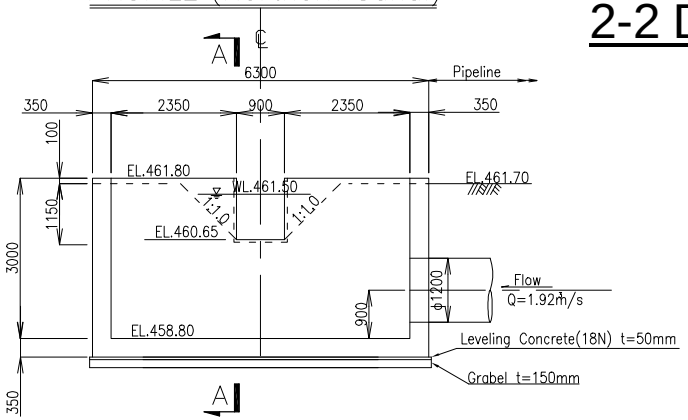




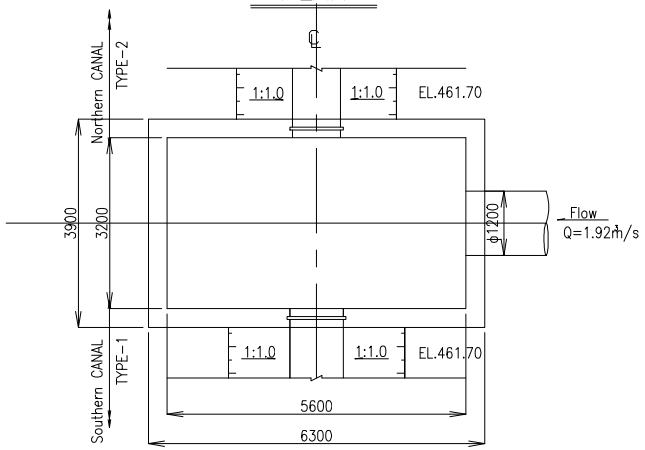
2-2 Discharge Chamber

ANN9-2: APP2/JL-4

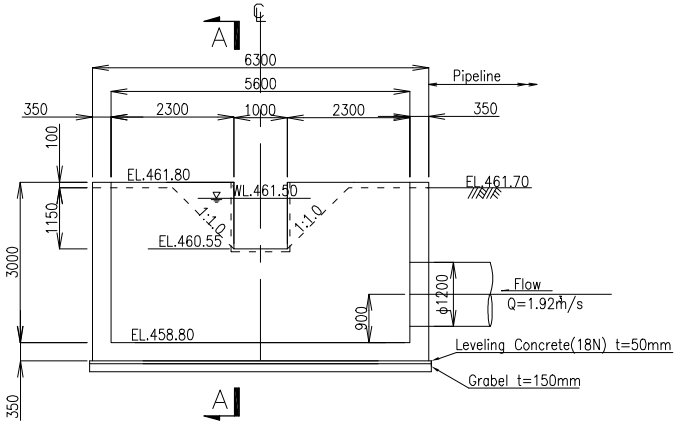
PROFILE (Northern Canal)



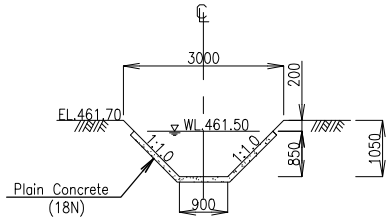
PLAN



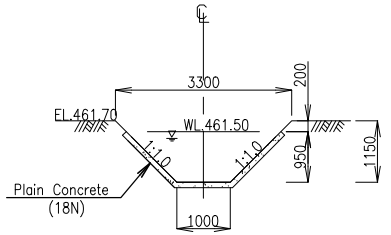
PROFILE (Soutern Canal)



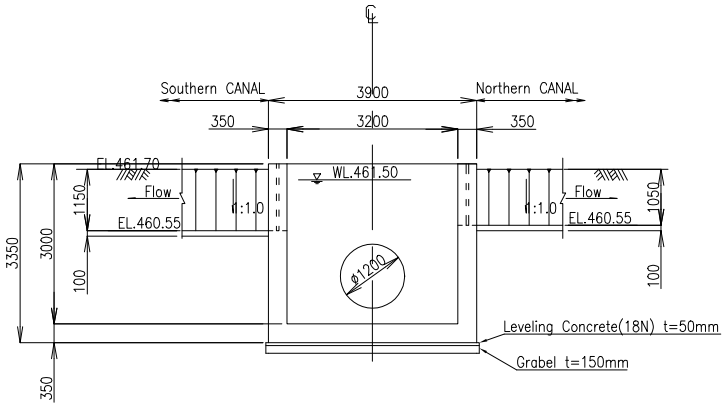
Northern Canal



Southern Canal

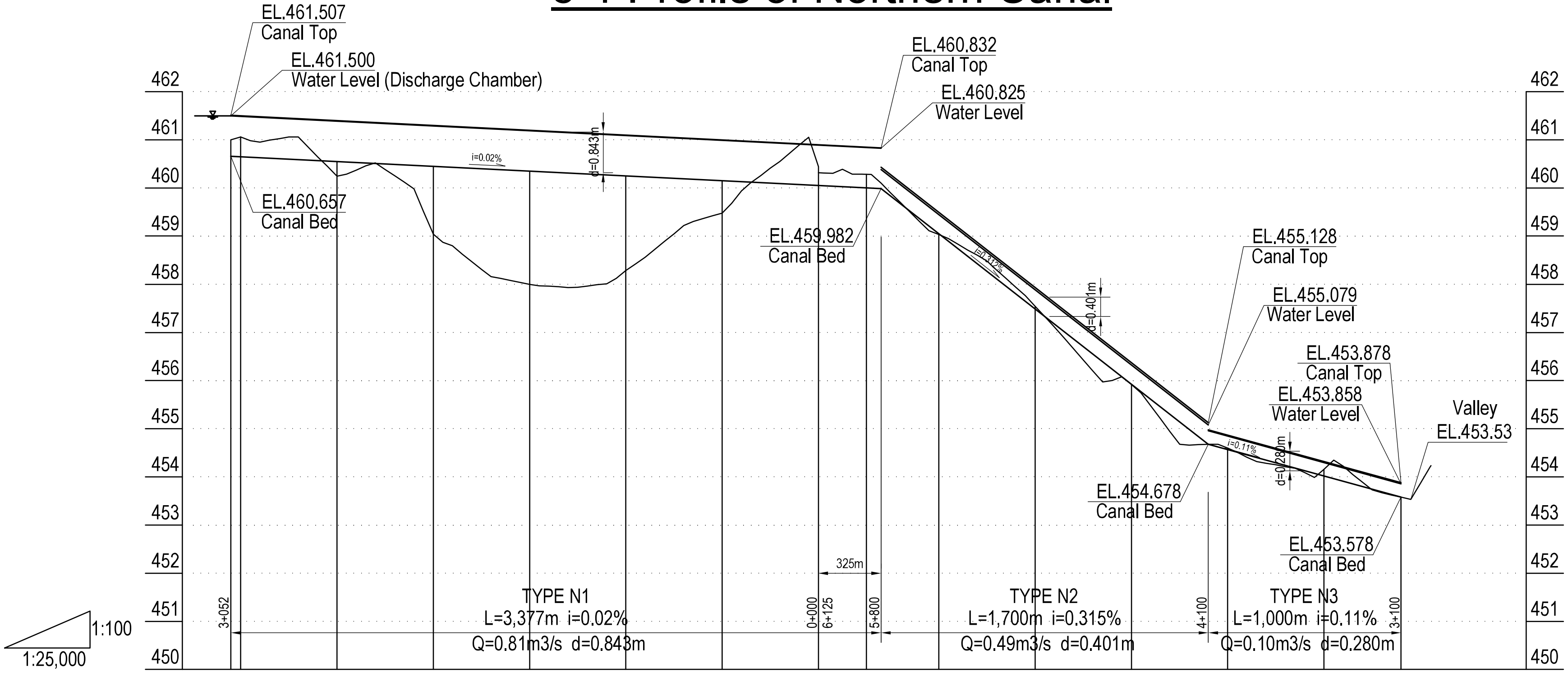


A—A



ANN9-2: APP2/JL-5

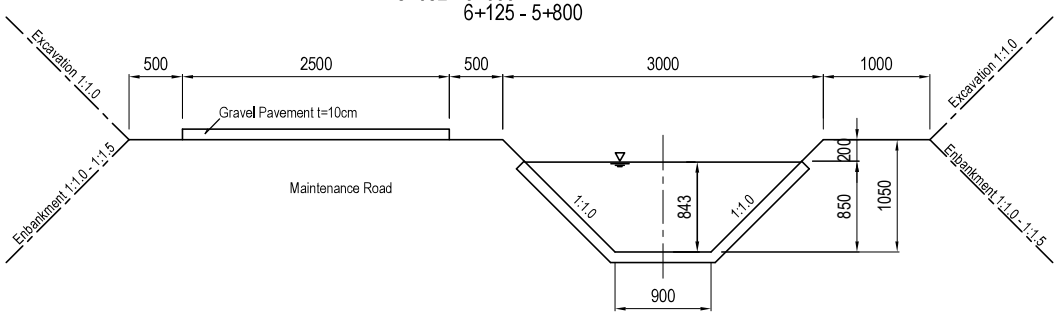
3-1 Profile of Northern Canal



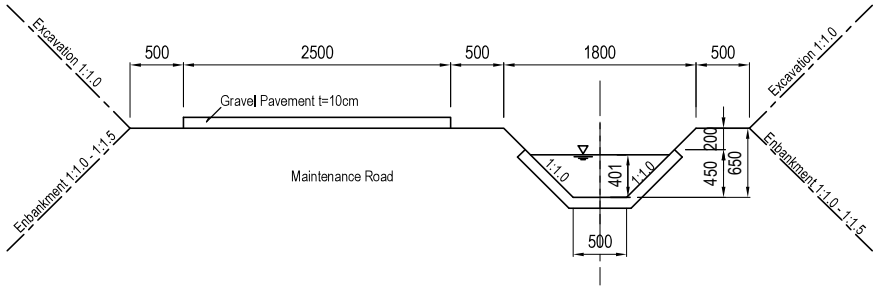
PLAN	GRADIENT	i=1:5,000 (0.02%)										i=1:321 (0.315%)			i=1:909 (0.11%)		
	DESIGN DISCHARGE	Q=0.81m3/s										Q=0.49m3/s			Q=0.10m3/s		
	WATER LEVEL	461.500	461.490	461.390	461.290	461.190	461.090	460.990	460.890		460.840	459.447	457.887	456.327	454.848	454.298	453.858
	TOP LEVEL	461.507	461.497	461.397	461.297	461.197	461.097	460.997	460.897		460.847	459.496	457.936	456.376	454.868	454.318	453.878
	BED LEVEL	460.657	460.647	460.547	460.447	460.347	460.247	460.147	460.047		459.997	459.046	457.486	455.926	454.568	454.018	453.578
PRESENT	GROUND LEVEL	461.00	461.06	460.24	459.04	458.00	458.28	459.48	460.44	460.32	460.39	459.03	457.54	455.92	454.60	454.16	453.58
	STATION NO.	3+052	3+000	2+500	2+000	1+500	1+000	0+500	0+000	6+125	6+000	5+500	5+000	4+500	4+000	3+500	3+100

3-2 Typical Cross Section of Northern Canal

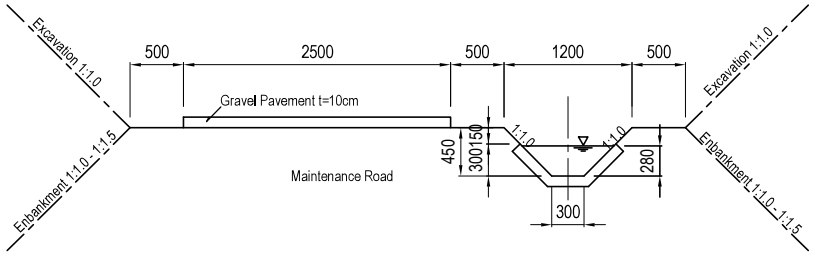
TYPE N1
3+052 - 0+000
6+125 - 5+800



TYPE N2
5+800 - 4+100



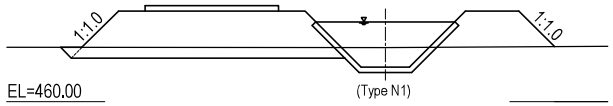
TYPE N3
4+100 - 3+100



ANN9-2: APP2/JL-6

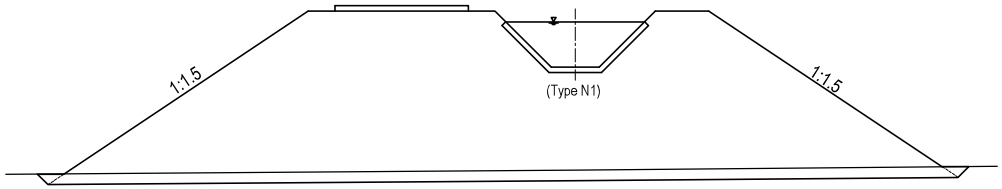
3-3 Cross Section of Northern Canal (1/2)

3+000
(Canal)



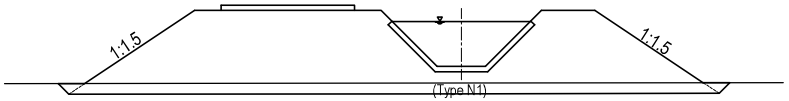
EL=460.00

1+000
(Canal)



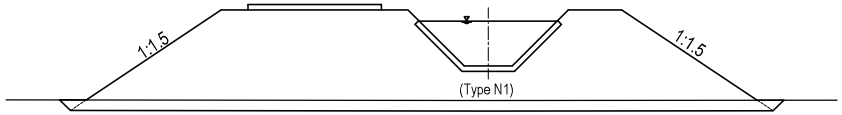
EL=457.00

2+500
(Canal)



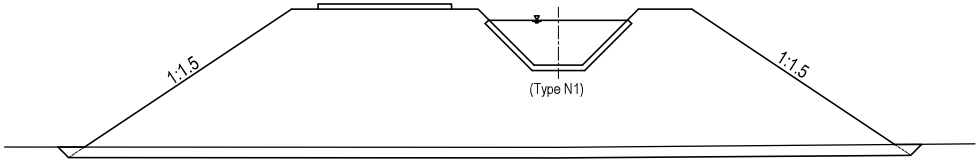
EL=459.00

0+500
(Canal)



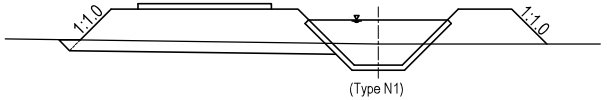
EL=458.00

2+000
(Canal)



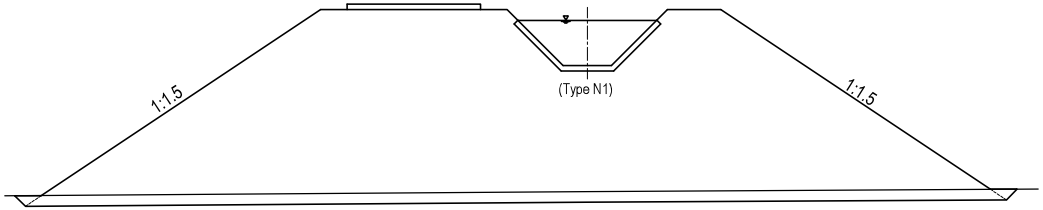
EL=458.00

0+000 (Canal) 6+125 (Command Area)



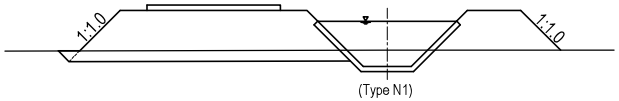
EL=450.00

1+500
(Canal)



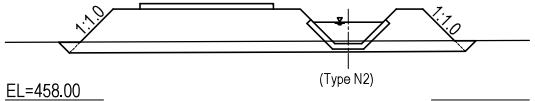
EL=457.00

6+000
(Command Area)



EL=459.00

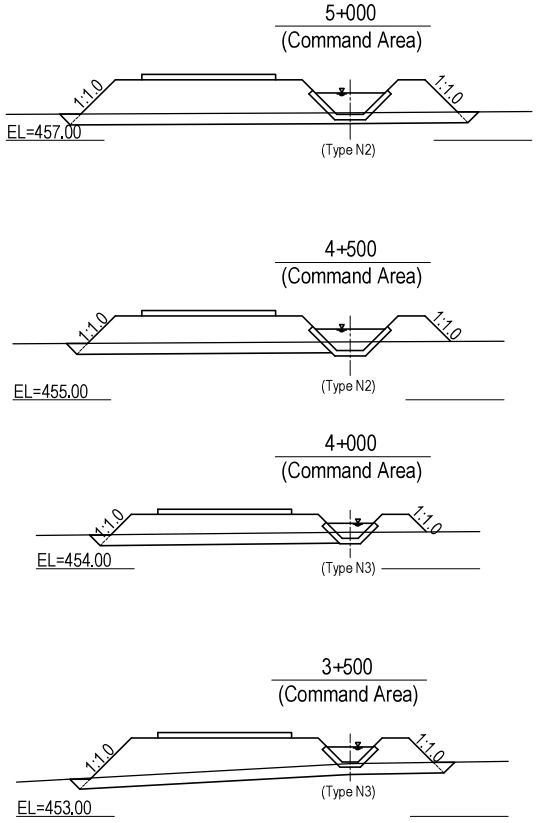
5+500
(Command Area)



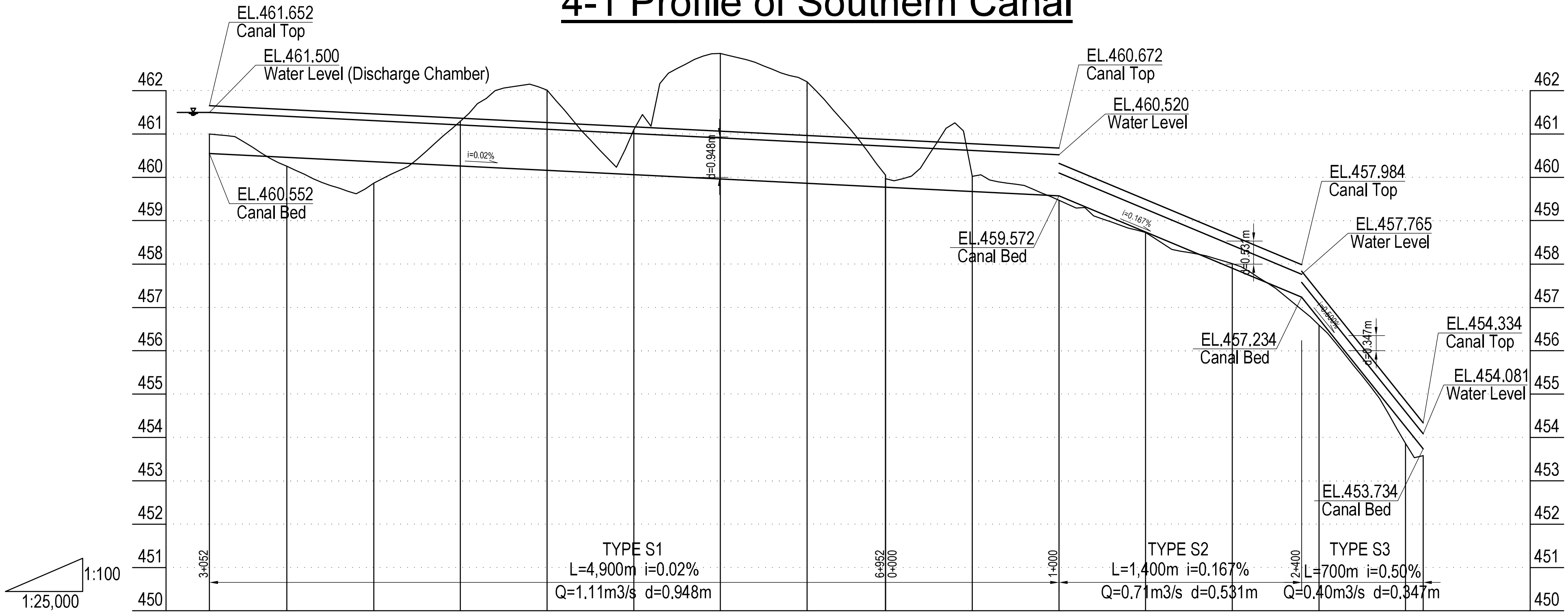
EL=458.00

ANN9-2: APP2/JL-7

3-4 Cross Section of Northern Canal (2/2)



4-1 Profile of Southern Canal

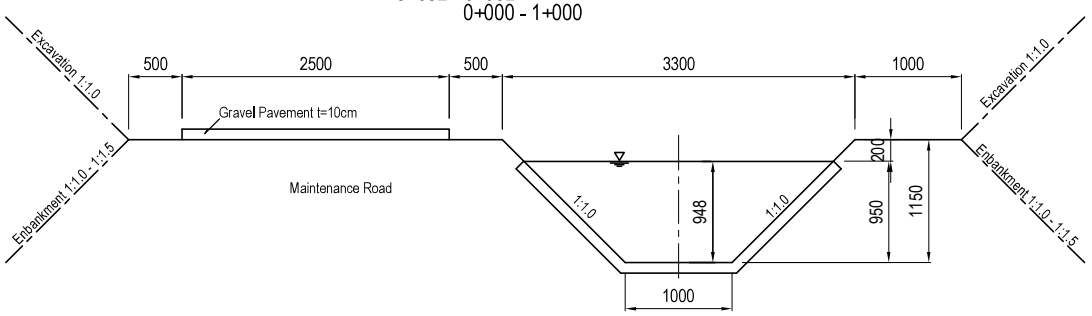


PLAN	GRADIENT	i=1:5,000 (0.02%)										i=1:600 (0.167%)			i=1:200 (0.50%)		
PLAN	DESIGN DISCHARGE	Q=1.11m3/s										Q=0.71m3/s			Q=0.40m3/s		
PLAN	WATER LEVEL	461.500	461.410	461.310	461.210	461.110	461.010	460.910	460.810	460.720	460.620	460.520 460.103	459.268	458.433	457.081	454.581	454.081
PLAN	TOP LEVEL	461.652	461.562	461.462	461.362	461.262	461.162	461.062	460.962	460.872	460.772	460.672 460.322	459.487	458.652	457.334	454.834	454.334
PLAN	BED LEVEL	460.552	460.462	460.362	460.262	460.162	460.062	459.962	459.862	459.772	459.672	459.572	458.737	457.902	456.734	454.234	453.734
PRESENT	GROUND LEVEL	461.00	460.26	459.87	461.29	462.01	461.10	462.86	462.20	460.05 459.97	460.02	459.47	458.73	458.01	456.59	453.86	453.58
PRESENT	STATION NO.	3+052	3+500	4+000	4+500	5+000	5+500	6+000	6+500	6+952 0+000	0+500	1+000	1+500	2+000	2+500	3+000	3+100

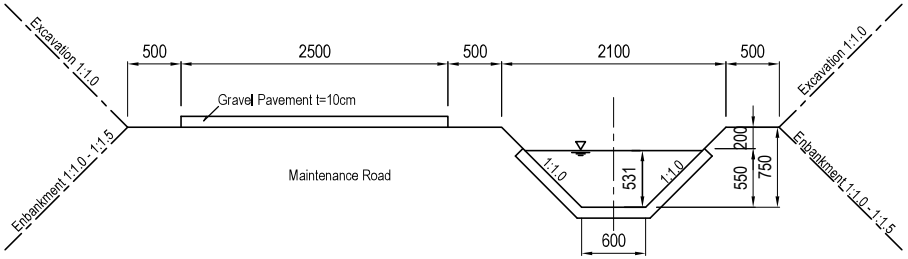
ANN9-2: APP2/JL-9

4-2 Typical Cross Section of Southern Canal

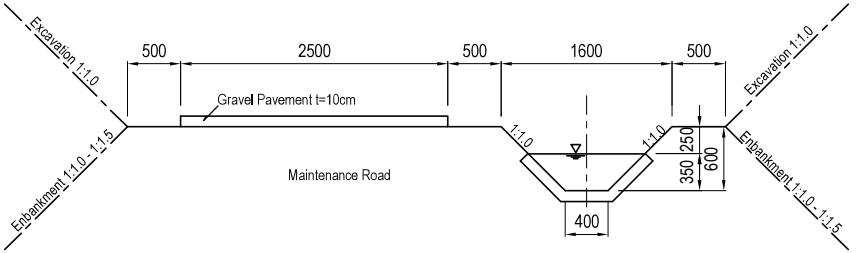
TYPE S1
3+052 - 6+952
0+000 - 1+000



TYPE S2
1+000 - 2+400



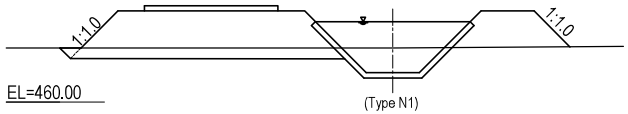
TYPE S3
2+400 - 3+100



4-3 Cross Section of Southern Canal (1/2)

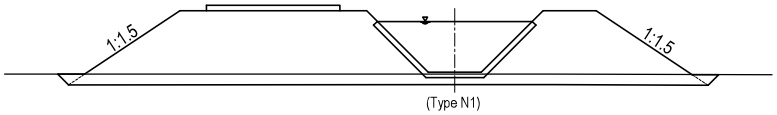
ANN9-2: APP2/JL-11

3+052
(Command Area)



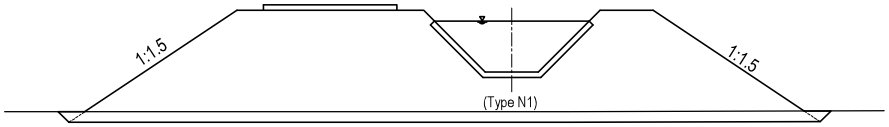
EL=460.00

3+500
(Command Area)



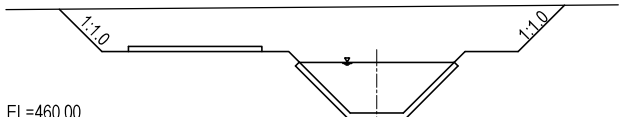
EL=459.00

4+000
(Command Area)



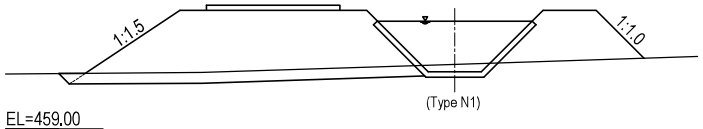
EL=459.00

5+000
(Command Area)



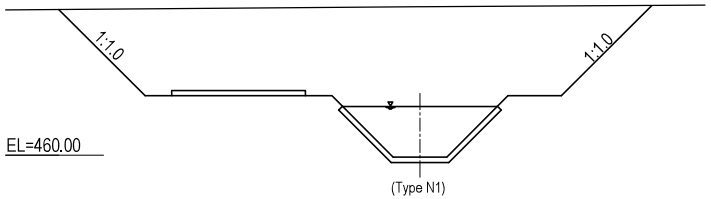
EL=460.00

5+500
(Command Area)



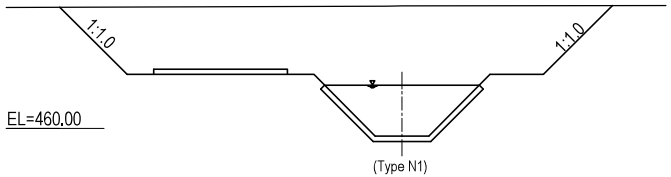
EL=459.00

6+000
(Command Area)



EL=460.00

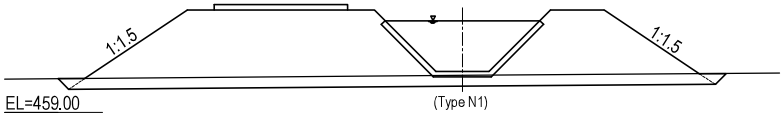
6+500
(Command Area)



EL=460.00

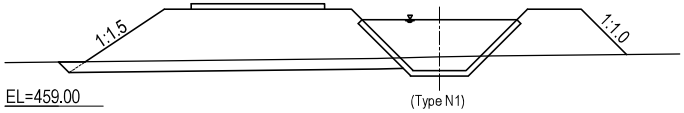
6+952
(Command Area)

0+000
(Canal)



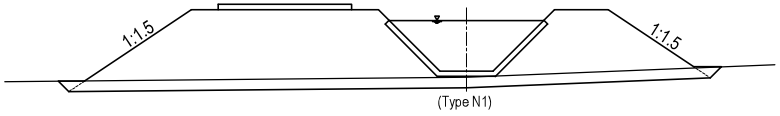
EL=459.00

0+500
(Canal)



EL=459.00

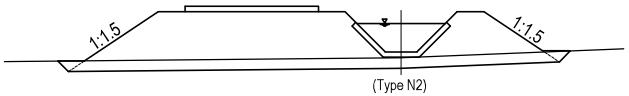
1+000
(Canal)



EL=458.00

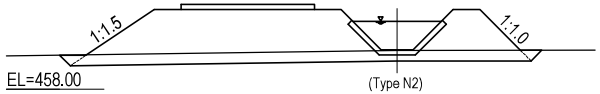
4-4 Cross Section of Southern Canal (2/2)

1+000
(Canal)



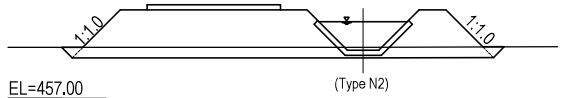
EL=458.00

1+500
(Canal)



EL=458.00

2+000
(Canal)

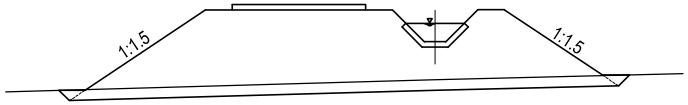


EL=457.00

2+500
(Canal)

EL=455.00

3+000
(Canal)

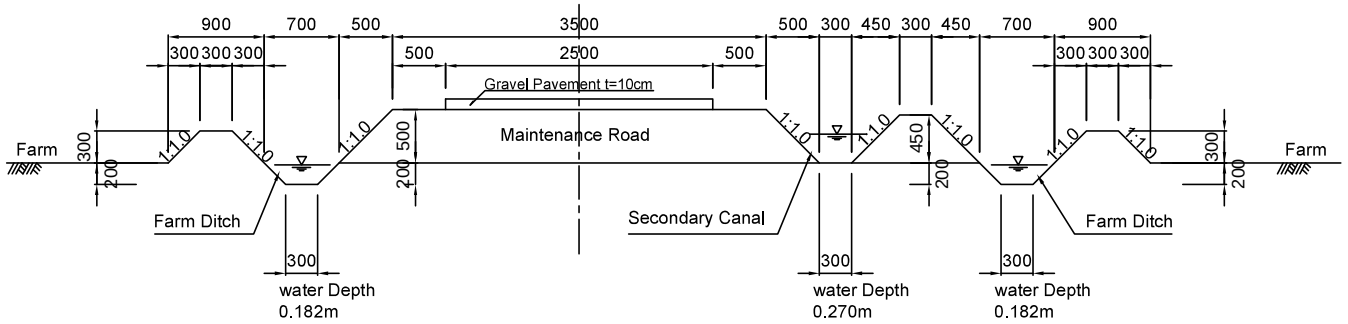


EL=452.00

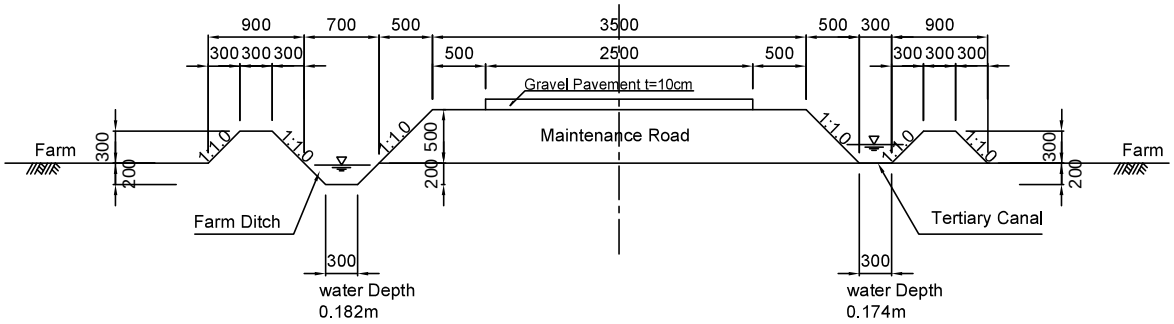
ANN9-2: APP2/JL-12

5-1 Typical Cross Section of Command Area

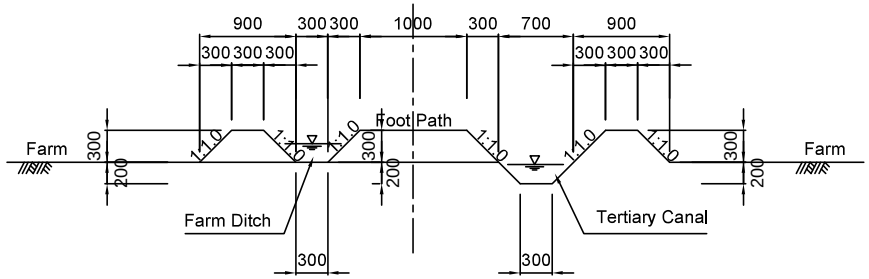
TYPE-A



TYPE-B



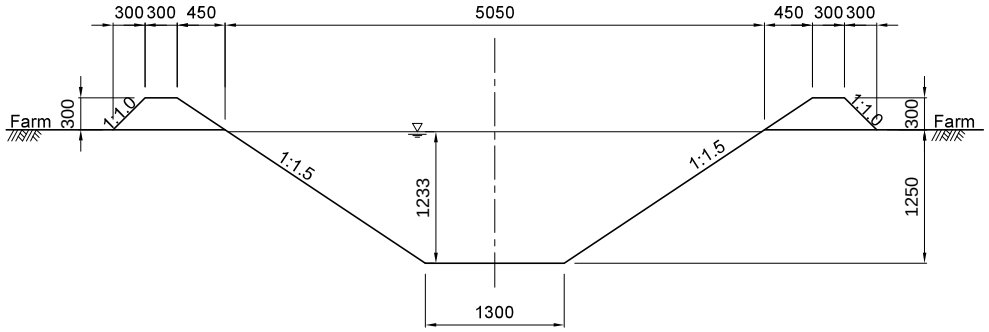
TYPE-C



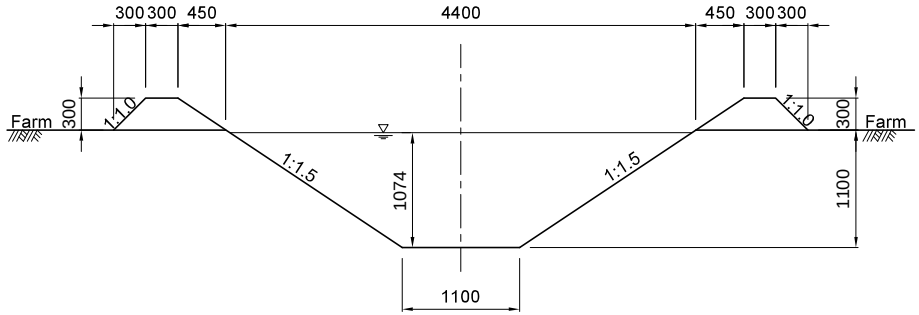
ANN9-2: APP2/JL-13

5-2 Typical Cross Section of Drainage Canal

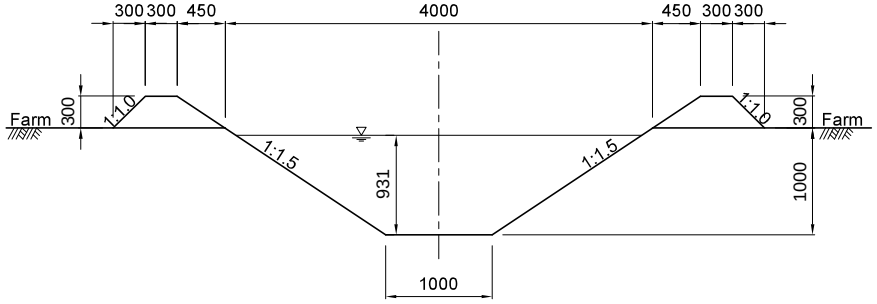
SD-1 (Q=3.78m3/s)



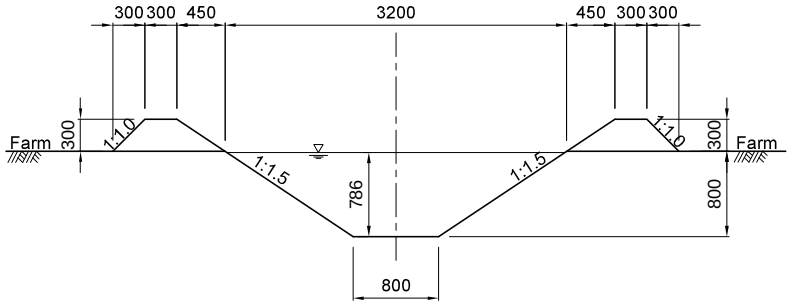
SD-2 (Q=2.83m3/s)



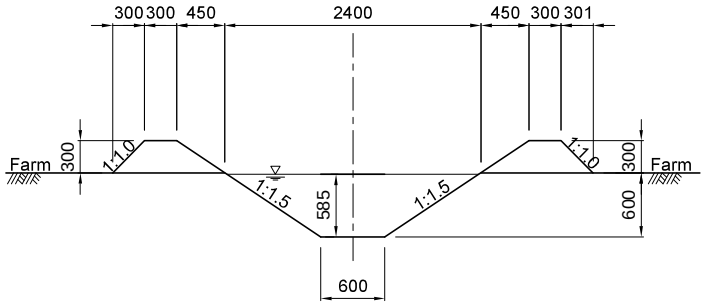
SD-3 (Q=2.16m3/s)



SD-4 (Q=1.44m3/s)



SD-5 (Q=0.72m3/s)

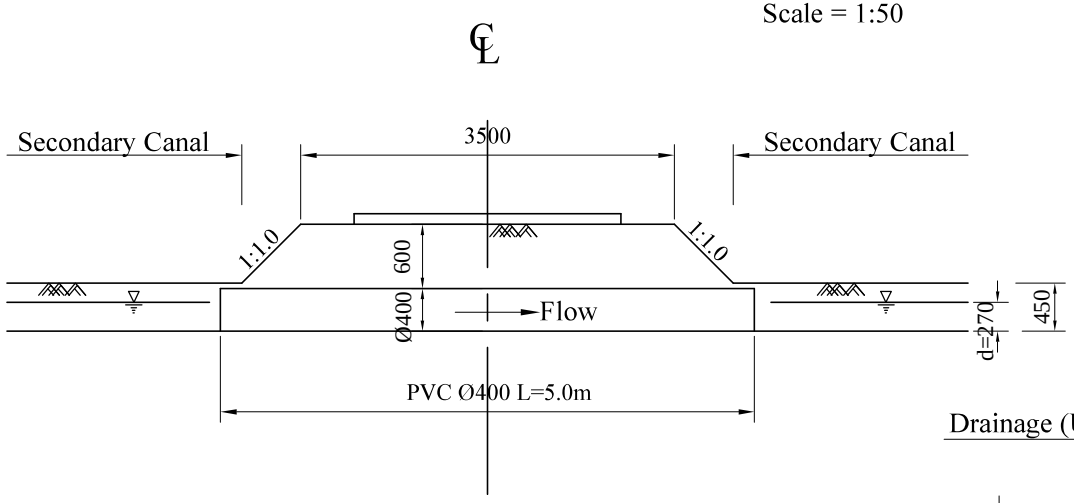


ANN9-2: APP2/JL-14

6-1 Road Crossing

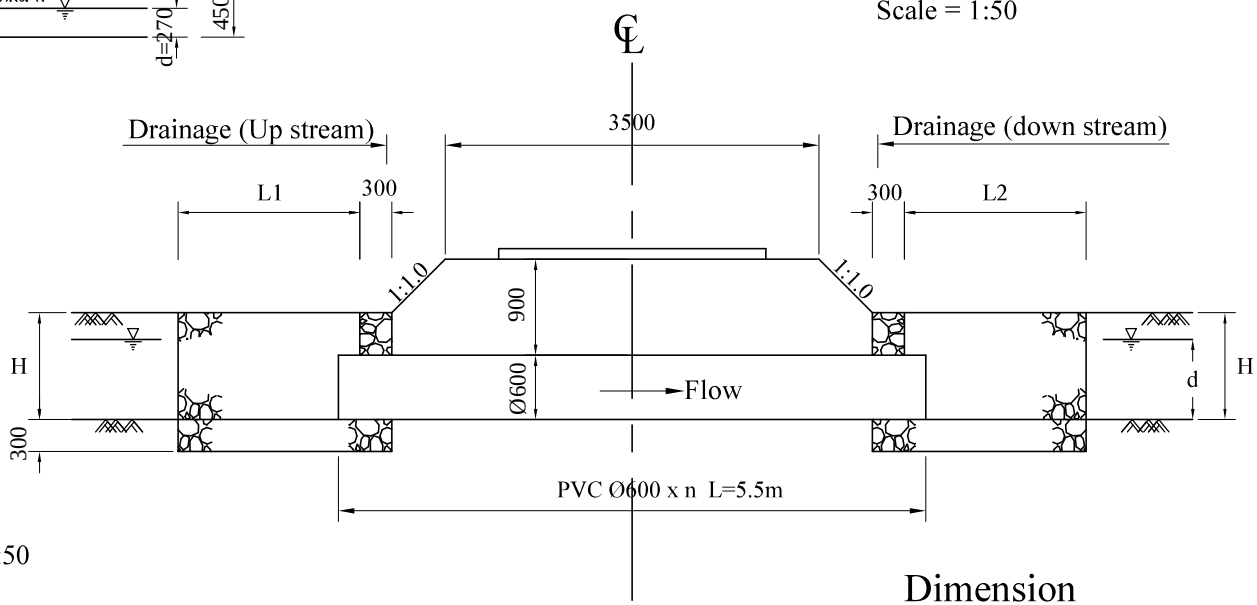
Road Crossing of Secondary Canal

Scale = 1:50



Road Crossing of Drainage

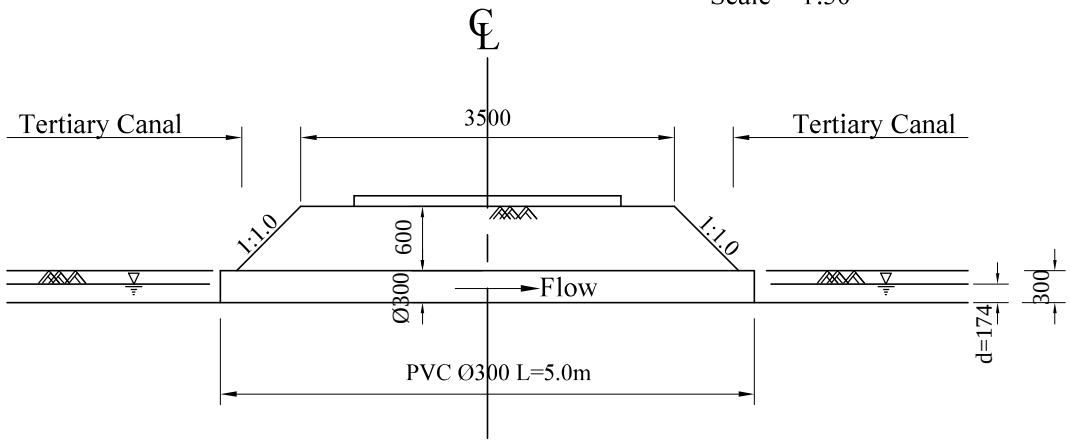
Scale = 1:50



ANN9-2: APP2/JL-15

Road Crossing of Tertiary Canal

Scale = 1:50



Dimension

Type	d (m)	H (m)	L1 (m)	L2 (m)	n
SD - 1	1.23	1.25	4.0	6.5	
SD - 2	1.07	1.10	3.5	5.5	4
SD - 3	0.93	1.00	3.0	5.0	3
SD - 4	0.79	0.80	2.5	4.0	2
SD - 5	0.59	0.60	2.0	3.0	1

APPENDIX - 3

PROJECT INVESTMENT COST

3.1 Project Investment Cost

Jebel Lado Irrigation Scheme

Project Cost 34 million US$

No.	Work Description	Unit	Quantity	Price (1000 US$)	Total (1000 US$)
1. Works					
1-1.	Pump Station	LS.	1	1,999	1,999
1-2.	Pipeline	LS.	1	3,437	3,437
1-3.	Main Irrigation Canal	LS.	1	7,908	7,908
1-4.	Facilities in Command Area	LS.	1	7,162	7,162
				Sub-total	20,506
	Direct Construction Cost (A)				**20,506**
	Indirect Construction Cost (B = A * 45%)				**9,228**
		C = A + B			**29,734**
	Adminiostration (D = C * 4%)				**1,189**
	Consultant Fee (E = C * 5%)				**1,487**
	Physical Contingency (F = C * 5%)				**1,487**
	Grand Total Cost (F = C + D + E)				**33,897**
					34,000
					(*1000 US$)
				FC. (60%)	**20,400**
				LC. (40%)	**13,600**
					(*1000 US$)
		ha	34 million US$ / 1330ha =		**25,600**
					(US$)

3.2 Pump Station & Pipeline Works

Jebel Lado Irrigation Scheme

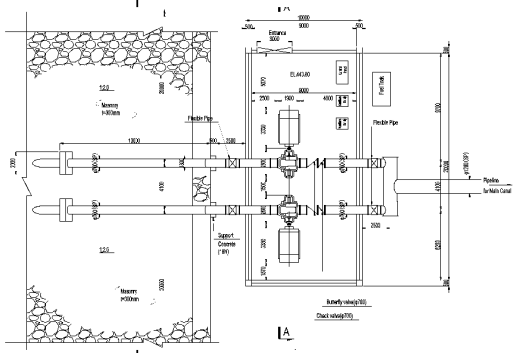
Pump Statoin & Pipeline Works 5.4 million US$

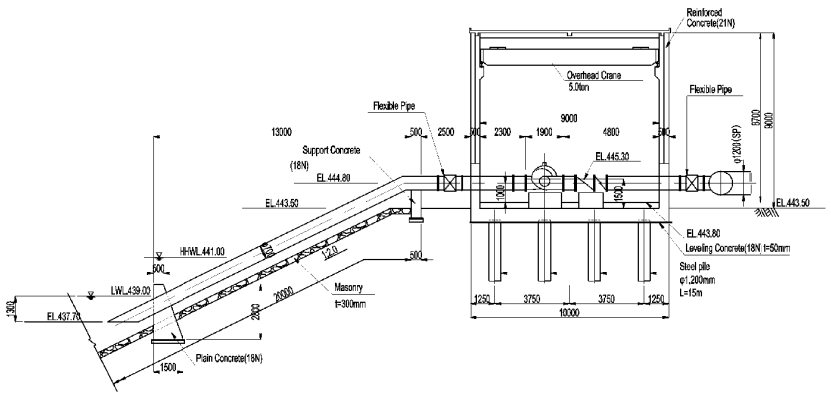
No.	Work Description	Unit	Quantity	Unit Price (US$)	Total (US$)
1. Pump Station Work					
1-1.	**Pump Building**				
1-1-1.	Common Excavation	m3	451	10.0	4,509
1-1-2.	Leveling Concrete	m3	11	350.0	3,784
1-1-3.	Backfill	m3	28	11.0	313
1-1-4.	Building	m2	210	2,800.0	588,000
				Sub total	596,606
1-2. Pump Facilities					
1-2-1.	Pump Facilities (Pump, Engne & Auxiliary equipment)	nos	2	420,000.0	840,000
1-2-2.	Pipe(SP, ű700)	m	50	500.0	25,115
1-2-3.	Control Panel	nos	1	86,500.0	86,500
1-2-4.	Overhead Crane(5ton)	nos	1	77,900.0	77,900
1-2-5.	Butterfly valve(ű700)	nos	2	33,000.0	66,000
1-2-6.	Check valve(ű700)	nos	2	64,000.0	128,000
1-2-7.	Flexible tube(ű700)	nos	4	8,100.0	32,400
1-2-8.	Steel pile(ű600, L=15m)	nos	28	3,600.0	100,800
				Sub total	1,356,715
1-3.	**Slope protection**				
1-3-1.	Masonry	m3	265	140.0	37,044
1-3-2.	Support Concrete (18N)	m3	13	350.0	4,582
1-3-3.	Leveling Concrete	m3	1	350.0	350
1-3-4.	Gravel	m3	1	50.0	72
1-3-5.	Temporary Works (River Close) 10% of above sum	L.S	1	4,200.0	4,200
				Sub total	46,248
2. Pipeline Work					
2-1.	**Pipeline**				
2-1-1.	Common Excavation	m3	13,623	10.0	136,228
2-1-2.	Sand(under)	m3	1,352	24.0	32,457
2-1-3.	Sand(around)	m3	4,903	24.0	117,669
2-1-4.	Backfill	m3	4,882	11.0	53,700
2-1-5.	Pipe(SP, ű1,200)	m	2,199	1,400.0	3,078,600
				Sub total	3,418,654
2-2.	**Discharge Chamber**				
2-2-1.	Common Excavation	m3	375	10.0	3,751
2-2-2.	Leveling Concrete	m3	1	300.0	384
2-2-3.	Gravel	m3	4	50.0	192
2-2-4.	Backfill	m3	243	11.0	2,676
2-2-5.	Reinforced Concrete	m3	25	440.0	11,057
				Sub total	18,060
			Direct cost	**Sub-total**	**5,436,283**
			Pump Station		**1,999,569**
			Pipeline		**3,436,714**

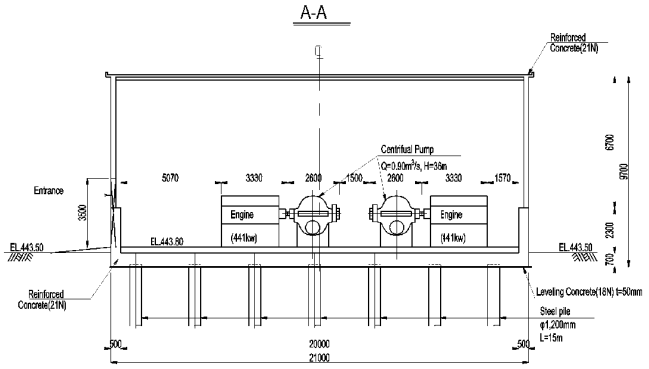
Quantity Calculation

Irrigation Scheme : Wau Rice Scheme
Item of Work : Pump Station Work

Item	Calculation			Quantity	Unit	Remark
1. Pump Station Work						
1-1. Pump Building						
1-1-1. Common Excavation	1/2*{(11.00*22.00)+(12.40*23.40)}*0.70	=	186.26			
	20.00*(20.00+4.10+20.00)*0.3	=	264.60			
			450.86	450.86	m3	







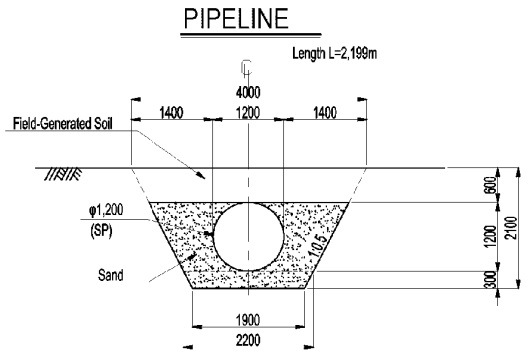
Irrigation Scheme : Wau Rice Scheme
Item of Work : Pump Station Work

Item	Calculation			Quantity	Unit	Remark
1-1-2. Leveling Concrete	10.20*21.20*0.05	=		10.81	m3	
1-1-3. Backfill	186.26-10.81-(10.00*21.00*0.70)	=		28.45	m3	
1-1-4. Building	10.00*21.00	=		210.00	m2	
1-1-5. Pump Facilities (Pump, Engne & Auxiliary equipment)				2.00	nos	
1-1-6. Pipe(SP, ϕ 700)	2*(15.876+1.70+3.25+0.60+3.69)	=		50.23	m	φ700、SP
1-1-7. Control Panel				1.00	nos	
1-1-8. Overhead Crane(5ton)				1.00	nos	
1-1-9. Butterfly valve(ϕ 700)				2.00	nos	
1-1-10. Check valve(φ700)				2.00	nos	
1-1-11. Flexible tube(φ700)				4.00	nos	
1-1-12. Steel pile(ϕ 600, L=15m)	4*7			28.00	nos	
1-2. Slope protection						
1-2-1. Masonry	20.00*(20.00+4.10+20.00)*0.30			264.60	m3	
1-2-2. Support Concrete (18N)	2*{1/2*(0.50+1.50)*2.80*2.00}	=	11.20			
	2*(0.50*1.45*1.30)	=	1.89			
			13.09	13.09	m3	
1-2-3. Leveling Concrete	2*(1.70*2.20*0.05+0.70*1.50*0.05)	=		0.48	m3	
1-2-4. Gravel	2*(1.70*2.20*0.15+0.70*1.50*0.15)	=		1.44	m3	

Quantity Calculation

Irrigation Scheme : Wau Rice Scheme
Item of Work : Pipeline Work

Item	Calculation		Quantity	Unit	Remark
2. Pipeline Work					
2-1. Pipeline					
2-1-1. Common Excavation	1/2*(4.00+1.90)*2.10*2,199.00	=	13,622.81	m3	
2-1-2. Sand(under)	1/2*(2.20+1.90)*0.30*2,199.00	=	1,352.39	m3	
2-1-3. Sand(around)	{1/2*(3.40+2.20)*1.20-1.20^2* π /4}*2,199.00	=	4,902.89	m3	
2-1-4. Backfill	1/2*(4.00+3.40)*0.60*2,199.00	=	4,881.78	m3	
2-1-5. Pipe(SP, φ 1,200)		=	2,199.00	m	



Quantity Calculation

Irrigation Scheme : Wau Rice Scheme
Item of Work : Discharge Chamber Work

Item	Calculation			Quantity	Unit	Remark
4. Discharge Chamber Work						
4-1. Discharge Chamber						
4-1-1. Common Excavation	1/2*((7.30*4.90)+(14.4*12.0))*3.55+(6.3*3.9*0.20)	=		375.13	m3	
4-1-2. Leveling Concrete	6.4*4.0*0.05	=		1.28	m3	
4-1-3. Gravel	6.4*4.0*0.15	=		3.84	m3	
4-1-4. Backfill	375.13-7.3*4.9*3.55-6.3*3.9*0.2	=		243.23	m3	
4-1-5. Reinforced Concrete	Base 6.6*3.9*0.35	=	8.60			
	Wall 1 3.9*3.0*0.35*2	=	8.19			
	Wall 2 5.6*3.0*0.35*2	=	11.76			
	South c -1.0*1.25	=	-1.25			
	North c -0.9*1.15	=	-1.04			
	Pipe -1/4*3.14*1.2^2	=	-1.13			
			25.13	25.13	m3	

3.3 Main Irrigation Canal Works

Jebel Lado Irrigation Scheme

Main Irrigation Canal Works 7.9 million US$

No.	Work Description	Unit	Quantity	Unit Price (US$)	Total (US$)
North Canal					
1. TYPE N1					
1-1. Preparatory Work					
1-1-1.	Site Clearing (Cutting & Clearing of Grass, Bushes)	ha	4.5	11,900.0	53,550
	*Average width of excavation x Canal length			**Sub total**	**53,550**
1-2. Earth Work					
1-2-1.	Excavation of Surface Soil (200mm Depth)	m3	8,694	8.0	69,554
1-2-2.	Excavation for Common Soil	m3	577	10.0	5,774
1-2-3.	Spreading (Bulldozer)	m3	75,196	13.0	977,545
1-2-4.	Embankment with Compaction	m3	75,196	14.0	1,052,741
1-2-5.	Soil (Banking Material)	m3	74,618	7.6	567,100
1-2-6.	Hauling by Dump Truck (Banking Material)	m3	74,618	9.0	671,566
1-2-7.	Aggregate, Crushed, 2-4cm (Gravel Pavement)	m3	819	50.0	40,965
1-2-8.	Spreading of Aggregate (Bulldozer)	m3	819	13.0	10,651
				Sub total	**3,395,896**
1-3. Canal Work (Main Canal)					
1-3-1.	Class 18 Concrete (include Form Work)	m3	1,182	350.0	413,700
				Sub total	**413,700**
1-4. Canal Structure (Main Canal)					
1-4-1.	Turnout (Slide Gate, B=0.3m, H=0.3m)	unit	1	220.0	220
				Sub total	**220**
				Total	**3,863,366**
2. TYPE N2					
2-1. Preparatory Work					
2-1-1.	Site Clearing (Cutting & Clearing of Grass, Bushes)	ha	1.3	11,900.0	15,470
	*Average width of excavation x Canal length			**Sub total**	**15,470**
2-2. Earth Work					
2-2-1.	Excavation of Surface Soil (200mm Depth)	m3	2,225	8.0	17,800
2-2-2.	Excavation for Common Soil	m3	908	10.0	9,080
2-2-3.	Spreading (Bulldozer)	m3	6,969	13.0	90,596
2-2-4.	Embankment with Compaction	m3	6,969	14.0	97,565
2-2-5.	Soil (Banking Material)	m3	6,061	7.6	46,063
2-2-6.	Hauling by Dump Truck (Banking Material)	m3	6,061	9.0	54,548
2-2-7.	Aggregate, Crushed, 2-4cm (Gravel Pavement)	m3	425	50.0	21,250
2-2-8.	Spreading of Aggregate (Bulldozer)	m3	425	13.0	5,525
				Sub total	**342,427**
2-3. Canal Work (Main Canal)					
2-3-1.	Class 18 Concrete (include Form Work)	m3	340	350.0	119,000
				Sub total	**119,000**
2-4. Canal Structure (Main Canal)					
2-4-1.	Turnout (Slide Gate, B=0.3m, H=0.3m)	unit	5	220.00	1,100
				Sub total	**1,100**
				Total	**477,997**

3. TYPE N3					
3-1. Preparatory Work					
3-1-1.	Site Clearing (Cutting & Clearing of Grass, Bushes)	ha	0.7	11,900.0	8,330
	*Average width of excavation x Canal length			**Sub total**	**8,330**
3-2. Earth Work					
3-2-1.	Excavation of Surface Soil (200mm Depth)	m3	1,617	8.0	12,932
3-2-2.	Excavation for Common Soil	m3	61	10.0	605
3-2-3.	Spreading (Bulldozer)	m3	4,832	13.0	62,817
3-2-4.	Embankment with Compaction	m3	4,832	14.0	67,649
3-2-5.	Soil (Banking Material)	m3	4,772	7.6	36,264
3-2-6.	Hauling by Dump Truck (Banking Material)	m3	4,772	9.0	42,944
3-2-7.	Aggregate, Crushed, 2-4cm (Gravel Pavement)	m3	331	50.0	16,550
3-2-8.	Spreading of Aggregate (Bulldozer)	m3	331	13.0	4,303
				Sub total	**244,064**
3-3. Canal Work (Main Canal)					
3-3-1.	Class 18 Concrete (include Form Work)	m3	172	350.0	60,200
				Sub total	**60,200**
3-4. Canal Structure (Main Canal)					
3-4-1.	Turnout (Slide Gate, B=0.3m, H=0.3m)	unit	3	220.0	660
				Sub total	**660**
				Total	**313,254**
South Canal					
4. TYPE S1					
4-1. Preparatory Work					
4-1-1.	Site Clearing (Cutting & Clearing of Grass, Bushes)	ha	5.6	11,900.0	66,640
	*Average width of excavation x Canal length			**Sub total**	**66,640**
4-2. Earth Work					
4-2-1.	Excavation of Surface Soil (200mm Depth)	m3	6,578	8.0	52,621
4-2-2.	Excavation for Common Soil	m3	24,274	10.0	242,741
4-2-3.	Spreading (Bulldozer)	m3	37,578	13.0	488,517
4-2-4.	Embankment with Compaction	m3	37,578	14.0	526,095
4-2-5.	Soil (Banking Material)	m3	13,304	7.6	101,111
4-2-6.	Hauling by Dump Truck (Banking Material)	m3	13,304	9.0	119,737
4-2-7.	Aggregate, Crushed, 2-4cm (Gravel Pavement)	m3	1,225	50.0	61,250
4-2-8.	Spreading of Aggregate (Bulldozer)	m3	1,225	13.0	15,925
				Sub total	**1,607,997**
4-3. Canal Work (Main Canal)					
4-3-1.	Class 18 Concrete (include Form Work)	m3	1,911	350.0	668,850
				Sub total	**668,850**
4-4. Canal Structure (Main Canal)					
4-4-1.	Turnout (Slide Gate, B=0.3m, H=0.3m)	unit	2	220.0	440
				Sub total	**440**
				Total	**2,343,927**
5. TYPE S2					
5-1. Preparatory Work					
5-1-1.	Site Clearing (Cutting & Clearing of Grass, Bushes)	ha	1.3	11,900.0	15,470
	*Average width of excavation x Canal length			**Sub total**	**15,470**

5-2. Earth Work					
5-2-1.	Excavation of Surface Soil (200mm Depth)	m3	2,415	8.0	19,316
5-2-2.	Excavation for Common Soil	m3	0	10.0	0
5-2-3.	Spreading (Bulldozer)	m3	8,137	13.0	105,775
5-2-4.	Embankment with Compaction	m3	8,137	14.0	113,911
5-2-5.	Soil (Banking Material)	m3	8,137	7.6	61,837
5-2-6.	Hauling by Dump Truck (Banking Material)	m3	8,137	9.0	73,229
5-2-7.	Aggregate, Crushed, 2-4cm (Gravel Pavement)	m3	350	50.0	17,500
5-2-8.	Spreading of Aggregate (Bulldozer)	m3	350	13.0	4,550
				Sub total	**396,118**
5-3. Canal Work (Main Canal)					
5-3-1.	Class 18 Concrete (include Form Work)	m3	322	350.00	112,700
				Sub total	**112,700**
5-4. Canal Structure (Main Canal)					
5-4-1.	Turnout (Slide Gate, B=0.3m, H=0.3m)	unit	5	220.00	1,100
				Sub total	**1,100**
				Total	**525,388**
6. TYPE S3					
6-1. Preparatory Work					
6-1-1.	Site Clearing (Cutting & Clearing of Grass, Bushes)	ha	0.7	10,833.30	7,583
	*Average width of excavation x Canal length			**Sub total**	**7,583**
6-2. Earth Work					
6-2-1.	Excavation of Surface Soil (200mm Depth)	m3	1,376	7.40	10,179
6-2-2.	Excavation for Common Soil	m3	0	10.60	0
6-2-3.	Spreading (Bulldozer)	m3	6,706	13.0	87,178
6-2-4.	Embankment with Compaction	m3	6,706	18.50	124,061
6-2-5.	Soil (Banking Material)	m3	6,706	7.60	50,966
6-2-6.	Hauling by Dump Truck (Banking Material)	m3	6,706	8.00	53,648
6-2-7.	Aggregate, Crushed, 2-4cm (Gravel Pavement)	m3	175	50.00	8,750
6-2-8.	Spreading of Aggregate (Bulldozer)	m3	175	9.30	1,628
				Sub total	**336,410**
6-3. Canal Work (Main Canal)					
6-3-1.	Class 18 Concrete (include Form Work)	m3	112	350.0	39,200
				Sub total	**39,200**
6-4. Canal Structure (Main Canal)					
5-4-1.	Turnout (Slide Gate, B=0.3m, H=0.3m)	unit	2	220.0	440
				Sub total	**440**
				Total	**383,633**
	Direct Construction Cost (A)				**7,907,565**
					(US$)

Irrigation Facility: Main Canal:

North:	(1) Canal Length (Pump Station to Command Area) =	3,052	m
	(2) Canal Length (Command Area) =	3,348	m
South:	(1) Canal Length (Dam Site to Command Area) =	3,900	m
	(2) Canal Length (Command Area) =	3,100	m
	Total	**13,400**	**m**

Quantity Calculation of Main Canal (TYPE N1) (Jebel Lado Irrigation Scheme)

Station No. (m)	Distance (m)	Stripping		Excavation		Embankment		Gravel Pavement		Concrete	
		Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)
3 + 52		1.03		0.67		4.89		0.25		0.35	
	52.00		53.6		34.8		254.3		13.0		18.2
3 + 0		1.03		0.67		4.89		0.25		0.35	
	500.00		887.5		167.5		4,490.0		125.0		175.0
2 + 500		2.52		0.00		13.07		0.25		0.35	
	500.00		1,427.5		0.0		10,777.5		125.0		175.0
2 + 0		3.19		0.00		30.04		0.25		0.35	
	500.00		1,727.5		0.0		18,652.5		125.0		175.0
1 + 500		3.72		0.00		44.57		0.25		0.35	
	500.00		1,792.5		0.0		20,347.5		125.0		175.0
1 + 0		3.45		0.00		36.82		0.25		0.35	
	500.00		1,540.0		0.0		13,525.0		125.0		175.0
0 + 500		2.71		0.00		17.28		0.25		0.35	
	500.00		927.5		182.5		5,445.0		125.0		175.0
0 + 0		1.00		0.73		4.50		0.25		0.35	
6 + 125	125.00		128.1		80.6		620.0		31.3		43.8
6 + 0		1.05		0.56		5.42		0.25		0.35	
	200.00		210.0		112.0		1,084.0		25.0		70.0
5 + 800		1.05		0.56		5.42				0.35	
Total	**3,377**	**-**	**8,694**	**-**	**577**	**-**	**75,196**	**-**	**819**	**-**	**1,182**

Quantity Calculation of Main Canal (TYPE N2) (Jebel Lado Irrigation Scheme)

Station No. (m)	Distance (m)	Stripping		Excavation		Embankment		Gravel Pavement		Concrete	
		Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)
5 + 800		1.52		0.00		4.48		0.25		0.20	
	300.00		456.0		0.0		1,343.1		75.0		60.0
5 + 500		1.52		0.00		4.48		0.25		0.20	
	500.00		762.5		382.5		2,274.0		125.0		100.0
5 + 0		1.53		1.53		4.62		0.25		0.20	
	500.00		622.5		437.5		1,999.8		125.0		100.0
4 + 500		0.96		0.22		3.38		0.25		0.20	
	400.00		384.0		88.0		1,352.0		100.0		80.0
4 + 100		0.96		0.22		3.38		0.25		0.20	
Total	**1,700**	**-**	**2,225**	**-**	**908**	**-**	**6,969**	**-**	**425**	**-**	**340**

Quantity Calculation of Main Canal (TYPE N3) (Jebel Lado Irrigation Scheme)

Station No. (m)	Distance (m)	Stripping		Excavation		Embankment		Gravel Pavement		Concrete	
		Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)
4 + 100		0.89		0.13		2.51		0.25		0.13	
	100.00		89.0		13.0		251.0		25.0		13.0
4 + 0		0.89		0.13		2.51		0.25		0.13	
	500.00		572.5		32.5		1,694.3		125.0		65.0
3 + 500		1.40		0.00		4.27		0.25		0.13	
	400.00		560.0		0.0		1,706.8		100.0		52.0
3 + 100		1.40		0.00		4.27		0.25		0.13	
Total	**1,000**	**-**	**1,222**	**-**	**46**	**-**	**3,652**	**-**	**250**	**-**	**130**

6+125 to 6+448	**323**		**395**		**15**		**1,180**		**80**		**42**

Quantity Calculation of Main Canal (TYPE S1) (Jebel Lado Irrigation Scheme)

Station No. (m)	Distance (m)	Stripping		Excavation		Embankment		Gravel Pavement		Concrete	
		Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)
3 + 52		1.03		0.92		4.90		0.25		0.39	
	448.00		761.6		206.1		3,550.4		112.0		174.7
3 + 500		2.37		0.00		10.95		0.25		0.39	
	500.00		1,305.0		0.0		7,775.0		125.0		195.0
4 + 0		2.85		0.00		20.15		0.25		0.39	
	1,000.00		1,425.0		5,020.0		10,075.0		250.0		390.0
5 + 0		0.00		10.04		0.00		0.25		0.39	
	500.00		340.0		2,590.0		2,102.5		125.0		195.0
5 + 500		1.36		0.32		8.41		0.25		0.39	
	500.00		340.0		4,700.0		2,102.5		125.0		195.0
6 + 0		0.00		18.48		0.00		0.25		0.39	
	500.00		0.0		8,235.0		0.0		125.0		195.0
6 + 500		0.00		14.46		0.00		0.25		0.39	
	452.00		556.0		3,268.0		2,610.3		113.0		176.3
6 + 952		2.46		0.00		11.55		0.25		0.39	
0 + 0	500.00		927.5		127.5		4,667.5		125.0		195.0
0 + 500		1.25		0.51		7.12		0.25		0.39	
	500.00		922.5		127.5		4,695.0		125.0		195.0
1 + 0		2.44		0.00		11.66		0.25		0.39	
Total	**4,900**	**-**	**6,578**	**-**	**24,274**	**-**	**37,578**	**-**	**1,225**	**-**	**1,911**

Quantity Calculation of Main Canal (TYPE S2) (Jebel Lado Irrigation Scheme)

Station No. (m)	Distance (m)	Stripping		Excavation		Embankment		Gravel Pavement		Concrete	
		Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)
1 + 0		1.88		0.00		7.02		0.25		0.23	
	500.00		912.5		0.0		3,285.0		125.0		115.0
1 + 500		1.77		0.00		6.12		0.25		0.23	
	500.00		850.0		0.0		2,807.5		125.0		115.0
2 + 0		1.63		0.00		5.11		0.25		0.23	
	400.00		652.0		0.0		2,044.0		100.0		92.0
2 + 400		1.63		0.00		5.11		0.25		0.23	
Total	**1,400**	**-**	**2,415**	**-**	**0**	**-**	**8,137**	**-**	**350**	**-**	**322**

Quantity Calculation of Main Canal (TYPE S3) (Jebel Lado Irrigation Scheme)

Station No. (m)	Distance (m)	Stripping		Excavation		Embankment		Gravel Pavement		Concrete	
		Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)	Area (m2)	Volume (m3)
2 + 400		1.83		0.00		7.48		0.25		0.16	
	100.00		183.0		0.0		748.0		25.0		16.0
2 + 500		1.83		0.00		7.48		0.25		0.16	
	500.00		982.5		0.0		4,790.0		125.0		80.0
3 + 0		2.10		0.00		11.68		0.25		0.16	
	100.00		210.0		0.0		1,168.0		25.0		16.0
3 + 100		2.10		0.00		11.68		0.25		0.16	
Total	**700**	**-**	**1,376**	**-**	**0**	**-**	**6,706**	**-**	**175**	**-**	**112**

3.4 On-Farm Irrigation Facilities

Jebel Lado Irrigation Scheme

Facilities in Farmlamds 7.2 million US$

No.	Work Description	Unit	Quantity	Unit Price (US$)	Total (US$)
Earth Works					
1. Earth Works of Command Area TYPICAL SECTION					
1-1.	Stripping	m3	140,448	8.0	1,123,584
1-2.	Spreading (Bulldozer)	m3	99,100	13.0	1,288,300
1-3.	Embankment (Canal, Road, etc.)	m3	198,170	14.0	2,774,380
1-4.	Aggregate, Crushed, 2-4cm (Gravel Pavement)	m3	9,975	50.0	498,750
1-5.	Spreading of Aggregate (Bulldozer)	m3	9,975	13.0	129,675
1-6.	Crossings (Tertianary canal, PVC ű300, L=5.0m)	place	173	200.0	34,600
1-7.	Crossings (Secondary canal, PVC ű400, L=5.0m)	place	80	300.0	24,000
1-8.	Crossings (Drainage, PVCű600, Masonry)	place	80	3780.0	302,400
1-9.	Excavation (Drainage Canal)	m3	79,800	10.0	798,000
1-10.	Embankment (Drainage Canal)	m3	13,433	14.0	188,062
				Sub-Total	**7,161,751**
	Direct Construction Cost (A)				**7,161,751**
					(US$)
	A=1,330	ha			**(5,385)**
					(US$)

Quantity Calculation

Irrigation Scheme : Jebel Lado Irrigation Scheme
Item of Work : Command Area TYPICAL SECTION

Item	Calculation	Quantity	Unit	Remark
1. Earth Works of Command Area TYPICAL SECTION				
1-A. Type-A				
1-A-1. Stripping	Section (10.0 + 9.6) x 0.2 x 0.5 x Total Length 2,000	**3,920**	**m3**	
1-A-2. Embankment	Section(1)			
	Section (0.9 + 1.3) x 0.5 x 0.5 x Total Length 2,000 x 2	2,200	m3	
	Section(2)			
	Section (6.0 + 6.4) x 0.2 x 0.5 x Total Length 2,000	2,480	m3	
	Section(3)			
	Section (3.5 + 4.5) x 0.5 x 0.5 x Total Length 2,000	4,000	m3	
	Section(4)			
	Section (0.3 + 1.2) x 0.5 x 0.5 x Total Length 2,000	750	m3	
	Total	**9,430**	**m3**	
1-A-3. Gravel Pavement (t=10cm)				
	2.5 x 0.1 x Total Length 2,000	**500**	**m3**	
1-A-4. Crossings (Tertianary canal, PVC ϕ 300, L=5.0m)		**10**	**place**	

Irrigation Scheme : Jebel Lado Irrigation Scheme
Item of Work : Command Area TYPICAL SECTION

Item	Calculation	Quantity	Unit	Remark
1-B. Type-B				
1-B-1. Stripping	(8.1 + 7.7) x 0.2 x 0.5 x 400 x 4 (Section / Total Length)	**2,528**	**m3**	
1-B-2. Embankment	Section(1)			
	(0.9 + 1.3) x 0.5 x 0.5 x 400 x 2 (Section / Total Length)	440	m3	
	Section(2)			
	(6.1 + 6.1) x 0.2 x 0.5 x 400 (Section / Total Length)	488	m3	
	Section(3)			
	(3.5 + 4.5) x 0.5 x 0.5 x 400 (Section / Total Length)	800	m3	
	Section(4)			
	(0.3 + 0.9) x 0.3 x 0.5 x 400 (Section / Total Length)	72	m3	
	Total	**1,800**	**m3**	
1-B-3. Gravel Pavement (t=10cm)	2.5 x 0.1 x 400 (Total Length)	**100**	**m3**	
1-B-4. Crossings (Secondary canal, PVC ϕ 400, L=5.0m)		**5**	**place**	
1-B-5. Crossings (Drainage, PVC ϕ 600, Masonry)		**5**	**place**	

Irrigation Scheme : Jebel Lado Irrigation Scheme
Item of Work : Command Area TYPICAL SECTION

Item	Calculation	Quantity	Unit	Remark
1-C. Type-C				
1-C-1. Stripping	(5.2 + 4.8) x 0.2 x 0.5 x 400 x 5	**2,000**	**m3**	
1-C-2. Embankment	Section(1)			
	(0.3 + 0.9) x 0.3 x 0.5 x 400	72	m3	
	Section(2)			
	(1.0 + 1.6) x 0.3 x 0.5 x 400	156	m3	
	Section(3)			
	(2.8 + 3.2) x 0.2 x 0.5 x 400	240	m3	
	Section(4)			
	(0.9 + 1.3) x 0.5 x 0.5 x 400	220	m3	
	Total	**688**	**m3**	

Section Total Length

Irrigation Scheme : Jebel Lado Irrigation Scheme
Item of Work : Command Area TYPICAL SECTION

Item	Calculation	Quantity	Unit	Remark
Total				
1-1. Stripping	1-1-1 3,920 + 1-2-1 2,528 + 1-3-1 2,000	8,448	m3/80 ha	1 Block=400mx2,000m
		105.6	m3/ha	=800,000 m2
	105.6 x 1,330 =	**140,448**	**m3**	=80 ha
1-2. Embankment	1-1-2 9,430 + 1-2-2 1,800 + 1-3-2 688	11,918	m3/80 ha	Commnd Area
		149.0	m3/ha	**1,330** ha
	149.0 x 1,330 =	**198,170**	**m3**	
1-3. Gravel Pavement (t=10cm)	1-1-3 500 + 1-2-3 100	600	m3/80 ha	
		7.5	m3/ha	
	7.5 x 1,330 =	**9,975**	**m3**	
1-4. Spreading of Aggregate (Bulldozer)	same as Gravl Pavement	**9,975**	**m3**	
1-5. Crossings (Tertianary canal, PVC φ300, L=5.0m)		10	place/80 ha	
		0.13	place/ha	
	0.13 x 1,330 =	**173**	**place**	
1-6. Crossings (Secondary canal, PVC φ400, L=5.0m)		5	place/80 ha	
		0.06	place/ha	
	0.06 x 1,330 =	**80**	**place**	
1-7. Crossings (Drainage, PVCφ600, Masonry)		5	place/80 ha	
		0.06	place/ha	
	0.06 x 1,330 =	**80**	**place**	

Quantity Calculation

Irrigation Scheme : Jebel Lado Irrigation Scheme
Item of Work : Drainage Canal

Item	Calculation	Quantity	Unit	Remark
Earth Works of Main Drainage Canal				
SD-1. Type SD-1: Q=3.78 m3/s				
SD-1-1. Excavation	(Section 1.3 + 5.05) x 1.25 x 0.5 x Total Length 400	**1,588**	**m3**	
SD-1-2 Embankment	(Section 0.3 + 1.05) x 0.3 x 0.5 x Total Length 400 x 2	**162**	**m3**	
SD-2. Type SD-2: Q=2.83 m3/s				
SD-2-1. Excavation	(Section 1.1 + 4.4) x 1.1 x 0.5 x Total Length 400	**1,210**	**m3**	
SD-2-2 Embankment	(Section 0.3 + 1.05) x 0.3 x 0.5 x Total Length 400 x 2	**162**	**m3**	
SD-3. Type SD-3: Q=2.16 m3/s				
SD-3-1. Excavation	(Section 1.0 + 4.0) x 1.0 x 0.5 x Total Length 400	**1,000**	**m3**	
SD-3-2. Embankment	(Section 0.3 + 1.05) x 0.3 x 0.5 x Total Length 400 x 2	**162**	**m3**	
SD-4. Type SD-4: Q=1.44 m3/s				
SD-4-1. Excavation	(Section 0.8 + 3.2) x 0.8 x 0.5 x Total Length 400	**640**	**m3**	
SD-4-2. Embankment	(Section 0.3 + 1.05) x 0.3 x 0.5 x Total Length 400 x 2	**162**	**m3**	

Irrigation Scheme : Jebel Lado Irrigation Scheme
Item of Work : Drainage Canal

Item	Calculation	Quantity	Unit	Remark
SD-5. Type SD-5: Q=0.72 m3/s				
SD-5-1. Excavation	Section (0.6 + 2.4) x 0.6 x 0.5 x Total Length 400	**360**	**m3**	
SD-5-2. Embankment	Section (0.3 + 1.05) x 0.3 x 0.5 x Total Length 400 x 2	**162**	**m3**	
Total				
1-8. Excavation (Drainage Canal)	2-1 1,588 + 2-2 1,210 + 2-3 1,000 + 2-4 640 + 2-5 360	4,798	m3/80 ha	1 Block=400mx2,000m
		60.0	**m3/ha**	=800,000 m2
	60.0 x 1,330 =	**79,800**	**m3**	=80 ha
1-9. Embankment (Drainage Cana	2-1 162 2-2 162 2-3 162 2-4 162 2-5 162	810	m3/80 ha	Commnd Area **1,330** ha
		10.1	**m3/ha**	
	10.1 x 1,330 =	**13,433**	**m3**	

APPENDIX - 4

OPERATION AND MAINTENANCE PLAN COST

4.1 Unit Cost of Personnel Expenses (SSP/month)

Department	Staffing and Specialization	Grade	Basic Pay (SSP per Month)	Average Pay (SSP per Month)	Accom. Allo. (SSP per Month)	Cost of Living Allo. (SSP per Month)	Respon. Allo.	Represen. Allo. (SSP per Month)	Job Specific (SSP per Month)	Gross Pay (SSP per Month)	Pension Contri. (5%of Gross)	Income Tax: 10% of (Gross-300-Pension)	Net Pay
1. Management staff	Manager (Irrigation/Dam Eng.)	3	1,625/2,000	1,813	1,800	75	88	88	810	4,674	234	414	4,026
	Deputy Manager (Electromechanical Eng.)	4	1525/1714	1620	1200	75	75	75	730	3,775	189	329	3258
	Senior Accountant	7	1188/1388	1,288	630	63			650	2,631	132	220	2280
	Assistant Accountant	9	925/1125	1,025	630	50			450	2,155	108	175	1873
	Cooperative/Marketing Officer	8	1075/1200	1,138	630	50			580	2,398	120	198	2080
	Asst. Cooperative/Marketing Officer	9	925/1125	1,025	630	50			450	2,155	108	175	1873
	Tariff Collector (Book-keeper)	12	375/440	408	450	38			400	1,296	65	93	1138
	Messenger/Guard/Driver	13	313/378	346	450	38			390	1,224	61	86	1077
2. Irrigation/Dam Operations and Maintenance	Senior Irri./Dam Eng. (Dam/Pump)	7	1188/1388	1,288	630	63			650	2,631	132	220	2280
	Electro-mechanical Eng.	8	1075/1200	1,138	630	50			580	2,398	120	198	2080
	Planning and Bugeting Officer	8	1075/1200	1,138	630	50			580	2,398	120	198	2080
	Asst. Irrigation/Dam Eng.	9	925/1125	1,025	630	50			450	2,155	108	175	1873
	Asst. Planning and Bugeting Officer	9	925/1125	1,025	630	50			450	2,155	108	175	1873
	Irrigation Technician	10	825/950	888	450	38			440	1,816	91	142	1582
	Pump operator	11	500/565	533	450	38			410	1,431	72	106	1254
	Irrigation Water Control Gate Operator	11	500/565	533	450	38			410	1,431	72	106	1254
	Facilities' Guards	11	500/565	533	450	38			410	1,431	72	106	1254
3. Farm Level Operations	Senior Agronomist	7	1188/1388	1,288	630	63			650	2,631	132	220	2280
	Agronomist	8	1075/1200	1,138	630	50			580	2,398	120	198	2080
	Agricultural Engineer	8	1075/1200	1,138	630	50			580	2,398	120	198	2080
	Asst. Agricultural Engineer	9	925/1125	1,025	630	50			450	2,155	108	175	1873
	Extension Worker	10	825/950	888	450	38			440	1,816	91	142	1582
	Tractor Operator	11	500/565	533	450	38			410	1,431	72	106	1254
	Asst. Tractor Operator	13	313/378	346	450	38			390	1,224	61	86	1077
4. Processing Operations	Rice mill operator	10	825/950	888	450	38			440	1,816	91	142	1582
	Asst. Rice mill operator	11	500/565	533	450	38			410	1,431	72	106	1254
Total per month				24,540	16,140	1,257	163	163	13,190	55,453	2,773	4,488	48,192
Total per year				294,474	193,680	15,084	1,956	1,956	158,280	665,430	33,272	53,856	578,303

4.2 Annual Personnel Expenses (SSP/year)

Department	Required Staff and Specialization	Grade	Jebel Lado Irrigation Scheme	
			Prposed Number of Staff	Salary Budget (Gross in SSP)
Management staff	Manager (Irrigation/Dam Eng.)	3	1	4,674
	Deputy Manager (Electromechanical Eng.)	4	1	3,775
	Senior Accountant	7	1	2,631
	Cooperative/Marketing Officer	8	1	2,155
	Assistant Accountant	9	1	2,398
	Asst. Cooperative/Marketing Officer	9	1	2,155
	Tariff Collector	12	2	1,296
	Messenger/Guard/Driver	13	6	1,224
Irrigation/Dam Operations and Maintenance	Senior Irri./Dam Eng, (Dam/Pump)	7	1	2,631
	Electromechanical Eng.	8	1	2,398
	Planning and Bugeting Officer	8	1	2,398
	Asst. Irrigation/Dam Eng.	9	1	2,155
	Asst. Planning and Bugeting Officer	9	1	2,155
	Irrigation Technician	10	2	1,816
	Pump operator	11	2	1,431
	Irrigation Water Control Gate Operator	11	2	1,431
	Facilities' Guards	11	4	1,431
Farm Level Operations	Senior Agronomist	7	1	2,631
	Agronomist	8	1	2,398
	Agricultural Engineer	8	1	2,398
	Asst. Agricultural Engineer	9	1	2,155
	Extension Worker	10	2	1,816
	Tractor Operator	11	1	1,431
	Asst. Tractor Operator	13	1	1,224
Processing Operations	Rice mill operator	10	0	0
	Asst. Rice mill operator	11	0	0
Total per month			37	52,206
Total per year				626,472

Note: W = Wau, JL = Jebel Lado and RE = Rejaf East

4.3 Equipment and Machinery Investment Cost

Cost Item	Grade/Spec	Unit Cost (SSP/unit) /a	Depreciation Schedule /b	Depreciation Cost /c	Jebel Lado Irrigation	
					Number	Cost (SSP/year)
Equipment/Machineries						
Motor Grader	220HP (John Deere)	2,141,480	15	128,500	1	128,500
Backhoe Loader	422F (Caterpillar)	953,304	15	57,200	1	57,200
Wheel Loaders	938H (Caterpillar)	2,030,952	15	121,900	1	121,900
Dump Truck	6 × 4 18CUM (Caterpillar)	863,500	15	51,800	1	51,800
Motor Bike		10,000	10	900	4	3,600
Tractor /d	75HP, 4WD (John Deere)	203,786	10	18,300	7	128,100
Attachment (plough)	3-disc (John Deere)	27,632	10	2,500	7	17,500
Attachment (harrow)	20-disc manually operated (John	43,175	10	3,900	7	27,300
Attachment (levellers)		3,600	10	300	7	2,100
Attachment (sprayer)	400ml, 8M (John Deere)	46,974	10	4,200	7	29,400
Attachment (fertilizer distributor)		13,816	10	1,200	7	8,400
Attachment (trailer)	5 tonne (John Deere)	58,718	10	5,300	7	37,100
Combine Harvester		81,000	10	7,300	5	36,500
Working machines (Workshop)						
Pick-pu Track	Single Cabine (4DW)	20,900	10	1,900	2	3,800
Portable Generator	240V Capacity	112,545	8	12,700	2	25,400
Nattery Charger	72V Chapacity	500	8	100	2	200
Generator	Perkins Type 1500RPM 150 kVA (380-54\\415V)	357,441	8	40,200	1	40,200
Lathe Machine	Universal High Precision	54,600	8	6,100	1	6,100
Power Saw		6,400	5	1,200	1	1,200
Welding Machine	Arc	2,700	5	500	2	1,000
Welding Machine	Acetylene Gas Welding	1,800	5	300	2	600
Power Drill	Portable Heavy Duty Hand Drill	500	5	100	1	100
Rice Mill						
Rice Mill	2.0t/hr	409,500	15	24,600		
Grain Threshing Machine	Vicon Type 1 tonne/hr	7,300	15	400		
Drying Machine		36,400	15	2,200		
Warehouse		41,000	15	2,500		
Total					76	728,000

Note: a/ Price quotations are obtained from Lonagro South Sudan Ltd. (Jhon Deere), Ezentus (Catepillar), and Aweil Irrigation Rehabilitation Project.

b/ Depreciation schedule is quoted from water supply project in Sounth Asia.

c/ 10% of residual value is taken into account in estimation of depreciation cost.

4.4 Equipment and Machinery O&M Cost

Cost Item	Grade/Spec	Unit Cost (SSP/unit) /a	O&M Cost (1% of Unit Cost)	Jebel Lado Irrigation Scheme	
				Number	Cost (SSP/year)
Equipment/Machineries					
Motor Grader	150-160HP	2,141,480	21,410	1	21,410
Backhoe Loader	90HP	953,304	9,530	1	9,530
Wheel Loaders	80HP	2,030,952	20,310	1	20,310
Dump Truck	160HP	863,500	8,640	1	8,640
Motor Bike		10,000	100	4	400
Tractor /d	75HP, 4WD	203,786	2,040	7	14,280
Attachment (plough)	3-disc	27,632	280	7	1,960
Attachment (harrow)	20-disc manually operated	43,175	430	7	3,010
Attachment (levellers)		3,600	40	7	280
Attachment (sprayer)	400ml, 8M	46,974	470	7	3,290
Attachment (fertilizer distributor)		13,816	140	7	980
Attachment (trailer)	5 tonne	58,718	590	7	4,130
Combine Harvester		81,000	810	5	4,050
Working machines (Workshop)					
Pick-pu Track	Single Cabine (4DW)	20,900	210	2	420
Portable Generator	240V Capacity	112,545	1,130	2	2,260
Battery Charger	72V Chapacity	500	10	2	20
Generator	Perkins Type 1500RPM 150 kVA (380-54\\415V)	357,441	3,570	1	3,570
Lathe Machine	Universal High Precision	54,600	550	1	550
Power Saw		6,400	60	1	60
Welding Machine	Arc	2,700	30	2	60
Welding Machine	Acetylene Gas Welding	1,800	20	2	40
Power Drill	Portable Heavy Duty Hand Drill	500	10	1	10
Rice Mill					
Rice Mill	1.0-2.0t/hr	409,500	4,100		
Grain Threshing Machine	Vicon Type 1 tonne/hr	7,300	70		
Drying Machine		36,400	360		
Warehouse		41,000	410		
Total				76	99,260

Note: a/ Price quotations are obtained from Lonagro South Sudan Ltd. (Jhon Deere), Ezentus (Catepillar), and Aweil Irrigation Rehabilitation Project.
b/ Depreciation schedule is quoted from water supply project in Sounth Asia.
c/ 10% of residual value is taken into account in estimation of depreciation cost.

4.5 Water Tariff Estimation

	Jebel Lado Irrigation Scheme	
	Detail	SSP
A. Project Cost (SSP)	USD 31,000,000	90,785,714
B. Depreciation Cost (SSP/year)		9,848,533
Project Facility	1,433,328	4,197,604
Equipment and Machinary		728,000
C. Annual O&M Cost (SSP/year)		
Personnel Expenses		626,472
Pump Operation	USD 1,402,189	4,106,411
Equipment and Machinary (1% of Procurement Cost)		99,260
Maintenance Cost (0.1% of Project Cost)		90,786
Sub-total (Annual Operation Cost)		4,922,929
D. Irrigable Area (ha)		1,330
Annual O&M Cost per Irrigable Area (SSP/ha)		3,701
Minimum Area for Feeding Family (ha/HH/year) /a		0.42
Number of Lot for Distribution (1lot = 1feddan = 0.42ha)		3,167
E. Water Consumption (m^3/season)	Total	29,790,115
Crop 1	Maize	12,326,585
Crop 2	Vegetables	15,687,302
Crop 3	Banana	1,776,228
F. Water Tariff Estimation		
Area-based Pricing (SSP/lot, or SSP/feddan)		SSP 1,560 fd
Volumetric Pricing 1 (SSP/m^3)	Total	SSP 0.17 m3
Crop 1	Maize	SSP 0.40 m3
Crop 2	Vegetables	SSP 0.31 m3
Crop 3	Banana	SSP 2.77 m3
Volumetric Pricing 2 (SSP/season/feddan)		
Crop 1	3,000 ac	**SSP 700 fd**
Crop 2	3,000 ac	**SSP 900 fd**
Crop 3	160 ac	**SSP 1,800 fd**
Volumetric Pricing 2 (SSP/season/ha)		
Crop 1	1,260 ha	SSP 1,600 ha
Crop 2	1,260 ha	SSP 2,100 ha
Crop 3	67 ha	SSP 4,400 ha
Member's Fee (SSP/lot) /b		**SSP 548 /ha**
Member's Fee (In Kind = Labor Work in days) /c		**14 days/year**

Note: a/ Necessary area for feeding family members (7person/HH) by planting maize is estimated at 0.21ha. Planned yield of maize is 3t/ha.

b/ Members' fee is estimated by dividing number of lot into depreciation cost of equipment and machinary.

c/ In kind is equivalent to labor cost of SSP40/ha.

4.6 Affordability to Pay (ATP)

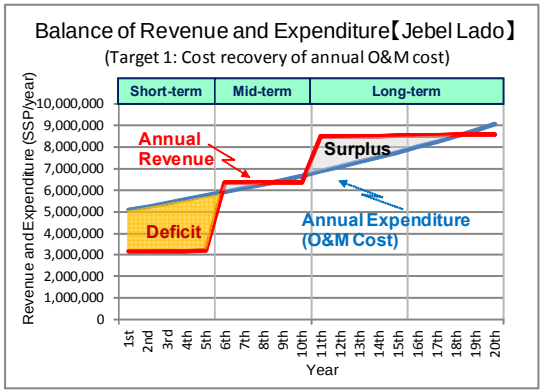
Term	Crops	Net Income /a (SSP/ha)	Cropped Area (ha)	Total Net Income (SSP/ha)	Affordability Rate (%)	ATP (SSP/ha)	Estimated ISF (SSP/ha)	ISF Adjustd (SSP/ha)
Short-term	Maize	5,222	1,260	6,579,720	3%	160	1,667	**160**
	Vegetable	89,235	1,260	112,436,100	3%	2,680	2,143	**2,143**
	Banana	35,117	67	2,352,839	3%	1,050	4,286	**1,050**
	Weighted Average	46,915	2,587	121,368,659	3%	1,410	1,560	1,410
Mid-term	Maize	5,222	900	4,699,800	5%	260	1,667	**260**
	Vegetable	89,235	1,626	145,096,110	5%	4,460	2,143	**2,143**
	Banana	35,117	67	2,352,839	5%	1,760	4,286	**1,760**
	Weighted Average	58,677	2,593	152,148,749	5%	2,930	1,560	1,560
Long-term	Maize	5,222	500	2,611,000	5%	260	1,667	**260**
	Vegetable	89,235	2,026	180,790,110	5%	4,460	2,143	**2,143**
	Banana	35,117	67	2,352,839	5%	1,760	4,286	**1,760**
	Weighted Average	71,637	2,593	185,753,949	5%	3,580	1,560	1,560

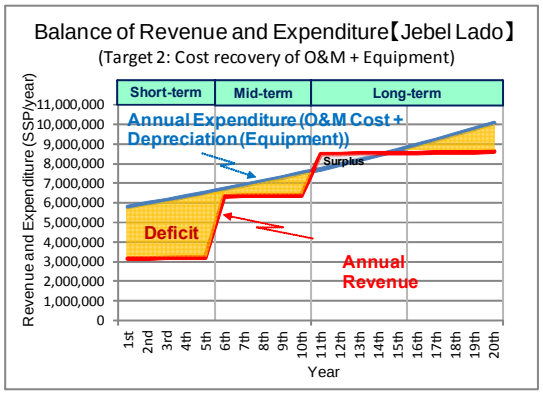
Note: a/ "Net income" is not cosidered in family labor cost.

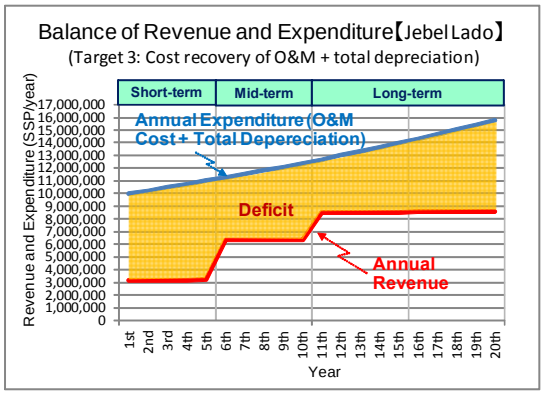
4.7 Cash Flow Analysis

	Short-term					Mid-term					Long-term									
	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	11th Year	12th Year	13th Year	14th Year	15th Year	16th Year	17th Year	18th Year	19th Year	20th Year
Revenue																				
Member Fee /a	728,410	728,410	728,410	728,410	728,410	728,410	728,410	728,410	728,410	728,410	728,410	728,410	728,410	728,410	728,410	728,410	728,410	728,410	728,410	728,410
Irrigation Service Fee /b	3,634,119	3,634,119	3,634,119	3,634,119	3,634,119	7,593,786	7,593,786	7,593,786	7,593,786	7,593,786	9,260,714	9,260,714	9,260,714	9,260,714	9,260,714	9,260,714	9,260,714	9,260,714	9,260,714	9,260,714
ISF Collection Rate	60%	60%	60%	60%	60%	70%	70%	70%	70%	70%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
Amount of ISF Collected	2,180,471	2,180,471	2,180,471	2,180,471	2,180,471	5,315,650	5,315,650	5,315,650	5,315,650	5,315,650	7,408,571	7,408,571	7,408,571	7,408,571	7,408,571	7,408,571	7,408,571	7,408,571	7,408,571	7,408,571
Tractor Service Fee /c	252,600	261,037	269,755	278,765	288,076	297,698	307,641	317,916	328,535	339,508	350,847	362,565	374,675	387,189	400,121	413,485	427,296	441,568	456,316	471,557
Sub-total	3,161,481	3,169,918	3,178,637	3,187,647	3,196,957	6,341,758	6,351,701	6,361,976	6,372,595	6,383,568	8,487,829	8,499,547	8,511,657	8,524,171	8,537,103	8,550,467	8,564,277	8,578,549	8,593,297	8,608,538
Expemditure																				
Annual O&M Cost (SSP/year)																				
Personnel Expenses	785,000	798,110	811,438	824,989	838,766	852,774	867,015	881,494	896,215	911,182	926,399	941,869	957,599	973,591	989,850	1,006,380	1,023,187	1,040,274	1,057,646	1,075,309
Pump Operation	4,106,411	4,243,565	4,385,300	4,531,769	4,683,131	4,839,547	5,001,188	5,168,228	5,340,847	5,519,231	5,703,573	5,894,072	6,090,934	6,294,372	6,504,604	6,721,857	6,946,367	7,178,376	7,418,134	7,665,900
Equipment and Machinary (1% of Procurement Cost)	99,260	102,575	106,001	109,542	113,200	116,981	120,889	124,926	129,099	133,411	137,867	142,471	147,230	152,147	157,229	162,480	167,907	173,515	179,311	185,300
Maintenance Cost (0.1% of Project Cost)	90,786	92,302	93,843	95,410	97,004	98,624	100,271	101,945	103,648	105,379	107,139	108,928	110,747	112,596	114,477	116,388	118,332	120,308	122,317	124,360
Sub-total	5,081,457	5,236,552	5,396,583	5,561,711	5,732,101	5,907,926	6,089,362	6,276,593	6,469,808	6,669,202	6,874,977	7,087,341	7,306,510	7,532,706	7,766,159	8,007,106	8,255,793	8,512,474	8,777,409	9,050,869
Depreciation Cost (SSP/year)																				
Project Facility	4,197,604	4,267,704	4,338,975	4,411,436	4,485,107	4,560,008	4,636,160	4,713,584	4,792,301	4,872,333	4,953,700	5,036,427	5,120,536	5,206,049	5,292,990	5,381,382	5,471,252	5,562,621	5,655,517	5,749,964
Equipment and Machinary	728,000	740,158	752,518	765,085	777,862	790,853	804,060	817,488	831,140	845,020	859,131	873,479	888,066	902,897	917,975	933,305	948,891	964,738	980,849	997,229
Sub-total	4,925,604	5,007,862	5,091,493	5,176,521	5,262,969	5,350,861	5,440,220	5,531,072	5,623,441	5,717,352	5,812,832	5,909,906	6,008,602	6,108,945	6,210,965	6,314,688	6,420,143	6,527,359	6,636,366	6,747,194
Annual O&M + Depreciation (Equipment)	5,809,457	5,976,710	6,149,101	6,326,796	6,509,963	6,698,778	6,893,422	7,094,081	7,300,948	7,514,222	7,734,108	7,960,820	8,194,576	8,435,603	8,684,134	8,940,412	9,204,685	9,477,212	9,758,258	10,048,098
Annual O&M + Depreciation (Total)	10,007,061	10,244,414	10,488,076	10,738,232	10,995,070	11,258,787	11,529,582	11,807,665	12,093,249	12,386,554	12,687,809	12,997,247	13,315,111	13,641,651	13,977,124	14,321,794	14,675,937	15,039,833	15,413,775	15,798,062
Balance /d																				
Target 1: Annual O&M Cost	-1,919,976	-2,066,634	-2,217,946	-2,374,064	-2,535,144	433,832	262,339	85,383	-97,214	-285,634	1,612,852	1,412,206	1,205,147	991,465	770,944	543,360	308,484	66,075	-184,111	-442,330
Subsidy (SSP/year)	1,919,976	2,066,634	2,217,946	2,374,064	2,535,144	-	-	-	97,214	285,634	-	-	-	-	-	-	-	-	184,111	442,330
Subsidy (%)	38%	39%	41%	43%	44%	0%	0%	0%	2%	4%	0%	0%	0%	0%	0%	0%	0%	0%	2%	5%
Target 2: Annual O&M Cost + Deprecoation (Equipment)	-2,647,976	-2,806,791	-2,970,464	-3,139,149	-3,313,006	-357,021	-541,721	-732,105	-928,353	-1,130,654	753,720	538,727	317,081	88,568	-147,031	-389,945	-640,408	-898,663	-1,164,960	-1,439,560
Subsidy (SSP/year)	2,647,976	2,806,791	2,970,464	3,139,149	3,313,006	357,021	541,721	732,105	928,353	1,130,654	-	-	-	-	147,031	389,945	640,408	898,663	1,164,960	1,439,560
Subsidy (%)	46%	47%	48%	50%	51%	5%	8%	10%	13%	15%	0%	0%	0%	0%	2%	4%	7%	9%	12%	14%
Target 3: Annual O&M Cost + Deprecoation (Total)	-6,845,580	-7,074,496	-7,309,439	-7,550,585	-7,798,113	-4,917,029	-5,177,881	-5,445,689	-5,720,654	-6,002,987	-4,199,980	-4,497,700	-4,803,455	-5,117,480	-5,440,021	-5,771,327	-6,111,659	-6,461,284	-6,820,478	-7,189,524
Subsidy (SSP/year)	6,845,580	7,074,496	7,309,439	7,550,585	7,798,113	4,917,029	5,177,881	5,445,689	5,720,654	6,002,987	4,199,980	4,497,700	4,803,455	5,117,480	5,440,021	5,771,327	6,111,659	6,461,284	6,820,478	7,189,524
Subsidy (%)	68%	69%	70%	70%	71%	44%	45%	46%	47%	48%	33%	35%	36%	38%	39%	40%	42%	43%	44%	46%

Note: a/ Member fee (fixed charge per year) is estimated by dividing procurment cost of equipment by number of lot (=1feddan). In Wau, milling facility is excluded from the procurment cost.
b/ Irrigation service fee (ISF) is estimated by dividing total water consumption volume by each crops' water consumption volume in a season.
c/ Unit price of tractor service fee is SSP200/feddan, quoted from Socio-economic Survey conducted by IDMP-TT in 2015.
d/ Balance is estimated to cover annual O&M cost by revenue of the scheme.







APPENDIX - 5

ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

Evaluation Sheet for Alternatives

Project Title: Irrigation Development in Jebel Lado

Evaluation Method

Evaluation method	Evaluation criteria: 5: Exceptionally suitable, 4: Suitable, 3: Negligible/ Neutral 2: Not suggestible, 1: Suggest avoiding Evaluation items ñPollutionò includes: ñAir Pollution ò, ñWater Pollution ò, ñWasteò, ñSoil/Sediment Contaminationò, ñNoise and Vibrationò, ñOdourò, ñGlobal Warmingò ñBiodiversityò includes: ñProtected Areasò ñEcosystemò ñNature, disastersò includes: ñHydrologyò, ñTopography and Geology ò, ñSubsidence / Erosionò, , ñLandscapeò ñLand occupies resettlementò includes: ñResettlementò. ñLand Useò ñSocial conflictò includes: ñVulnerable Groupsò, ñWater Use / Rightsò ñLiving conditionò includes: ñLiving and Livelihood ò, ñLocal Economy ò, ñHistorical / Cultural Heritageò ñSocial Infrastructure / Servicesò, ñInfectious Diseasesò ñEconomy, developmentò means: contribution to economic improvement in the RSS ñConsistencyò means: consistency / harmonization with the RSS policies

Project Summary

	Alternative A	Alternative B	Zero option
Project Summary	Pump irrigation	Dam irrigation without pump station No project	

Evaluation

Valuation Items		Alternative A	Alternative B	Zero option
Natural Environment	**Average of a), b), c) ------- (1)**	**2.7**	**2.3**	**3.0**
	a) Pollution	3 3 3		
	b) Ecosystem	2 1 3		
	c) Nature, disasters	3 3 3		
	Reason		Due to existence of dam and long distance canal, significant obstruction to wildlife habitats, feeding / watering activities may rise.	
Social Environment	**Average of a), b), c) ------- (2)**	**2.7**	**2.0**	**3.0**
	a) Land occupies, resettlement	3 1 3		
	b) Social conflict	2 2 3		
	c) Living condition	3 3 3		
	Reason		Large scale land occupation may accelerate possibility of resettlement.	
Economy, development	**Average of a), b), c) ------- (3)**	**4.0**	**4.0**	**2.5**
	a) Economy, development	4 4 2		
	b) Consistency	4 4 3		
	Reason			

Results

	Alternative A	Alternative B	Zero option
Total score (1) + (2) + (3)	**9.4 8.3 8.5**		
Ranking	**1 3 2**		
Overall	Both alternatives are expected to contribute to improvement of agricultural production. However alternative B is not suggestible due to significant impacts likely caused by large scale of land occupation by dam site.		

Preliminary Scoping Check Sheet

Project Title: Irrigation Development in Jebel Lado

Project Activity: Pre-construction
Land preparation

Environmental Items		Duration a)	Extent b)	Intensity c)	Cumulative d)	Reversible e)	Total Score (T) a)+b)+c)+d)+e) / Rank
		Short: 1 Medium: 2 Long: 3	Limited: 1 Medium: 2 Wide: 3	Small/Negligible: 1 Medium: 2 Big: 3	Non-Cumulative: 1 Cumulative: 3	Reversible: 1 Irreversible: 3	
		Indication: no: no impact, +: positive -: negative Rough indication for ranking: The score is rough value. Your judgement based on your experiences / knowledge will be reflected to the ranking. -15 -12 | -11 -7 | -6 +6 | +7 +11 | +12 +15 -A | -B or -C | D or ±C | +B or +C | +A					
Pollution	Air Pollution	-1	-1	-1	-1	-1	-5/D
	Water Pollution	no	no	no	no	no	D
	Waste	-1	-2	-1	-1	-1	-6/-C
	Soil/Sediment Contamination	no	no	no	no	no	D
	Noise and Vibration	-1	-1	-1	-1	-1	-5/-C
	Odour	no	no	no	no	no	D
Natural Environment	Protected Areas	no	no	no	no	no	D
	Ecosystem	-1	-1	-1	-1	-1	-5/-C
	Hydrology	-1	-1	-1	-1	-1	-5/-C
	Topography and Geology	no	no	no	no	no	D
	Subsidence / Erosion	no	no	no	no	no	D
	Global Warming	no	no	no	no	no	D
	Landscape	no	no	no	no	no	D
Social Environment	Resettlement	-3	-1	-1	-1	-3	-9/-C
	Living and Livelihood	-2	-1	-1	-1	-1	-6/-C
	Local Economy	no	no	no	no	no	D
	Historical / Cultural Heritage	no	no	no	no	no	D
	Land Use	-1	-1	-1	-1	-3	-7/-C
	Vulnerable Groups	no	no	no	no	no	D
	Local Conflict	-1	-1	-1	-1	-1	-5/-C
	Water Use / Right	no	no	no	no	no	D
	Social Infrastructure / Services	-1	-1	-1	-1	-1	-5/-C
	Infectious Diseases	no	no	no	no	no	D
Remark							

Preliminary Scoping Check Sheet

Project Title: Irrigation Development in Jebel Lado

Project Activity: Construction

Construction of pump station

Environmental Items		Duration a)	Extent b)	Intensity c)	Cumulative d)	Reversible e)	Total Score (T) a)+b)+c)+d)+e) / Rank
		Short: 1 Medium: 2 Long: 3	Limited: 1 Medium: 2 Wide: 3	Small/Negligible: 1 Medium: 2 Big: 3	Non-Cumulative: 1 Cumulative: 3	Reversible: 1 Irreversible: 3	
		Indication: no: no impact, +: positive -: negative Rough indication for ranking: The score is rough value. Your judgement based on your experiences / knowledge will be reflected to the ranking. -15 -12: -A; -11 -7: -B or -C; -6 +6: D or ±C; +7 +11: +B or +C; +12 +15: +A					
Pollution	Air Pollution	-1	-1	-1	-1	-1	-5/-C
	Water Pollution	-1	-1	-1	-1	-1	-5/-C
	Waste	-1	-1	-1	-1	-1	-5/-C
	Soil/Sediment Contamination	no	no	no	no	no	D
	Noise and Vibration	-1	-1	-1	-1	-1	-5/-C
	Odour	no	no	no	no	no	D
Natural Environment	Protected Areas	no	no	no	no	no	D
	Ecosystem	-1	-1	-1	-1	-1	-5/-C
	Hydrology	-1	-1	-1	-1	-1	-5/-C
	Topography and Geology	no	no	no	no	no	D
	Subsidence / Erosion	no	no	no	no	no	D
	Global Warming	no	no	no	no	no	D
	Landscape	no	no	no	no	no	D
Social Environment	Resettlement	no	no	no	no	no	D
	Living and Livelihood	no	no	no	no	no	D
	Local Economy	+1	+1	+1	+1	+1	+5/+C
	Historical / Cultural Heritage	no	no	no	no	no	D
	Land Use	no	no	no	no	no	D
	Vulnerable Groups	no	no	no	no	no	D
	Local Conflict	no	no	no	no	no	D
	Water Use / Right	-1	-1	-1	-1	-1	-5/-C
	Social Infrastructure / Services	-1	-1	-1	-1	-1	-5/-C
	Infectious Diseases	no	no	no	no	no	D
Remark							

Preliminary Scoping Check Sheet

Project Title: Irrigation Development in Jebel Lado

Project Activity: Construction

Installation of canal and pipe line

Environmental Items		Duration a)	Extent b)	Intensity c)	Cumulative d)	Reversible e)	Total Score (T) a)+b)+c)+d)+e) / Rank
		Short: 1 Medium: 2 Long: 3	Limited: 1 Medium: 2 Wide: 3	Small/Negligible: 1 Medium: 2 Big: 3	Non-Cumulative: 1 Cumulative: 3	Reversible: 1 Irreversible: 3	
		Indication: no: no impact, +: positive -: negative Rough indication for ranking: The score is rough value. Your judgement based on your experiences / knowledge will be reflected to the ranking. -15 -12 | -11 -7 | -6 +6 | +7 +11 | +12 +15 -A | -B or -C | D or ±C | +B or +C | +A					
Pollution	Air Pollution	-1	-1	-1	-1	-1	-5/-C
	Water Pollution	-1	-1	-1	-1	-1	-5/-C
	Waste	-1	-1	-1	-1	-1	-5/-C
	Soil/Sediment Contamination	no	no	no	no	no	D
	Noise and Vibration	-1	-1	-1	-1	-1	-5/-C
	Odour	no	no	no	no	no	D
Natural Environment	Protected Areas	no	no	no	no	no	D
	Ecosystem	-1	-1	-2	-1	-1	-6/-C
	Hydrology	-1	-1	-1	-1	-1	-5/-C
	Topography and Geology	no	no	no	no	no	D
	Subsidence / Erosion	no	no	no	no	no	D
	Global Warming	no	no	no	no	no	D
	Landscape	no	no	no	no	no	D
Social Environment	Resettlement	-1	-1	-1	-1	-1	-5/-C
	Living and Livelihood	-1	-1	-1	-1	-1	-5/-C
	Local Economy	+1	+1	+2	+1	+1	+6/+C
	Historical / Cultural Heritage	no	no	no	no	no	D
	Land Use	no	no	no	no	no	D
	Vulnerable Groups	no	no	no	no	no	D
	Local Conflict	-2	-1	-2	-1	-1	-7/-C
	Water Use / Right	no	no	no	no	no	D
	Social Infrastructure / Services	-1	-1	-1	-1	-1	-5/-C
	Infectious Diseases	no	no	no	no	no	D
Remark							

Preliminary Scoping Check Sheet

Project Title: Irrigation Development in Jebel Lado

Project Activity: Construction

Land clearance and leveling in command area

Environmental Items		Duration a)	Extent b)	Intensity c)	Cumulative d)	Reversible e)	Total Score (T) a)+b)+c)+d)+e) / Rank
		Short: 1 Medium: 2 Long: 3	Limited: 1 Medium: 2 Wide: 3	Small/Negligible: 1 Medium: 2 Big: 3	Non-Cumulative: 1 Cumulative: 3	Reversible: 1 Irreversible: 3	
		Indication: no: no impact, +: positive -: negative Rough indication for ranking: The score is rough value. Your judgement based on your experiences / knowledge will be reflected to the ranking. -15 -12 | -11 -7 | -6 +6 | +7 +11 | +12 +15 -A | -B or -C | D or ±C | +B or +C | +A					
Pollution	Air Pollution	-1	-1	-1	-1	-1	-5/D
	Water Pollution	-1	-1	-2	-1	-1	-6/-C
	Waste	-1	-1	-2	-1	-1	-6/-C
	Soil/Sediment Contamination	-1	-1	-1	-1	-1	-5/-C
	Noise and Vibration	-1	-1	-1	-1	-1	-5/D
	Odour	no	no	no	no	no	D
Natural Environment	Protected Areas	no	no	no	no	no	D
	Ecosystem	-3	-1	-2	-1	-3	-10/-B
	Hydrology	-1	-1	-1	-1	-1	-5/-C
	Topography and Geology	no	no	no	no	no	D
	Subsidence / Erosion	-2	-1	-1	-1	-1	-6/-C
	Global Warming	no	no	no	no	no	D
	Landscape	no	no	no	no	no	D
Social Environment	Resettlement	-2	-1	-1	-1	-1	-6/-C
	Living and Livelihood	+1	+1	+1	+1	+1	+5/+C
	Local Economy	+2	+1	+1	+1	+1	+6/+B
	Historical / Cultural Heritage	no	no	no	no	no	D
	Land Use	-1	-1	-1	-1	-3	-7/-C
	Vulnerable Groups	no	no	no	no	no	D
	Local Conflict	-2	-1	-2	-1	-1	-7/-B
	Water Use / Right	-1	-1	-2	-1	-1	-6/-C
	Social Infrastructure / Services	-1	-1	-1	-1	-1	-5/-C
	Infectious Diseases	no	no	no	no	no	D
Remark		The proposed command area seems to be low production in bare land, however possible resettlement or relocation of facilities may occur. In addition, wildlife may also affected.					

Preliminary Scoping Check Sheet

Project Title: Irrigation Development in Jebel Lado

Project Activity: Operation and Maintenance

Operation of pump

Environmental Items		Duration a)	Extent b)	Intensity c)	Cumulative d)	Reversible e)	Total Score (T) a)+b)+c)+d)+e) / Rank
		Short: 1 Medium: 2 Long: 3	Limited: 1 Medium: 2 Wide: 3	Small/Negligible: 1 Medium: 2 Big: 3	Non-Cumulative: 1 Cumulative: 3	Reversible: 1 Irreversible: 3	
		Indication: no: no impact, +: positive -: negative Rough indication for ranking: The score is rough value. Your judgement based on your experiences / knowledge will be reflected to the ranking. -15 -12 | -11 -7 | -6 +6 | +7 +11 | +12 +15 -A | -B or -C | D or ±C | +B or +C | +A					
Pollution	Air Pollution	-1	-1	-2	-1	-1	-6/-C
	Water Pollution	-1	-1	-2	-1	-1	-5/-C
	Waste	no	no	no	no	no	D
	Soil/Sediment Contamination	no	no	no	no	no	D
	Noise and Vibration	-1	-1	-2	-1	-1	-6/-C
	Odour	no	no	no	no	no	D
Natural Environment	Protected Areas	no	no	no	no	no	D
	Ecosystem	no	no	no	no	no	D
	Hydrology	no	no	no	no	no	D
	Topography and Geology	no	no	no	no	no	D
	Subsidence / Erosion	no	no	no	no	no	D
	Global Warming	-1	-1	-1	-1	-1	-5/-C
	Landscape	no	no	no	no	no	D
Social Environment	Resettlement	no	no	no	no	no	D
	Living and Livelihood	no	no	no	no	no	D
	Local Economy	no	no	no	no	no	D
	Historical / Cultural Heritage	no	no	no	no	no	D
	Land Use	no	no	no	no	no	D
	Vulnerable Groups	no	no	no	no	no	D
	Local Conflict	no	no	no	no	no	D
	Water Use / Right	-1	-1	-1	-1	-1	-5/-C
	Social Infrastructure / Services	no	no	no	no	no	D
	Infectious Diseases	no	no	no	no	no	D
Remark							

Preliminary Scoping Check Sheet

Project Title: Irrigation Development in Jebel Lado

Project Activity: Operation and Maintenance
Farming

Environmental Items		Duration a)	Extent b)	Intensity c)	Cumulative d)	Reversible e)	Total Score (T) a)+b)+c)+d)+e) / Rank
		Short: 1 Medium: 2 Long: 3	Limited: 1 Medium: 2 Wide: 3	Small/Negligible: 1 Medium: 2 Big: 3	Non-Cumulative: 1 Cumulative: 3	Reversible: 1 Irreversible: 3	
		Indication: no: no impact, +: positive -: negative Rough indication for ranking: The score is rough value. Your judgement based on your experiences / knowledge will be reflected to the ranking. -15 -12 | -11 -7 | -6 +6 | +7 +11 | +12 +15 -A | -B or -C | D or ±C | +B or +C | +A					
Pollution	Air Pollution	no	no	no	no	no	D
	Water Pollution	-2	-2	-2	-1	-1	-8/-B
	Waste	-1	-1	-1	-1	-1	-5/-C
	Soil/Sediment Contamination	-1	-1	-1	-1	-1	-5/-C
	Noise and Vibration	no	no	no	no	no	D
	Odour	no	no	no	no	no	D
Natural Environment	Protected Areas	no	no	no	no	no	D
	Ecosystem	+2	+1	+1	+1	+3	+8/+C
	Hydrology	no	no	no	no	no	D
	Topography and Geology	no	no	no	no	no	D
	Subsidence / Erosion	no	no	no	no	no	D
	Global Warming	no	no	no	no	no	D
	Landscape	no	no	no	no	no	D
Social Environment	Resettlement	no	no	no	no	no	D
	Living and Livelihood	+3	+1	+2	+1	+3	+10/+B
	Local Economy	+3	+2	+3	+3	+3	+14/+A
	Historical / Cultural Heritage	no	no	no	no	no	D
	Land Use	-3	-2	-1	-1	-1	-8/-B
	Vulnerable Groups	-1	-1	-1	-1	-1	-5/-C
	Local Conflict	-2	-1	-2	-3	-1	-9/-B
	Water Use / Right	-1	-1	-1	-1	-1	-5/-C
	Social Infrastructure / Services	no	no	no	no	no	D
	Infectious Diseases	-1	-1	-1	-1	-1	-5/-C
Remark		Agricultural production can contribute to economic improvement. Water / soil pollution may occur if pesticide / fertilize is not properly used.					

Scoping Matrix

Project Title: Irrigation Development in Jebel Lado

Environmental Parameters		Pre-construction		Construction									Operation & Maintenance				
		Land preparation		Construction of pump station	Installation of canals and pipe	Land clearance and levelling, in command area							Operation of pump	Farming			Overall
Remark		positive: +, negative: - A: Significant impact is expected, B: Moderate impact is expected, C: Level of impact unknown, D: No / negligible impact															
Pollution	Air Pollution	D		-C	-C	D							-C	D			-C
	Water Pollution	D		-C	-C	-C							-C	-B			-C
	Waste	-C		-C	-C	-C							D	-C			-C
	Soil/Sediment Contamination	D		D	D	-C							D	-C			-C
	Noise and Vibration	-C		-C	-C	D							-C	D			-C
	Odour	D		D	D	D							D	D			D
Natural Environment	Protected Areas	D		D	D	D							D	D			D
	Ecosystem	-C		-C	-C	-B							D	+C			-B
	Hydrology	-C		-C	-C	-C							D	D			-C
	Topography and Geology	D		D	D	D							D	D			D
	Subsidence / Erosion	D		D	D	-C							D	D			-C

Environmental Parameters		Pre-construction		Construction								Operation & Maintenance				
		Land preparation		Construction of pump station	Installation of canals and pipe	Land clearance and levelling, in command area						Operation of pump	Farming			Overall
Remark		positive: +, negative: - A: Significant impact is expected, B: Moderate impact is expected, C: Level of impact unknown, D: No / negligible impact														
	Global Warming	D		D	D	D						-C	D			D
	Landscape	D		D	D	D						D	D			D

Scoping Matrix

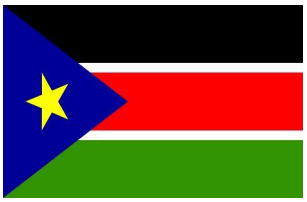
Environmental Parameters		Pre-construction		Construction									Operation & Maintenance				Overall
		Land preparation		Construction of pump station	Installation of canals and pipe	Land clearance and levelling, in command area							Operation of pump	Farming			
Remark		positive: +, negative: - A: Significant impact is expected, B: Moderate impact is expected, C: Level of impact unknown, D: No / negligible															
Social Environment	Resettlement	-C		D	-C	-C							D	D			-C
	Living and Livelihood	-C		D	-C	+C							D	+B			+B
	Local Economy	D		+C	+C	+B							D	+A			+A
	Historical / Cultural Heritage	D		D	D	D							D	D			D
	Land Use	-C		D	D	-C							D	-B			-B
	Vulnerable Groups	D		D	D	D							D	-C			D
	Local Conflict	-C		D	-C	-B							D	-B			-B
	Water Use / Right	D		-C	D	-C							-C	-C			-C
	Social Infrastructure / Services	-C		-C	-C	-C							D	D			-C
	Infectious Diseases	D		D	D	D							D	-C			D

Outline of Scoping Results

Project Title: Irrigation Development in Jebel Lado

Type of Impact and Score		Outline of Impact	Expected Mitigations	Study Items for EIA	Recommended Method
(1) Pollution					
Air pollution	-C	- Exhaust gas generated by construction works and operation of pump	- Use low-emission equipment with proper maintenance	- Air quality conditions - Construction plan, pump operation plan	- Check of quality of construction equipment and pump in terms of prevention from exhaust gas - Site survey on location of possible sensitive zones against air pollution such as residential area, school zone, etc.
Water pollution, Soil / sediment contamination	-C	- Turbid water from construction site - Oil leakage - Pesticide and fertilizers in farming	- Proper temporary drainage - Storage of used oil - Proper use of pesticide and fertilizers	- Water quality conditions - Farming plan in terms of use of chemicals	- Measure of current water quality - Examine of possible pollution sources by the project
Waste	-C	- Construction waste - Agricultural waste	- Proper use of waste disposal site - Proper waste storage - Waste recycle, reuse and reduction	- Disposal site - Waste type	- Investigation of possible disposal site for construction waste - Estimation approximate waste volume
Noise	-C	- Construction noise by equipment, truck, e.g. - Noise form generator during pump operation	- Noise barrier - Select low-noise generator, equipment, truck, etc. - Adjust construction time avoiding night time	- Noise measurement - Sensitive zone	- Check of quality of construction equipment and pump in terms of prevention from noise / vibration - Site survey on possible sensitive zones against noise / vibration such as residential area, school zone, etc.
(2) Natural Environment					
Ecosystem	-B	- Possible habitats, feeding / nurturing area for wildlife - Secondary forest, plantation	- Canal and pipeline route avoiding wildlife corridor	- Location of wildlife habitats, feeding / nurturing area - Forest, plantation	- Interview with local communities - Direct observation on wildlife habitats, migration, etc. - Trap survey
Hydrology, Floods	-C	- Obstruction of water flow during rainy season	- Proper design of command area - Flood prevention	- River water flow - Possible flood prone area	- Historical records of floods - Condition of water body in rainy season

Type of Impact and Score		Outline of Impact	Expected Mitigations	Study Items for EIA	Recommended Method
(3) Social Environment					
Resettlement	-C	- Land occupation - Proposed command area is mostly bare land with low production.	- Agreement on resettlement with proper compensation plan	- Land use - Public consultation - Resettlement plan	- Survey on land use, land status, land ownership, etc. - Estimation of land and asset price - Public consultation for consensus building
Living and livelihood	+B	- Land occupation - Job / business opportunity be construction works, farming	- Public announcement, consensus building - Priority recruitment to local community	- Community and local job profile - Public consultation	- Investigation of community living condition and livelihood - Interview with communities
Local economy	+A	- Job / business opportunity be construction works, farming	- Priority procurement from local - Proper farming plan to increase agricultural production	- Business profile in local - Expected agricultural production by the project	- Investigation of local economic profile - Investigation of future plans, developments, investments
Land use	-B	- Land occupancy - Obstruction of existing business - Proposed command area is mostly bare land with low production.	- Consensus building - Encourage alternative improvement	- Existing and future land use plan - Public consultation	- Survey on land use, land status, land ownership - Investigation of land use plan - Public consultation
Local Conflict	-B	- Gap of benefits among communities	- Consensus building - Income recovery plan - Proper compensation	- Public consultation - Compensation plan	- Investigation of job profile, income level and sources - Public consultation
Water use / right	-C	- Increasing of water irrigated	- Consensus building - Proper rules on fair water use	- Public consultation - Legal status on water use / right	- Investigation of water use / right - Public consultation
Social Infrastructure / Services	-C	- Scattered grave yards in the project site	- Proper design avoiding those facilities, relocation if possible and necessary	- Land use - Mapping	- Site survey on location of social infrastructures - Interview with local communities, etc.



THE REPUBLIC OF SOUTH SUDAN

MINISTRY OF ELECTRICITY, DAMS, IRRIGATION & WATER RESOURCES

WATER SECTOR

IRRIGATION DEVELOPMENT MASTER PLAN

(FINAL REPORT)

ANNEX 9: IMPLEMENTATION PLANS FOR PRIORITY PROJECTS

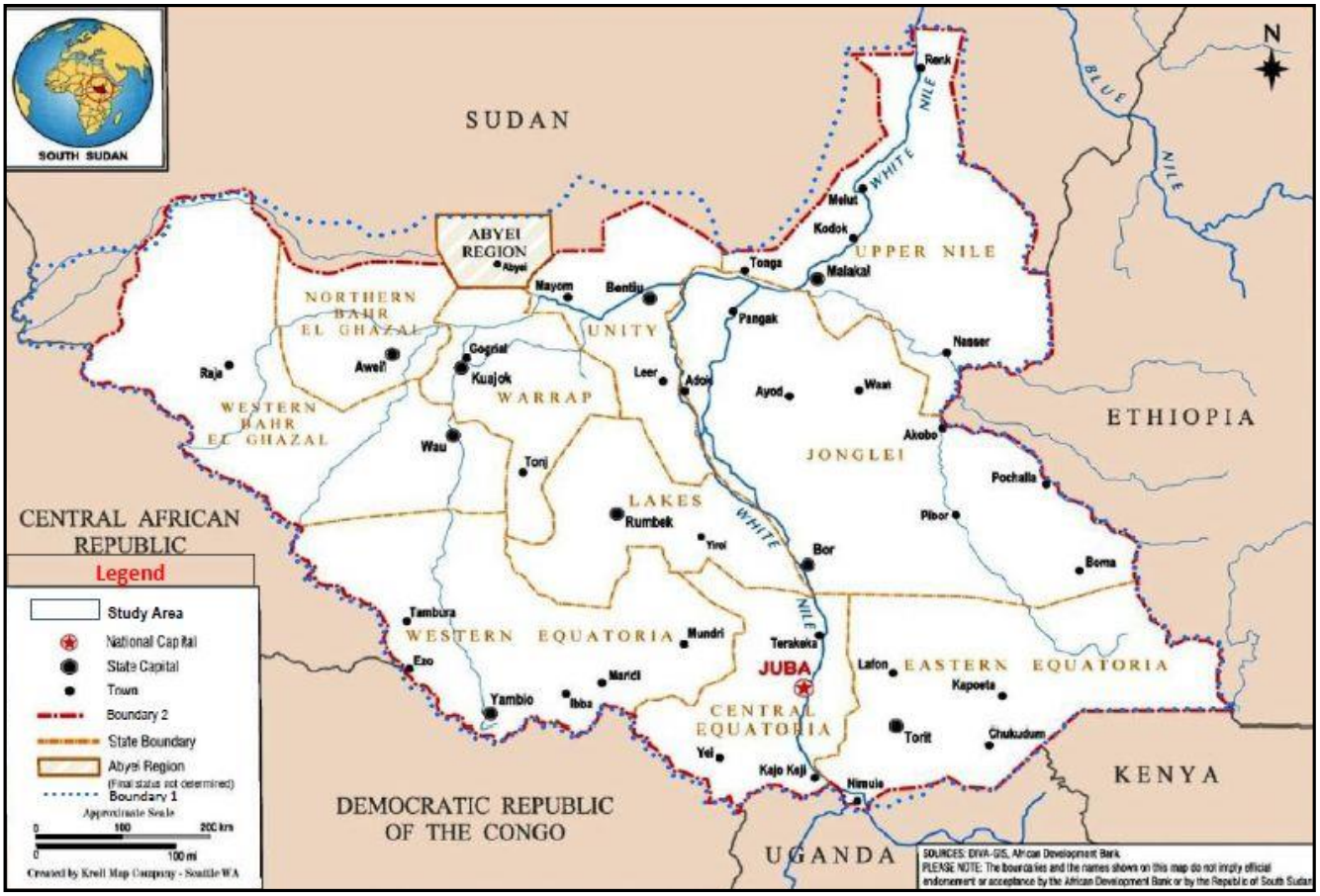
9-3: Pre-Feasibility Study of Rejaf East Irrigation Scheme

NOVEMBER 2015

THE PROJECT FOR IRRIGATION DEVELOPMENT MASTER PLAN IN THE REPUBLIC OF SOUTH SUDAN (RSS)

LOCATION MAP

Map of the Republic of South Sudan



Location Map: Adopted from African Development Bank

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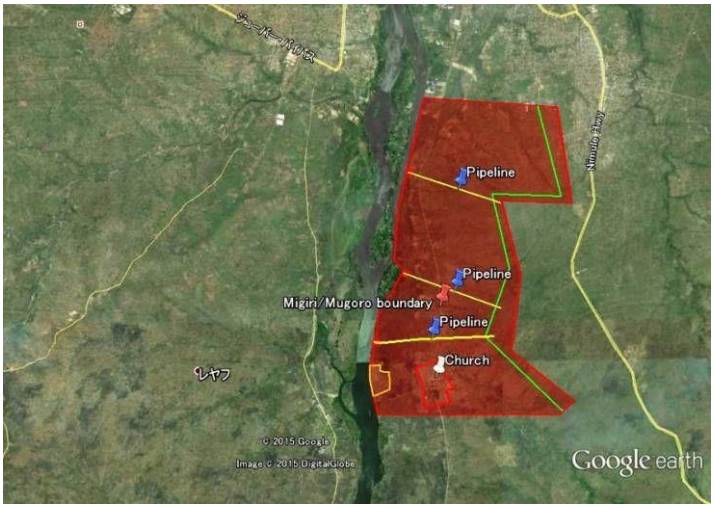
TABLES AND FIGURES

PART 1 PRESENT SITUATION OF THE PROJECT AREA

CHAPTER 1 SITE PROFILE

1.1 Location

Rejaf East Irrigation Scheme is located adjacent per-urban area of Juba city, where high demand of food supply due to its large population. Hence, there is a large potential to generate cash income by producing cash crops including vegetables. Especially, production of leafy vegetables, which are not imported from foreign countries because of its perishability, is likely to make a good profit. In addition, low humidity in dry season can lead to reduction of risk caused by fungi or disease.



Source: IDMP TT (Soil survey 2015)

Figure 1.1.1 Location of Project Area

1.2 Beneficial Area and Communities

There are three (3) communities residing in the project area namely Guduge, Migiri and Mogoro. The land is tenured under the communities, while certain areas have been invested by private sectors for farmlands, housing site, etc. Due to close location from Juba city, land potential is high, so that land holding could be complicated.

1.3 Basic Community Profile

(1) Basic information about the communities

Dominant livelihood of those communities is farming and fishery, but also certain people work in Juba city for side businesses. According to the communities, they were caught in battles under the past civil war. Therefore many grave yards are scattered in the project site.

(2) Basic agricultural status

High demand of food supply is expected due to its large population. Hence, there is a large potential to generate cash income by producing cash crops. There some farmers who have been already engage in cultivating crops by irrigation using portable pumps.

Some farmers are practicing irrigated agriculture using small pump along the Bahr el Jebel and they are cultivating banana and vegetables, which are mainly for selling. It seems they have potential to cultivate cash crops in dry season.

CHAPTER 2 NATURAL CONDITIONS

2.1 Topographic Survey

(1) Scope of works

For topographic survey, the following equipment was used:

- Total station Sokkia set 510;
- Global positioning system (GPS) receiver (Sokkia GRX1 , Trimble 5800);
- Level and
- AutoCAD system (Autocad civil 3d).

Survey structure contains:

1) Pipeline:

- Establishment of temporary benchmark (TBM)
- Longitudinal profile survey: in drawing profile use the Auto cad civil 3d and layout in (A3) paper (plan & profile in one sheet Scale: V=1/100, H=1/1,000)
- Cross-sectional Survey: any 100 m, width of section 200m, 15sections (scale: V=1/100, H=1/100)
- Plane Survey: area (1500*3300 m^2) create contour map by scale 1:4000

2) Canal route survey:

- Establishment of temporary benchmark (TBM)
- Longitudinal profile survey: in drawing profile use the Auto cad civil 3d and layout in (A3) paper (plan & profile in one sheet Scale: V=1/100, H=1/1,000)
- Cross-sectional Survey: any 200m, width of section 200m, 15sections (scale: V=1/100, H=1/100)
- Plane Survey: 4 area (200*200 m^2) create contour map by scale 1:4000

3) Command area survey:

- Establishment of temporary benchmark (TBM)
- Longitudinal profile survey: in drawing profile use the Auto cad civil 3d and layout in (A3) paper (plan & profile in one sheet Scale: V=1/100, H=1/1,000)
- Cross-sectional Survey: any 100m, width of section 200m, 15sections (scale: V=1/100, H=1/100)
- Plane Survey: area (6500*2000 m2) create contour map by scale 1:4000

4) Pumping station survey:

- Establishment of temporary benchmark (TBM)
- Cross-sectional Survey: any 500m, width of section 500m, 15sections (scale: V=1/100, H=1/100)
- Plane Survey: area (500*300 m^2) create contour map by scale 1:4000

The survey area is described as below:

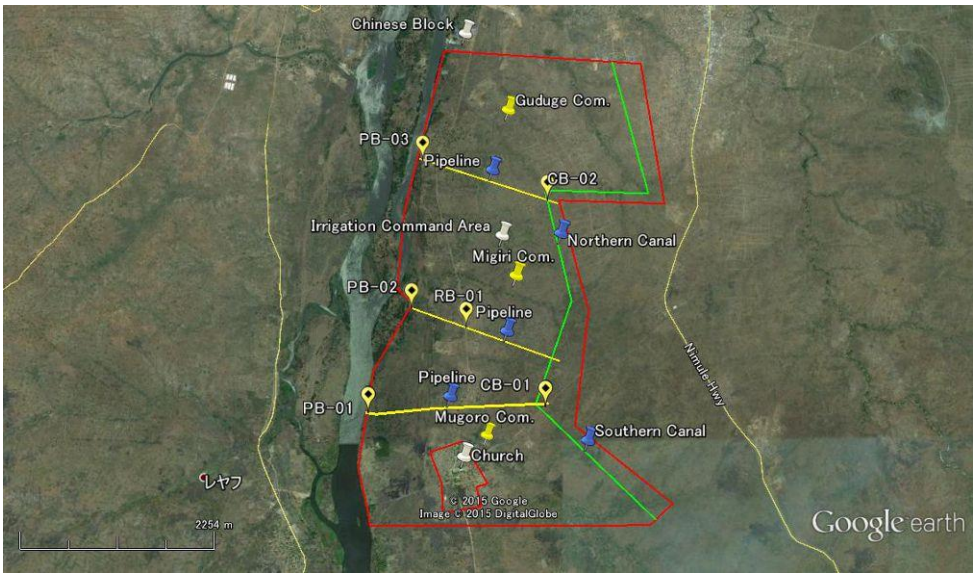


Figure 2.1.1 Overview of Survey Area

(2) Topographical profile

Command area is located from right bank of Bahr el Jebel toward the hillside of 2km distance. The terrain between riverside and Rejaf Road is flat, and many small irrigation farms are scattered along the river. The terrain of hillside is undulate, and many bushes, trees and grasses dominate in the site. Pump station site has some big trees. In the pipe line and canal line, the conditions are almost same as the command area.

2.2 Geological Survey

(1) Scope of works

1) Borehole drilling

The borehole drilling works at the proposed three pump stations constituted a total of 45mts and detailed as:

- PB-01: 10m X 1 borehole (at the pumping station No. 1 in the Mugoro Community)
- PB-02: 10m X 1 borehole (at the pumping station No. 2 in the Migiri Community)
- PB-03: 10m X 1 borehole (at the pumping station No. 3 in the Guduge Community)
- CB-01 & CB-02: 5m X 2 boreholes (on the North & South Main canal alignment)
- RB=01: 5m X 1 borehole (on the pipe line alignment at the crossing of the Rejaf-Eat Town road)

2) Standard penetration test (SPT)

A total of 45 STP tests are designed to be run in this project activity and the details are presented as:

- At three Pump Stations: 10 tests X 3 boreholes (at 1 mt interval in 10mt ï borehole at the three pumping stations)
- On The North & South Main Canal Alignments: 5 tests X 2 boreholes (at 1mt interval in 5m ï borehole on the canal alignment)

- At the Pipe Line Alignment: 5 tests X 1borehole (at 1m interval in 5m- borehole on the pipeline alignment across Rejaf-East Town road)

3) Laboratory test

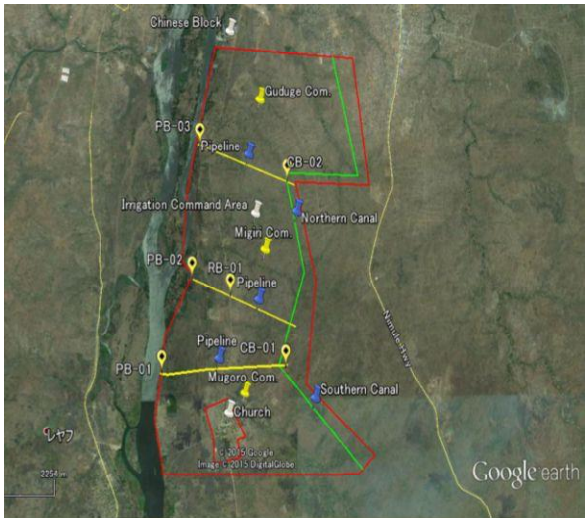
As per to the technical specification provided by the Consultant, the Nine Samples to be taken to the Laboratory are detailed as:

- 2 samples from 10m-borehole × 3 pumping stations,
- 2 samples from 5m-borehole on the canal alignment, and
- 1 samples from 5m-borehole on the pipeline alignment across Rejaf-East Town road

Locations of boreholes are shown in Figure 2.2.1.

(2) Geological profile

The pump site area is covered by thick (3m-8m) soils（ML, CL, SM, SC, SP）, the River deposit along the river bank and the base rock is Gneiss. The command area is covered by relatively thin (2m- 3m) soil (SW). There are outcrops of sound bed rock in the command area. The rock underlying the thin soil layer is moderately weathered Gneiss and is found out slightly weathered and well jointed Granite.



Source: IDMP TT

Figure 2.2.1 Locations of Boreholes in the Survey Area

2.3 Hydrology

Annual rainfall is about 1000mm. Bahr el Jebel has plenty of water for irrigation water.

2.4. Soil Investigation

(1) Methodology

Generally, there are two (2) ways to select survey points in certain area. The first way is just to choose points to cover the area equally, for instance by covering square mesh with certain distance and selecting the crossing as survey points. This way is applied in case no specific geological or topographic information is available. On the other hand, the second way is to select survey points according to the existing information regarding soil type distribution in the area, which is applicable only in case thereôs available information got on the ground. In case of Rejaf East, the second way was applied because it is recognized soil condition changes from the river bank (western part of the command area) to eastern part where main road connecting to Juba. In addition, there is existing residential area and farmland in the command area, for instance, the area around church located in southern part of the command area is intensively populated. Hence, it was necessary to avoid choosing points in such area.

Figure 2.4.1 shows the points at which actual survey was carried out and 9 points were examined after all.

(2) Result of field observation (soil conditions)

In the command area, there is heavy vegetation like Jebel Lado, it covered with trees and bushes. Soil in the command area has deep dark brown colour ant its texture mainly ranges from Sandy Loam to Loam. Relatively much amount of gravels was observed on the section from the top to 1m depth. In some part of the command area, large stones being out on the surface were observed. Soil is not compacted on the whole, and it was very soft from top up to at least 60 to 70 cm. Around No.7 near from the river (See Figure 2.4.1) is like damp area, where oxidized mottles were observed on the section.

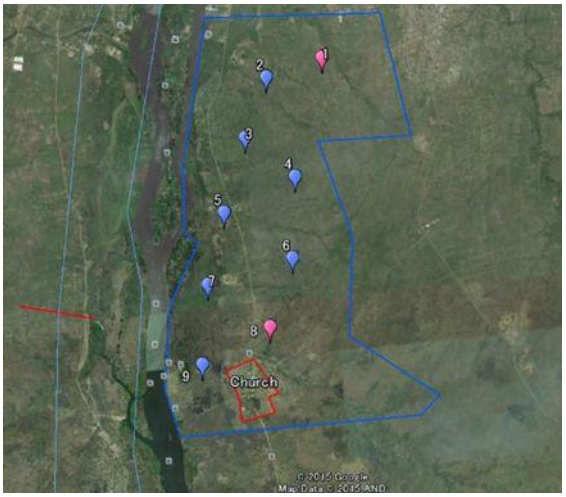


Figure 2.4.1 Soil Survey Points

* Blue points are for 50 cm depth cross section survey, and red ones are for 1 m depth.
* Distance of mesh covered over the command area is 1 km.

Figure 2.4.2 Soil Profile in Command Area

Figure 2.4.3 Land Scape in Command Area

1) Result of chemical analysis and consideration (soil chemistry)

Table 2.4.1 shows the result of chemical analysis. Humus ratio was as high as 2.7 % and at some points it was more or nearly equal to 4%. CEC was 13.9 me/100g on average. Compared to desirable value (generally it is said more than 20 me/100g is ideal), it is relatively low and it can be improved more by land management.

Nutrient contents vary widely place to place. For instance, at No.3 to 5 (the middle part of the command area, see Figure 2.4.1) Calcium and Magnesium contents tend to be low. Apart from the amount of contents, unbalanced base ratio would have to be moderated as same as other two (2) sites.

Soil pH is almost within suitable range, but only soil at No.5 was alkaline. Detailed distribution of soil pH is not available, but pH control may have to be treated at some parts of the command area at the stage of actual farming operation.

Table 2.4.1 Chemical Analysis Results

	Average	Minimum value	Maximum value
Humus ratio (%)	2.7	1	4.7
CEC (me/100g) *1 *2	13.9	7.6	21
NO_3-N (mg/100g)	1.1	0.3	2.7
Fe_2O_3 (ppm)	11.4	0	30
P_2O_5 (mg/100g)	20.6	0	50
K_2O (mg/100g)	81.9	1	168
CaO (mg/100g)	248.1	61	514
MgO (mg/100g)	43.0	5	131
Mn (mg/100g)	2.1	0	5
pH	6.8	6	8.9
EC *3	0.0	0	0.06
Total N (%) *2	0.2	0.09	0.36
CN ratio *2	6.7	5.8	7.6
Base ratio			
CaO/MgO *2	8.4	1.1	20.3
MgO/K2O *2	18.1	0.1	136.3
CaO/K2O *2	100.1	1.4	699.2

Source: IDMP TT (Soil survey 2015)
*1 CEC is an abbreviation of Caption Exchange Capacity
*2 Estimated value.
*3 EC is an abbreviation of Electric conductivity.

CHAPTER 3 AGRICULTURE AND SOCIO-ECONOMIC

3.1 Methods of Agriculture and Socio-Economic Survey

Agriculture and Socio-Economic Survey was conducted by interview with a questionnaire in the project area. The related three (3) communities were targeted; namely Guduge, Migiri, and Mogoro, which are located north, central, and south part of the command area respectively. All of communities are under Tokiman boma, Rejaf payam, Juba County. The survey aimed to take necessary data for making the farming plan and evaluating the priority projects from the viewpoints of socio-economic and marketing. The contents of the questionnaire consisted of 14 items, centralizing the related questions to the situation of farming and household.

The enumerators in pairs were going to hold two interviews a day, target interviewees counted 26 households. It is necessary to previously explain the survey method to the interviewees since the questions include private points, such as household income, expenditure, etc. Grasping the current situation of the target communities is indispensable for the planning of the priority projects. Hence, a preliminary workshop was held before the survey. Days of workshop and number of interviewees are given as below:

Days of Workshops : Middle of June, 2015
Number of interviewees : 26 persons (Breakdown is shown in the table below)

Table 3.1.1 Interviewees' Information

Community	Male	Female	Total
Gwuduge	4	5	9
Mogiri	6	2	8
Mugoro	8	1	9
Total	18	8	26

Source: IDMP TT (Socio-economic survey, 2015)

The contents of the questionnaire are divided into the 14 items; 1) Background of household, 2) Land holding and land tenure, 3) Inventory of farm machinery and hiring cost of farming power, 4) Crop production and farming practices, 5) Income from other crops in home garden, livestock and other products, 6) Wages/ salary, leasing, business and other income, 7) Living expenses, 8) Present farming situation, 9) Selling of agriculture products, 10) Existing farmers' group and farmersôorganization, 11) Irrigation service charge / activity of WUA or WG, 12) Loan, 13) Agricultural services / agricultural activities, and 14) Gender/ roles and responsibilities.

In terms of the social sector, questions, such as land tenure, gender issues/roles, drinking water, cooking fuel, etc., were set in the questionnaire, referring Handbook on Community Engagement, April 2012, South Sudan Law Society. Though there is enough development potential of the land use, some issues, such as dealing of community land, land utilizing division of tribes, etc., have to be treated carefully.

From the viewpoints of making the planting plan, the enumerators asked the interviewees about their views for future crops based on the existing planting model. In addition to the question, the enumerators also asked their intention of the crop selection in order to grasp the needs of an irrigation project and reflect to the farming plan. Also, as for the introduction of fertilizer, concerned questions were made based on the results of the sales conditions survey in Juba to make the agriculture input plan for the priority projects in accordance with the actual conditions.

3.2 Socio-Economic Indicators

(1) Household members

Table 3.2.1 shows the average household members with the number of children under14 years old in Rejaf East. The total average number of family members is 6.4 persons/ household.

Table 3.2.1 Average Household Members

Community	Adults equal/above 14			Children under 14			Total
	Male	Female	Sub Total	Male	Female	Sub Total	
Gwuduge	2.4	2.3	4.8	0.6	0.2	0.8	5.6
Migiri	2.8	2.1	4.9	1.1	1.3	2.4	7.3
Mogoro	1.9	2.5	4.4	0.6	1.6	2.3	6.6
Total	2.4	2.3	4.7	0.8	1.0	1.8	6.4

Source: IDMP TT (Socio-economic survey, 2015)

Interviewees' education experiences were also asked in the questionnaire. In Rejaf East, half of the interviewees who answered to this question graduated only from primary school and another half has secondary school educational experience or higher grade.

Interviewees and their families are sometimes engaged in another work, such as employee/Government staffs.

(2) Income from farming and others

Table 3.2.2 shows the estimated net cash income and net income per annum from farming in Rejaf East. The annual net cash income from farming is about four (4) thousand SSP and annual net income is about eight (8) thousand SSP, respectively. About half of net income is consumed within household. Major components of net income are those from Maize, Okra and Jew's mallow followed by Sorghum and Cassava. On the other hand, Major components of net cash income are those from Jew's mallow, Okra, followed by Maize and Eggplant.

Table 3.2.2 Net Cash/Inputted Income from Farming

	Area (ha/HH) (a)	Yield (t/ha) (b)	Production (kg/HH) (c)=(a)*(b)	ratio for sale (d)	Farm gate price (SSP/kg) (e)	Production cost (SSP/ha) (f)	Net cash income (SSP/HH) (g) =(c)*(d)*(e)-(a)*(f)	Net income (SSP/HH) (h) =(c)*(e)-(a)*(f)
Maize	0.73	0.7	486.8	48.1%	3.7	125	775	1,710
Sorghum	0.24	0.9	209.9	-	(4.2)	98	-23	858
Cassava	0.12	1.6	187.6	1.0%	5	441	-44	885
Common bean	0.04	0.3	14.6	-	(4.6)	16	-1	67
G nut	0.23	0.8	181.3	-	(3.9)	154	-36	672
Sesame	0.01	0.5	3.2	-	(4.8)	0	-	15
Vegetables								
Okra	0.12	1.1	131.3	92.5%	9.1	1,005	985	1,074
Tomato	0.02	3.6	75.0	98.1%	4.3	571	304	311
Egg plant	0.03	1.8	55.1	92.7%	14.5	580	722	780
Pumpkin	0.01	0.8	4.0	92.0%	10	159	36	39
Jew's mallow	0.12	2.2	263.8	96.0%	4.5	690	1,057	1,105
Amaranthus	0.05	3.2	157.2	98.8%	0	621	-31	-31
Sukuma wiki	0.01	0.9	10.8	34.4%	5	926	7	42
Cowpea	0.05	0.7	35.7	100.0%	3.6	175	120	120
Onion	0.01	2.9	24.0	100.0%	2	7,190	-12	-12
Green pepper	0.02	0.8	16.5	75.0%	13.8	1,011	150	206
Total							4,009	7,841

Source: IDMP TT (Socio-economic survey, 2015)
Note: Farm-gate price in ( ) is the average of other sites due to lack of data in this site

Next table shows annual average household income from other than farming in each area. We can find that the salary income from other occupation, such as government official, company employee, driver, etc. in Rejaf East is much bigger than other areas. Figures in receipt of gifts and remittance from relatives and others were estimated, based on the monthly income. There is only one case of lease income of farm land in Rejaf East.

Table 3.2.3 Average Household Income from Non-faming (SSP/year)

Areas	Salary of other occupations	Wages as casual worker	Gifts and remittance	Lease of farm land	Total
Wau	317	162	462	-	940
Jebel Lado	706	-	-	-	706
Rejaf East	3,005	-	462	38	3,505
Total	1,299	53	320	13	1,685

Source: IDMP TT (Socio-economic survey, 2015)

(3) Living expenses

Next table shows average household expenditure in a year. The annual total outlay is about 17 thousand SSP. Outlay for foods is about nine thousand SSP, which occupies 52 % of the total expenditure. Purchase of meat and eggs is SSP 20 hundred, which is the biggest item and occupies 11 % of the total expenditure. The following big items are outlay for education, SSP 19 hundred (11%), outlay for medical care, SSP 16 hundred (9%), and purchase of clothing, SSP 15 hundred (9%).

Table 3.2.4 Average Household Expenditure

Foods	(SSP/HH)	(%)	Other than foods	(SSP/HH)	(%)
Maize	1,274	7.3	Tobacco and Cigarettes	539	3.1
Sorghum	642	3.7	Soap, Shampoo	729	4.2
Cassava	145	0.8	Electricity charges	-	-
Common Beans	330	1.9	Firewood, cooking fuel and LP-gas	450	2.6
Ground nut	379	2.2	Lighting fuel	170	1.0
Sesame	62	0.4	Household furnishing and equipment	-	-
Other tubers and Roots	119	0.7	Repair and maintenance of house	-	-
Fish	524	3.0	Clothing	1,537	8.8
Meat and Eggs	1,959	11.2	Medical care	1,614	9.2
Vegetables	209	1.2	Education	1,938	11.1
Flour	346	2.0	Recreation	18	0.1
Bread	430	2.5	Ceremonial Occasions	292	1.7
Tea and Coffee	491	2.8	Transportation and communication	1,059	6.1
Milk and Yogurt	90	0.5	Remittance to relatives	41	0.2
Liquor and Soft drinks	-	0.0	Land and house rent	-	-
Cooking oil	1,239	7.1	Taxes	-	-
Sugar and Salt	784	4.5	Loan repayment	-	-
Spice and other foods	54	0.3	Sub total	8,388	48.0
Sub total	9,077	52.0	Grand total	17,466	100.0

Source: IDMP TT (Socio-economic survey, 2015)

(4) Loans

Question regarding loan was made in the questionnaire and 15 interviewees answered to the question. Four (4) of them borrow money, and one (1) borrowed from Equity bank and three (3) from their relatives. One (1) borrowed from 350-700 SSP, two (2) borrowed from 700-1400 SSP and one borrowed more than 3500 SSP from Equity bank with 20 %/month of interest rate and three (3) years repayment period.

Their purposes of borrowing money were 1) To hire agricultural labor, 2) Agricultural machines such as water pump and 3) House construction.

On the other hand, majority of the interviewees are not borrowing money. The most major reason of not borrowing money was lack of opportunity / place to borrow money, followed by ñNot necessaryò, ñUnable to refundò and ñUnable to provide with collateralò.

(5) Farmers' groups/organizations

There were four (4) interviewees who was a member of an existing farmersô group (FG) or farmersô organization (FO) in 20 interviewees answered to concerned questions. A common objective of the four-FG/FO is organizing social activities for the village. Two of them are also organized for cooperative shipping of products, and one of them is also organized for cooperative purchasing of farm inputs such as fertilizers, agro-chemical, etc.

Three members of the FG/FO are not satisfied about the present activities though one member is fairly satisfied about them. The three members answered about problems of their FG/FO as follows.

- No fund to manage FG/FO.
- Farmers have no interest to organizationôs activities.
- No leader.
- FG/FO is managed only on the leaderôs ideas and opinion of members is not considered.
- Leader has no sense of responsibility to the members.

There was no interviewee who was a member of an existing water group or water users association.

(6) Roles of males, females and children

Next table shows gender rates of selling cereals in each area. We can find that the ratio of female only is higher and the ratio of male only is lower than those of the total. The reason is considered that selling amount of cereals in Rejaf East is smaller than the total average so that the sales do not require male power so much. The ratio of ñWith Childrenò means that children participate in the sales in 13 % of the total households which answered concerned questions in Rejaf East.

Table 3.2.5 Gender Rates of Selling Cereals (%)

Area	Male only	Female only	Both M&F	With Children
Wau	42	19	38	12
Jebel Lado	13	65	22	9
Rejaf East	19	50	31	13
Total	26	43	31	11

Source: IDMP TT (Socio-economic survey, 2015)

Next table shows gender rates of selling vegetables. The ratio of female only is higher than that of male only. The reason is considered that selling vegetables does not require male power so much.

Table 3.2.6 Gender Rates of Selling Vegetables (%)

Area	Male only	Female only	Both M&F	With Children
Wau	36	48	16	8
Jebel Lado	9	78	13	9
Rejaf East	25	56	19	6
Total	23	61	16	8

Source: IDMP TT (Socio-economic survey, 2015)

Next table shows gender rates of selling livestock. We can find that almost all sales of livestock are conducted by men. The reasons are considered that selling livestock requires male power and that provide comparatively big money.

Table 3.2.7 Gender Rates of Selling Livestock(%)

Area	Male only	Female only	Both M&F	With Children
Wau	92	0	8	0
Jebel Lado	100	0	0	0
Rejaf East	88	0	13	19
Total	94	0	6	5

Source: IDMP TT (Socio-economic survey, 2015)

To grasp the situation of money management in households, gender rates of managing incomes are arranged in tables below. We can find that ratios of male only are higher than those of female only; especially, most income management of livestock is conducted by men. Item whose ratio of female only is comparatively high is vegetable.

Table 3.2.8 Managing Income of Cereals (%)

Area	Male only	Female only	Both M&F
Wau	46	8	46
Jebel Lado	78	13	9
Rejaf East	44	25	31
Total	57	14	29

Source: IDMP TT (Socio-economic survey, 2015)

Table 3.2.9 Managing Income of Vegetables(%)

Area	Male only	Female only	Both M&F
Wau	42	25	33
Jebel Lado	70	13	17
Rejaf East	38	31	31
Total	51	22	27

Source: IDMP TT (Socio-economic survey, 2015)

Table 3.2.10 Managing Income of Livestock (%)

Area	Male only	Female only	Both M&F
Wau	71	4	25
Jebel Lado	100	0	0
Rejaf East	53	0	47
Total	76	2	22

Source: IDMP TT (Socio-economic survey, 2015)

Table 3.2.11 Managing Income of Non-farming (%)

Area	Male only	Female only	Both M&F
Wau	42	23	35
Jebel Lado	22	17	61
Rejaf East	38	25	38
Total	34	22	45

Source: IDMP TT (Socio-economic survey, 2015)

On the other hand, almost all works of water taking and collecting firewood are conducted by women as showing tables below.

Table 3.2.12 Gender Rates of Water Taking (%)

Area	Male only	Female only	Both M&F	With Children
Wau	4	92	4	35
Jebel Lado	0	96	4	57
Rejaf East	7	93	0	33
Total	3	94	3	42

Source: IDMP TT (Socio-economic survey, 2015)

Table 3.2.13 Gender Rates of Collecting Firewood (%)

Area	Male only	Female only	Both M&F	With Children
Wau	4	96	0	44
Jebel Lado	0	100	0	59
Rejaf East	6	94	0	31
Total	3	97	0	46

Source: IDMP TT (Socio-economic survey, 2015)

Next tables show average distances from houses to water source / collecting point of firewood, and necessary times per day/week for the works.

Table 3.2.14 Basic Data on Water Taking

Area	Distance (meter)	Times per day	Hours per time	Hours per day
Wau	830	3.1	0.7	2.1
Jebel Lado	447	3.3	0.4	1.4
Rejaf East	266	2.9	0.4	1.2
Total	556	3.1	0.5	1.7

Source: IDMP TT (Socio-economic survey, 2015)

Table 3.2.15 Basic Data on Collecting Firewood

Area	Distance (meter)	Times per week	Hours per time	Hours per week
Wau	660	3.4	2.2	7.6
Jebel Lado	820	2.1	1.5	3.3
Rejaf East	920	2.5	1.4	3.4
Total	780	2.7	1.7	4.7

Source: IDMP TT (Socio-economic survey, 2015)

(7) Land lease/borrow

There was one interviewee who leased 1 feddan of irrigated field and there were two interviewees who borrowed average 2 feddan of irrigated field in the case of Rejaf East. The lease and borrow average monthly charge are 83 SSP/fed and 146 SSP/fed respectively. The reason of the borrowing irrigated field is to sell the production. Additional interview related land ownership was conducted.

Table 3.2.16 shows land tenure type of interviewee's cultivating land and with/without land registration. In case of Rejaf East, all of the interviewee's agricultural lands belong to the community and not registered.

Table 3.2.16 Land Tenure and Registration

Land tenure type of cultivating land		
Community	Private	Others
9	-	-
Registration of agricultural land		
Registered	Not Registered	partial
-	9	-

Source: IDMP TT (Socio-economic survey, 2015)

Table 3.2.17 shows land control access situation of communal and private land. Regarding selling rights both of communal and private lands, all of the interviewees who answered to the question recognize that they cannot make any decision of selling their land without permission from traditional/public attorney. Regarding selling communal land, the interviewees just have to obtain permission from traditional attorney and family head. On one hand, in case the interviewees sell their private land, they have to get permission from both of Traditional attorney and County land authorities. It indicates that land control authorities customarily are exercised by both of traditional and county authorities at county level.

Regarding change of land use type and change of crop to cultivate are totally up to the interviewees, namely to those who are actual land users.

Table 3.2.17 Land Control Situation

	Y	N	Traditional attorney	Public total	Land commission	County land authorities	Payam land councils	Others
For land's tenure as "Community"								
i) "if you want to sell land, can you decide yourself?"								
	-	9	4	-	-	-	-	4*1
ii) "if you want to change land use type, can you decide yourself?"								
	9	-	-	-	-	-	-	-
iii) "if you want to change the currently cultivating crop, can you decide yourself?"								
	9	-	-	-	-	-	-	-
For land's tenure as "Private"								
	Y	N	Traditional attorney	Public total	Land commission	County land authorities	Payam land councils	Others
i) "if you want to sell land, can you decide yourself?"								
	-	4	4	4	-	4	-	-
ii) "if you want to change land use type, can you decide yourself?"								
	4	-	-	-	-	-	-	-
iii) "if you want to change the currently cultivating crop, can you decide yourself?"								
	4	-	-	-	-	-	-	-

Source: IDMP TT (Socio-economic survey, 2015)
Note*1: "Others" specification was family head or family member.

All of the interviewees who answered the question answered that their cultivating land is hereditary land. Those successors are generally interviewees ósonô and one (1) interviewee answered his/her daughter is the one who inherit land. This means their land can be inherited to normally son and sometimes to brother even though those lands owner is community.

In addition, following questions are asked in the questionnaire;

1) If irrigation network is passing through your private land, how do you coordinate with the surrounding land belonging to other people for its smooth operation?
2) If the planned irrigation canal is passing through your land, will you accept to let it pass through?

Interviewees generally gave positive response to the above questions. To first one above, following answer was given by the interviewee; ñI will coordinate it smoothlyò.

(8) Effect caused by the conflict

The answers to the question of problems that caused by the conflict occurred in December 2013 are summarized into two points below. The second point mentions that even in Rejaf East, which is located next to Juba town, the market of agricultural produce is shrinking after the crisis.

- No problem
- No market for products

3.3 Farm Land and Cropping Pattern

(1) Farm land area

Table 3.3.1 shows the total farm land holding area with its breakdowns; 1) irrigated, 2) non-irrigated and 3) homestead. Nearly half of the farmland is irrigated land on average in Rejaf East. One third of total farmland is non-irrigated and the rest is homestead. The average irrigated area and its land share are larger than other two (2) sites. In addition, land share of home stead and its area is larger than other two (2) sites and consequently non-irrigated land in Rejaf East is the smallest among three (3) sites.

Table 3.3.1 Average of Farm Land Area (fed/HH)

	Total area						
		Irrigated		Non-irrigated		Homestead	
Jebel Lado	4.3	0.6	(14.0%)	3.1	(72.0%)	0.6	(14.0%)
Wau Rice Scheme	6.7	0.2	(3.0%)	5.6	(83.6%)	0.9	(13.4%)
Rejaf East	**5.5**	**2.7**	**(49.1%)**	**1.6**	**(29.1%)**	**1.2**	**(21.8%)**

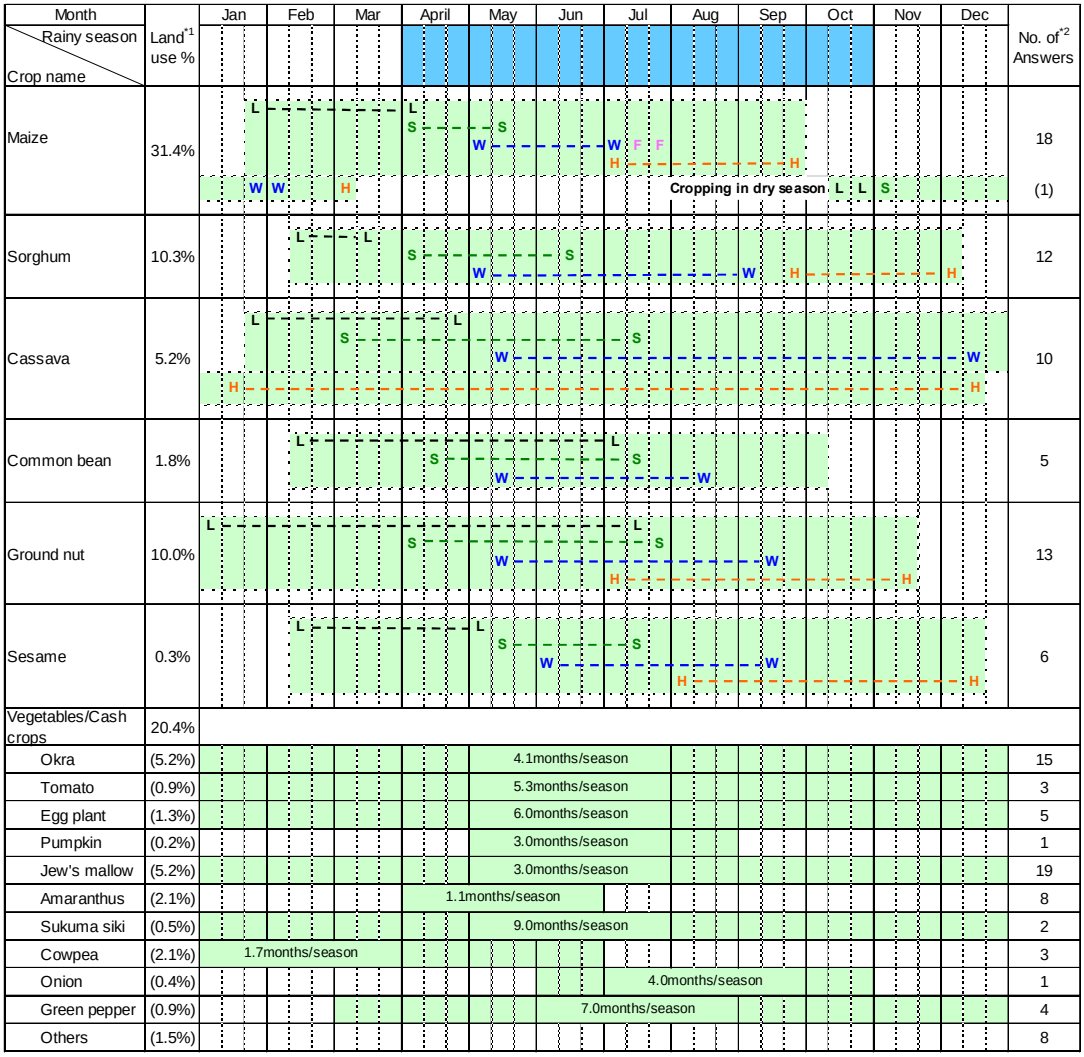
Source: IDMP TT (Socio-economic survey, 2015)

(2) Cropping pattern

Figure 3.3.1 shows the cropping pattern in Rejaf East, which is estimated based on the socio-economic survey results and Figure 3.2.2 shows summarized land use ratio of crops in three (3) priority project sites. The overall cropping intensity is 79.4 %, lowest among the three (3) sites. The most largely cultivated crop is Maize, 31.4 % of total farmland, followed by Sorghum, 10.3 % and Ground nut, 10.0%. The land use ratio of vegetables is as high as 20.4 %, which is the highest as land use ratio of vegetable among the three (3) sites. Among the vegetables cultivated in the site, Okra and Jewôs mallow are popular among the farmers.

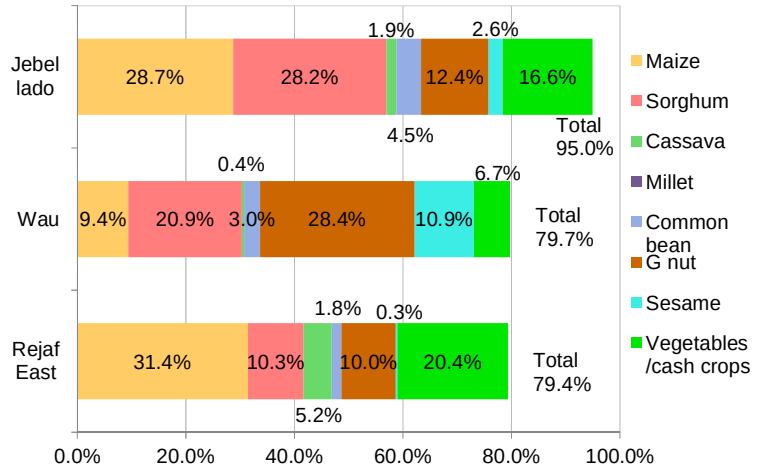
In Rejaf East, vegetables are grown throughout a year, actually, cultivation periods of popular vegetables like Okra, Jewôs mallow, Tomato and Egg plant vary depend on the individuals. In addition,

some of the farmers seem to cultivate same vegetable repeatedly through the year. While Maize, Sorghum, Ground nut and sesame are grown mainly in dry season as same as other two (2) sites, there is a farmer who cultivate maize in dry season



Source: IDMP TT (Socio-economic survey, 2015)
*1: Parenthesized numbers show the breakdown of the above percentage.
*2: Parenthesized numbers shows the breakdown of the above number
*3: Cultivation period of vegetables shown in the figure above, is the average period of each cropsôsamples.

Figure 3.3.1 Cropping Pattern



Source: IDMP TT (Socio-economic survey, 2015)

Figure 3.3.2 Land Use Ratio in 3 Priority Project Sites

3.4 Farming Practices

(1) Agricultural inputs procurement

Table 3.4.1 shows the sources of agricultural inputs procurement. Information regarding agro-chemicals, fertilizer and fuel for tractor is few due to their limited use among the interviewees, however, there surely are some farmers applying agro-chemicals especially for vegetables and also a few is using it for maize.

The major way to obtain cereal seed is to make it by themselves as same as other two (2) sites and the other ways are to get it from NGO, town shop, trader, and other farmers. There is no farmer among the interviewee who obtains any kind of seeds from the government. Regarding other seeds, popular source of obtaining is town/village shops, traders, other farmers and also the farmers are making it by themselves.

Table 3.4.1 Sources of Agricultural Inputs Procurement (no. of Answers)

	Agro-chemicals	Fertilizer	Seed (Cereal)	Seed (Bean)	Seed (vegetables)	Fuel for tractor
Government	-	-	-	-	-	--
NGO	-	-	4	-	-	-
Town shop	-	-	3	3	6	-
Village shop	-	-	-	-	1	-
Trader	-	-	3	-	5	-
Other farmers	-	-	3	3	4	-
FarmersôOrganization	-	-	-	-	-	-
Others	-	-	-	-	-	-
Made by themselves	-	-	8	4	5	-
Total	-	-	21	10	21	-

Source: IDMP TT (Socio-economic survey, 2015)
* The questionnaire allowed multiple answers to the interviewee.

Table 3.4.2 shows the problems in obtaining farm inputs recognized by the interviewee. Problem in obtaining agro-chemicals and fertilizer is that those goods are not available when those are in need. Unaffordability of agro-chemicals and fertilizer due to the lack of finance or those high prices is not mentioned in the survey.

Regarding seeds, both of availability and affordability are cited as issues in obtaining. Particularly, many farmers feel high price of vegetable seeds is the problem for them.

Table 3.4.2 Problems in Obtaining Farm Inputs (no. of Answers)

	Agro-chemicals	Fertilizer	Seed (Cereal)	Seed (Bean)	Seed (vegetables)	Fuel for tractor
Non availability	-	-	2	-	1	-
Not available when needed	4	4	-	-	4	-
Available in small quantities only	-	-	4	-	-	-
Expensive	-	-	2	3	7	-
Transport problems	-	-	1	-	1	-
Lack of finance	-	-	4	-	1	-
Low quality	-	-	4	-	-	-
Total	4	4	17	3	14	-

Source: IDMP TT (Socio-economic survey, 2015)
* The questionnaire allowed multiple answers to the interviewee

(2) Agro chemicals use

There are not many farmers using agro-chemicals such as fertilizers or pesticide, however, the number of answer regarding use of agrochemicals are observed much more than other two (2) sites. Among the interviewee, one (1) farmer described chemical fertilizer use for maize In addition, there are some farmers applying agro-chemicals for vegetables, such as Okra, Jewôs mallow and green pepper. The cost of agro-chemicals for one (1) feddan ranges from about 150 to 800 SSP /feddan. As same as other two (2) sites, availability is the most noticeable issue in obtaining agro-chemicals in Rejaf East, according to the answers shown in Table 3.

(3) Labour

As same as other two (2) sites, necessary labour for farming operation is supplied mainly from family, but sometimes farmers work as group. In other word, they help each other without any physical payment. Required working days for major farming operation was surveyed in the socio-economic survey. Declared working days vary widely and tend to be longer than that is considered as normal, because farmers repeatedly practice same operation such as land preparation or seeding with trial and error. Farmers often failed to start or continue cultivation due to deficit of rainfall or unexpected delay of rainy season.

(4) Farm machinery/tools

Table 3.4.3 shows the inventory of farm machinery and tools the farmers own. As same as other two (2) sites, manual hand tools are popular among the interviewees, however, the number of farmers who own water pump is larger than other two (2) sites. In Rejaf East, there are farmers practicing irrigated farming along the river passing through the west side of the command area and they are using water pumps.

Regarding tractor, there is no interviewee who own tractor. However, some farmers hired tractor from the government and community. Those who received tractor rental service from the community are from Migiri and Mogoro communities. Both of the rental fees of the government and community range from 200 to 400 SSP / feddan. They plowed one (1) to four (4) feddan of their farmland with a tractor a day.

Table 3.4.3 Inventory of Owned Farm Machinery/Tools

	No. of HHs owning machineries (no.)				Average no. of machinery (no./HH)
	Gwuduge	Migiri	Mogoro	Total	Total
4-wheel tractor	-	-	-	-	-
Hand tractor	-	-	-	-	-
Hand sprayer	-	2	2	4	1.5

	No. of HHs owning machineries (no.)				Average no. of machinery (no./HH)
	Gwuduge	Migiri	Mogoro	Total	Total
Engine sprayer	-	-	-	-	-
Weeder	-	-	-	-	-
Seeder	-	-	-	-	-
Hoe	9	7	8	24	3.3
Shovel	2	2	6	10	1.2
Manual thresher	-	1	2	3	2.3
Engine thresher	-	-	-	-	-
Oxen-drawn plow	-	-	-	-	-
Water pump(Oil)	1	5	1	7	1.3
Water pump (Electric)	-	-	-	-	-
Milling machine	-	-	-	-	-
Agro well	-	-	-	-	-
Mobile phone	7	6	7	20	1.3
Spade	-	-	-	-	-
Ax	2	-	4	6	1.8
Panga	2	-	4	6	2.8
Moloda	3	-	2	5	1.6
Gudum	-	-	-	-	-
Knife	4	-	3	7	2.9

Source: IDMP TT (Socio-economic survey, 2015)

(5) Livestock raising

Average numbers of livestock in the owners and average numbers of livestock in the total of samples are shown in the tables below. Cow and goats in Rejaf East are much less than those in Wau, so that we can clearly find weight of crop cultivation in Rejaf East is higher than that of Wau. In addition to those animals shown in the tables, a interviewee has 15 pigeons as livestock.

Table 3.4.4 Average Number of Livestock with the Owners

Area	Cow	Bull/Ox	Sheep	Goats	Pigs	Chicken	Ducks
Wau	14.9	3.5	8.9	13.2	-	12.3	-
Jebel Lado	3.0	-	6.4	8.8	-	14.0	2.0
Rejaf East	2.0	-	11.3	5.9	1.0	8.4	10.0
3 areas	12.7	3.5	8.7	10.3	1.0	12.4	6.0

Source: IDMP TT (Socio-economic survey, 2015)

Table 3.4.5 Average Number of Livestock in the Samples

Area	Cow	Bull/Ox	Sheep	Goats	Pigs	Chicken	Ducks
Wau	8.0	1.1	5.2	9.2	-	8.0	-
Jebel Lado	0.3	-	1.4	3.4	-	11.0	0.1
Rejaf East	0.1	-	1.3	2.0	0.0	2.3	0.4
3 areas	2.9	0.4	2.7	4.9	0.0	6.9	0.2

Source: IDMP TT (Socio-economic survey, 2015)

3.5 Productivity

(1) Crop yields

Table 3.5.1 shows average crop yield in Rejaf East. Yields in Rejaf East range from nearly equal to the average yields of three (3) sites to relatively lower than those averages, except some crops such as Tomato and Onion. Even though the farmers in Rejaf East seem to be relatively keen to utilize modern farming ways such as agro-chemical application, water pump irrigation and tractor use compared to the farmers in other two (2) sites, the productivities of crops are not so high.

Table 3.5.1 Crop Yields

Crop	Average Yield (t/ha)	Minimum Yield (t/ha)	Maximum Yield (t/ha)	No. of sample	(Average yield of 3 sites) (t/ha)
Maize	0.7	0.1	1.9	17	0.7
Sorghum	0.9	0.4	1.8	7	1.2
Cassava	1.6	0.4	3.6	6	1.6
Common bean	0.3	0.2	0.5	3	0.6
Ground nut	0.8	0.4	1.6	9	1.5
Sesame	0.5	0.5	0.5	1	0.6
Vegetables					
Okra	1.1	0.2	5.6	14	1.8
Tomato	3.6	3.3	3.8	3	2.8
Egg plant	1.8	0.2	4.8	5	1.8
Pumpkin	0.8	0.8	0.8	1	0.8
Jew's mallow	2.2	0.4	4.4	19	3.1
Amaranthus	3.2	1.0	6.0	8	3.2
Cowpea	0.7	0.5	0.9	3	0.8
Onion	2.9	2.9	2.9	1	2.5
Green pepper	0.8	0.2	2.2	4	0.8

Source: IDMP TT (Socio-economic survey, 2015)

Table 3.5.2 shows the important causes of pre-harvest damage or loss in cereal and other crops cultivation which was mentioned by the farmers in Rejaf East. Damages and losses caused by animals, pest and disease are raised as dominant problems, while water shortage is recognized by fewer farmers.

Table 3.5.2 Important Causes of Pre-harvest Damage or Loss (no. of Answers)

	Cereal	Other crop
Domestic animals	10	10
Birds	10	10
Other wild animals	10	10
Pest	10	9
Disease	10	6
Too much rain	7	5
Too little rain	9	5
Shortage of irrigation water	4	4
Others		
Total	70	59

Source: IDMP TT (Socio-economic survey, 2015)
*1 :The questionnaire allowed multiple answers to the interviewee
*2 ñOthersò were not specified.

(2) Produces use

Table 3.5.3 shows crop product use in Rejaf East. Like other two (2) sites, Maize, Sorghum, Cassava, Common bean, Ground nut and sesame are principally consumed in household. Among the above crops, nearly half of Maize produce is sold at market. Comparing the other two (2) sites, the percentage of vegetables sold at market is high, for instance, those of Okra and Jewôs mallow, which are popular in the site, are more than 90 %. The farmers cultivate vegetables mostly for selling. Agro chemical use are practiced for vegetables more than for cereals, namely they ñinvestò more in vegetable cultivation, which implies vegetable cultivation is substantial mean of cash generation for the farmers in Rejaf East.

Table 3.5.3 Crop Produces Use

	Household use	Self-consumption	Stock for seed	Loan payment	Land tenant fee	Post-harvest losses	Others	Sold to market	No. of samples
Maize	51.9%	42.2%	4.8%	2.7%	-	-	2.2%	48.1%	17
Sorghum	100.0%	72.2%	14.0%	-	-	-	13.8%	-	7
Cassava	99.0%	93.2%	-	-	-	0.3%	5.5%	1.0%	6
Common bean	100.0%	70.0%	17.5%	-	-	-	12.5%	-	3
G nut	100.0%	69.1%	22.7%	-	-	-	8.2%	-	9
Sesame	100.0%	100.0%	-	-	-	-	-	-	1
Vegetables									
Okra	7.5%							92.5%	15
Tomato	1.9%							98.1%	3
Egg plant	12.2%							92.7%	3
Pumpkin	8.0%							92.0%	1
Jew's mallow	4.2%							96.0%	18
Amaranthus	1.3%							98.8%	8
Sukuma wiki	65.6%							34.4%	2
Cowpea	0.0%							100.0%	3
Onion	0.0%							100.0%	1
Green pepper	25.0%							75.0%	4

Source: IDMP TT (Socio-economic survey, 2015)

(3) Profitability

Table 3.5.4 shows net / gross cash income and production cost per ha in Rejaf East. Gross income values of crops are generally low compared to the average of three (3) sites due to low yield. Regarding the crops whose self-consumption rate is high, such as Sorghum, Cassava, Common bean and Ground nut results in negative net cash income. Regarding vegetables, even though most of all vegetable are sold, those net cash income values are low as a whole except some vegetables such as Tomato, whose yield is fair. Apart from low yield, high production cost of vegetable in Rejaf East leads to low profitability of vegetables.

Table 3.5.4 Net Cash Income, Gross Cash Income and Production Cost per ha

	Net cash income (SSP/ha)		Gross cash income (SSP/ha)		Production cost (SSP/ha)		No of samples
	Rejaf East	(Average of 3 sites)	Rejaf East	(Average of 3 sites)	Rejaf East	(Average of 3 sites)	
Maize	232	(791)	357	(917)	125	(125)	17
Sorghum	-98	(959)	0	(1,058)	98	(99)	7
Cassava	-203	(1,537)	238	(1,958)	441	(420)	6
Common bean	-16	(1,064)	0	(1,139)	16	(75)	3
G nut	-154	(1,713)	0	(1,955)	154	(242)	9
Sesame	-	(643)	-	(735)	0	(92)	1
Vegetables							
Okra	5,895	(10,058)	6,899	(10,661)	1,005	(603)	14
Tomato	14,000	(10,335)	14,571	(10,949)	571	(614)	3
Egg plant	9,253	(7,949)	9,833	(8,552)	580	(602)	5
Pumpkin	7,143	(7,143)	7,302	(7,302)	159	(159)	1
Jew's mallow	6,435	(9,557)	7,125	(10,112)	690	(555)	19
Amaranthus	6,577	(7,110)	7,198	(7,696)	621	(586)	8
Sukuma wiki	4,312	(4,312)	5,238	(5,238)	926	(926)	1
Cowpea	2,365	(1,838)	2,540	(2,000)	175	(162)	3
Onion	-1,476	(2,508)	5,714	(5,079)	7,190	(2,571)	1
Green pepper	7,918	(7,918)	8,929	(8,929)	1,011	(1,011)	4

Source: IDMP TT (Socio-economic survey, 2015)
*1 Each unit values of net cash income, gross cash income and production cost were calculated respectively excluding invalid/unavailable values, hence net cash income value is not equivalent to the reminder after deducting unit production cost from unit gross income.

*2 Breakdown of vegetable production cost are Seed, fertilizer and agro-chemical obtains.
*3 No. of samples are only that of Rejaf East.

In addition to net cash income, the results of net income calculated are listed in the following table:

Table 3.5.5 Net Income Estimate

Crop	Yield (t/ha)	Farm-gate Price SSP/kg	Gross Income SSP/ha	Production Cost SSP/ha	Net Income SSP/ha
Maize	0.7	3.7	2,590	125	2,465
Sorghum	0.9	(4.2)	3,780	98	3,682
Cassava	1.6	5	8,000	441	7,559
Common bean	0.3	(4.6)	1,380	16	1,364
Groundnut	0.8	(3.9)	3,120	154	2,966
Sesame	0.5	(4.8)	2,400	0	2,400
Vegetables					
Okra	1.1	9.1	10,010	1005	9,005
Tomato	3.6	4.3	15,480	571	14,909
Egg plant	1.8	14.5	26,100	580	25,520
Jew's mallow	2.2	4.5	9,900	690	9,210
Amaranthus	3.2	2.6	8,320	621	7,699
Cowpea	0.7	3.6	2,520	175	2,345
Green pepper	0.8	13.8	11,040	1011	10,029
pumpkin	0.8	10	8,000	159	7,841

(Source: IDMP-TT, Socio-economy Survey, 2015)
Note: Farm-gate price in ( ) is the average of other sites due to lack of data in this site

3.6 Selling of Produces

Table 3.6.1 shows the mode of transport the farmers use for selling their produce in Rejaf East. The most popular mode of transport in Rejaf East is Motorbike followed by bicycle and on foot. The farmers are selling their produce at the markets; Juba, Konyokonyo and other local markets, where are located averagely five (5) to six (6) km away from the communities.

Table 3.6.1 Mode of Transport

Mode of transport	No. of answers
Public bus	1
Tractor	-
Private car	-
Motorbike	18
Bicycle	4
On foot	4
No need	-
Total	27

Source: IDMP TT (Socio-economic survey, 2015)
* The questionnaire allowed multiple answers to the interviewee

Table 3.6.2 shows the problems in marketing of produce mentioned by the farmers in Rejaf East. The farmers particularly feel difficulty with low market prices, like the farmers in Jebel Lado. The second major problem is high cost of transportation.

Table 3.6.2 Problems in Marketing of Produces

Problems in marketing of produce	No. of answers
Low selling prices	17
Lack of transportation facilities	9
High cost of transportation	15
Lack of storage facilities	9
Quality problems of products	8
Lack of packing material	10
Total	68

Source: IDMP TT (Socio-economic survey, 2015)
* The questionnaire allowed multiple answers to the interviewee

CHAPTER 4 DEVELOPMENT CONSTRAINTS AND POTENTIALS

Table 4.1.1 shows the problems in farming in Rejaf East. For the farmers in the site, damage by pests and disease are considered as crucial problem followed by water shortage and damage by wild animal. These problems seem to be prevailing generally on the ground.

Table 4.1.1 Problems in Farming

Problems in farming	No. of answers
Water shortage	20
Drought damage	13
Low yield of crops	12
Drainage problems	12
Damage by pests and diseases	24
Weed damage	15
Damage by wild animal	18
Difficulty in hiring animal/mechanical power	6
Labour shortage	8
Difficulty in obtaining seeds	5
Difficulty in purchasing agro-chemicals	12
Difficulty in purchasing fertilizer	10
Lack of farm roads	14
Damage by domestic animal	15
Shortage of selling opportunity	10
Lack of storage facilities	10
Problems related to loans	5
Others	11
Total	220

Source: IDMP TT (Socio-economic survey, 2015)
* The questionnaire allowed multiple answers to the interviewee

Table 4.1.2 shows the items needed to be improved in farming. Corresponding to the result shown in Table 4.1.1, Prevention from pest and disease is the most common item and prevention from wild / domestic animals and weed damage is also raised by many farmers. In addition, they feel mechanization and improved seeds /farm road are important factor to practice farming in better way.

Table 4.1.2 Items Needed to be Improved

Items needed to be improved	No. of answers
To acquire irrigation water	13
To improve irrigation facilities	9
To drain out excess water	5
To prevent pests and diseases	23
To prevent damage by animal	22
To prevent weed damage	22
To improve supplying system of farm inputs	11
To improve farm road	22
To improve transportation of products	15
To introduce improved seed/plant varieties	20
To improve farming practices	19
To introduce mechanized farming	20
To strengthen agricultural extension services	12
To improve and expand agricultural credit	6
To construct drying yard	7
To construct processing facilities	10
To construct storage facilities	14
Others	10
Total	260

Source: IDMP TT (Socio-economic survey, 2015)
* The questionnaire allowed multiple answers to the interviewee

Summarized findings/features in the present agricultural situation in Rejaf East

- ✓ Cropping intensity was the highest (95%) among 3 sites, furthermore, land use share for vegetable growing was the highest, which was one fifth of the total.
- ✓ Relatively more farmers are familiar to mechanized farming having an experience in hiring tractors or water pump. Some community organizations supply tractor rental service apart from that from the government.
- ✓ There are farmers having an experience in irrigated farming along the river and their irrigated farmland share/area is the highest among 3 sites.
- ✓ Yield is generally lower than other 2 sites. In addition, production cost tends to be higher resulting low profitability. A part of cause of high production cost seems to be that farmers cost much on agro-chemicals.