

Table 3.6 Calculation of Diversion Requirements for Paddy (3 Blocks) (Case 5)

Period	Eto (mm/day)	F (")	Re (")	AWLR (")	ACC	LPA	CA	LPWR (")	ETC (")	NLPR (")	NFR1 (")	NFR2 (")	NFR-Days (mm)	Div. Req. (l/sec/ha)
Jan. 1	3.30	3.00	4.80	1.67	1.03		1.00	11.60	3.40	0.00	1.60	3.27	32.70	0.68
Jan. 2	3.40	3.00	1.70	0.83	1.03		1.00	11.60	3.50	0.00	4.80	5.63	56.30	1.18
Jan. 3	3.60	3.00	1.20	1.53	1.00		0.67	11.80	3.60	0.00	3.62	5.15	56.63	1.08
Feb. 1	3.80	3.00	4.10	1.67	1.00		0.67	11.90	3.80	0.00	1.81	3.48	34.80	0.73
Feb. 2	3.90	3.00	0.30		1.05		0.33	12.00	4.10	0.00	2.24	2.24	22.40	0.47
Feb. 3	3.90	3.00	1.30	0.83	0.95		0.33	12.00	3.71	0.00	1.78	2.61	23.53	0.55
Mar. 1	3.50	3.00	7.70	0.83	0.95		0.33	11.70	3.33	0.00	0.00	0.83	8.30	0.17
Mar. 2	4.10	3.00	4.70			0.67		12.10	0.00	0.00	0.00	0.00	0.00	0.00
Mar. 3	4.20	3.00	4.20			0.67		12.20	0.00	0.00	0.00	0.00	0.00	0.00
Apr. 1	4.00	3.00	13.80			0.67		12.10	0.00	0.00	0.00	0.00	0.00	0.00
Apr. 2	4.10	3.00	10.70		1.10	0.33	0.33	12.10	4.51	0.46	0.00	0.46	4.60	0.10
Apr. 3	4.20	3.00	6.30		1.10	0.33	0.33	12.20	4.62	1.95	0.44	2.38	23.80	0.50
May 1	3.80	3.00	8.40		1.10	0.33	0.67	11.90	4.18	1.16	0.00	1.16	11.60	0.24
May 2	3.90	3.00	3.60	0.83	1.08	0.33	0.67	12.00	4.21	2.77	2.42	6.02	60.20	1.27
May 3	3.90	3.00	3.20	0.77	1.08	0.33	0.67	12.00	4.21	2.90	2.69	6.36	69.98	1.34
Jun. 1	3.90	3.00	5.90	0.83	1.07		1.00	12.00	4.17	0.00	1.27	2.10	21.00	0.44
Jun. 2	4.00	3.00	3.10	1.67	1.03		1.00	12.10	4.12	0.00	4.02	5.69	56.90	1.20
Jun. 3	4.10	3.00	1.40	0.83	1.03		1.00	12.10	4.22	0.00	5.82	6.65	66.50	1.40
Jul. 1	4.40	3.00	4.80	1.67	1.00		0.67	12.30	4.40	0.00	1.74	3.41	34.10	0.72
Jul. 2	3.80	3.00	0.40	1.67	1.00		0.67	11.90	3.80	0.00	4.29	3.96	39.60	1.25
Jul. 3	3.90	3.00	2.50	1.67	1.05		0.33	12.00	4.10	0.00	1.52	1.52	16.68	0.32
Aug. 1	3.90	3.00	2.20	0.83	0.95		0.33	12.00	3.71	0.00	1.49	2.32	23.20	0.49
Aug. 2	3.90	3.00	1.10	0.83	0.95		0.33	12.00	3.71	0.00	1.85	2.68	26.80	0.56
Aug. 3	3.80	3.00	2.40					11.90	0.00	0.00	0.00	0.00	0.00	0.00
Sep. 1	4.10	3.00	1.40					12.10	0.00	0.00	0.00	0.00	0.00	0.00
Sep. 2	4.00	3.00	5.10					12.10	0.00	0.00	0.00	0.00	0.00	0.00
Sep. 3	3.80	3.00	5.70					11.90	0.00	0.00	0.00	0.00	0.00	0.00
Oct. 1	4.00	3.00	6.10			0.67		12.10	0.00	0.00	0.00	0.00	0.00	0.00
Oct. 2	3.90	3.00	7.20			0.67		12.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct. 3	3.80	3.00	2.10			0.67		11.90	0.00	6.90	0.00	6.90	75.91	1.45
Nov. 1	3.60	3.00	8.10		1.10	0.33	0.33	11.80	3.96	1.22	0.00	1.22	12.20	0.26
Nov. 2	3.90	3.00	2.00		1.10	0.33	0.33	12.00	4.29	3.30	1.75	5.05	50.50	1.06
Nov. 3	3.60	3.00	5.30		1.10	0.33	0.67	11.80	3.96	2.15	1.11	3.26	32.60	0.69
Dec. 1	3.50	3.00	1.70	0.83	1.08	0.33	0.67	11.70	3.78	3.30	3.40	7.53	75.30	1.58
Dec. 2	3.40	3.00	10.00	0.83	1.08	0.33	0.67	11.60	3.67	0.53	0.00	1.36	13.60	0.29
Dec. 3	3.40	3.00	10.50	0.77	1.07		1.00	11.60	3.64	0.00	0.00	0.77	8.47	0.16

File name : TABLE-45.WJ2

Table 3.7 Calculation of Diversion Requirements for Palawija (3 Blocks)
 (Case 4 Start of 1st Crop : Apr. 1, 2nd Crop : Oct. 21)

Period	Eto (mm/day)	Re (")	ACC	CA	ETC (")	NFR (")	NFR*Days (mm)	Div. Req. (l/sec/ha)
Jan. 1	3.3	3.4	0.92	1.00	3.04	0.00	0.00	0.00
2	3.4	3.4	0.86	1.00	2.92	0.00	0.00	0.00
3	3.6	3.4	0.94	1.00	3.38	0.00	0.00	0.00
Feb. 1	3.8	3.4	0.76	1.00	2.89	0.00	0.00	0.00
2	3.9	3.4	0.91	0.67	3.55	0.10	1.00	0.02
3	3.9	3.3	0.64	0.67	2.50	0.00	0.00	0.00
Mar. 1	3.5	3.8	0.82	0.33	2.87	0.00	0.00	0.00
2	4.1	3.8	0.45	0.33	1.85	0.00	0.00	0.00
3	4.2	3.8		0.33	0.00	0.00	0.00	0.00
Apr. 1	4	3.9		0.33	0.00	0.00	0.00	0.00
2	4.1	3.9	0.50	0.33	2.05	0.00	0.00	0.00
3	4.2	3.9	0.75	0.33	3.15	0.00	0.00	0.00
May 1	3.8	3.7	0.63	0.67	2.39	0.00	0.00	0.00
2	3.9	3.7	0.68	0.67	3.43	0.00	0.00	0.00
3	3.9	3.6	0.75	1.00	2.92	0.00	0.00	0.00
Jun. 1	3.9	2.4	0.92	1.00	3.59	1.19	11.90	0.28
2	4	2.4	0.86	1.00	3.44	1.04	10.40	0.24
3	4.1	2.4	0.94	1.00	3.85	1.45	14.50	0.34
Jul. 1	4.4	2.9	0.76	1.00	3.34	0.44	4.40	0.10
2	3.8	2.9	0.91	0.67	3.46	0.37	3.70	0.09
3	3.9	2.9	0.64	0.67	2.50	0.00	0.00	0.00
Aug. 1	3.9	2.9	0.82	0.33	3.20	0.10	1.00	0.02
2	3.9	2.9	0.45	0.33	1.76	0.00	0.00	0.00
3	3.8	2.9		0.33	0.00	0.00	0.00	0.00
Sep. 1	4.1	3.8			0.00	0.00	0.00	0.00
2	4	3.8			0.00	0.00	0.00	0.00
3	3.8	3.8			0.00	0.00	0.00	0.00
Oct. 1	4	3.8			0.00	0.00	0.00	0.00
2	3.9	3.8			0.00	0.00	0.00	0.00
3	3.8	3.7			0.00	0.00	0.00	0.00
Nov. 1	3.6	3.6			0.00	0.00	0.00	0.00
2	3.9	3.6	0.50	0.33	0.00	0.00	0.00	0.00
3	3.6	3.6	0.75	0.33	1.95	0.00	0.00	0.00
Dec. 1	3.5	3.4	0.63	0.67	2.70	0.00	0.00	0.00
2	3.4	3.4	0.88	0.67	2.21	0.00	0.00	0.00
3	3.4	3.4	0.75	1.00	2.55	0.00	0.00	0.00

File name : TABLE-5.WJ2

Table 3.8 Comparison of Diversion Requirements

Max. Div. Req.

Period	Case 1			Case 2			Case 3			Case 4			Case 5		
	Paddy	Palawija	Total	Paddy	Palawija	Total	Paddy	Palawija	Total	Paddy	Palawija	Total	Paddy	Palawija	Total
	Feb. 11 Sep. 1	Mar. 1 Sep. 21	Mar. 11 Oct. 1	Feb. 21 Sep. 11	Mar. 11 Oct. 1	Mar. 11 Oct. 11	Mar. 1 Sep. 21	Mar. 1 Oct. 11	Mar. 1 Oct. 11	Mar. 11 Oct. 21	Mar. 11 Oct. 21	Mar. 11 Oct. 21	Mar. 21 Oct. 11	Mar. 21 Nov. 1	Mar. 21 Nov. 1
Jan. 1	0.12	0.00	0.11	0.56	0.00	0.56	0.00	0.00	0.00	0.51	0.00	0.51	0.69	0.00	0.69
2	0.49	0.00	0.49	0.34	0.00	0.34	1.01	0.00	1.01	1.01	0.00	1.01	1.18	0.00	1.18
3	0.52	0.00	0.52	0.52	0.00	0.52	1.08	0.00	1.08	1.08	0.00	1.08	1.08	0.00	1.08
Feb. 1	0.00	0.00	0.00	0.35	0.00	0.35	0.20	0.01	0.21	0.20	0.00	0.20	0.73	0.04	0.77
2	1.65	0.00	1.65	0.00	0.00	0.00	0.62	0.00	0.62	0.62	0.02	0.64	0.47	0.00	0.47
3	1.51	0.00	1.51	1.51	0.00	1.51	0.55	0.00	0.55	0.55	0.00	0.55	0.55	0.04	0.59
Mar. 1	0.28	0.00	0.28	0.56	0.00	0.56	0.56	0.00	0.56	0.00	0.00	0.00	0.17	0.00	0.17
2	0.71	0.00	0.71	0.71	0.00	0.71	1.04	0.00	1.04	1.04	0.00	1.04	0.00	0.00	0.00
3	1.04	0.00	1.04	0.79	0.00	0.79	0.79	0.00	0.79	1.13	0.00	1.13	1.13	0.00	1.13
Apr. 1	0.17	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.27	0.00	0.27	0.27	0.00	0.27	0.10	0.00	0.10	0.10	0.00	0.10	0.10	0.00	0.10
3	0.43	0.00	0.43	0.42	0.00	0.42	0.76	0.00	0.76	0.60	0.00	0.59	0.50	0.00	0.50
May 1	0.35	0.00	0.35	0.17	0.00	0.17	0.42	0.00	0.42	0.42	0.00	0.42	0.24	0.00	0.24
2	0.89	0.00	0.89	1.07	0.00	1.07	0.93	0.00	0.92	0.92	0.00	0.92	1.27	0.00	1.27
3	0.84	0.02	0.85	0.97	0.00	0.96	1.13	0.00	1.12	1.00	0.00	1.00	1.34	0.00	1.34
Jun. 1	0.49	0.13	0.62	0.49	0.29	0.78	0.41	0.22	0.63	0.59	0.28	0.86	0.44	0.12	0.56
2	0.28	0.19	0.47	0.90	0.15	1.05	0.90	0.31	1.21	1.02	0.24	1.26	1.20	0.30	1.50
3	0.56	0.03	0.58	0.41	0.21	0.62	1.16	0.17	1.32	1.16	0.34	1.46	1.40	0.26	1.66
Jul. 1	0.34	0.05	0.39	0.34	0.00	0.34	0.20	0.17	0.36	0.72	0.10	0.82	0.72	0.29	1.01
2	0.00	0.00	0.00	0.61	0.02	0.63	0.61	0.00	0.61	0.46	0.09	0.54	1.25	0.00	1.25
3	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.02	0.47	0.45	0.00	0.45	0.32	0.10	0.42
Aug. 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.02	0.51	0.49	0.00	0.49
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.02	0.58
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sep. 1	1.51	0.00	1.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.99	0.00	0.99	0.99	0.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.53	0.00	0.53	0.53	0.00	0.53	0.87	0.00	0.87	0.87	0.00	0.87	0.00	0.00	0.87
Oct. 1	0.51	0.00	0.51	0.51	0.00	0.51	0.85	0.00	0.84	0.85	0.00	0.84	0.00	0.00	0.84
2	0.35	0.00	0.34	0.34	0.00	0.34	0.34	0.00	0.34	0.00	0.00	0.34	0.68	0.00	0.68
3	1.65	0.00	1.65	1.50	0.00	1.50	1.10	0.00	1.10	1.03	0.00	1.03	1.45	0.00	1.45
Nov. 1	0.43	0.00	0.43	0.43	0.00	0.43	0.26	0.00	0.26	0.26	0.00	0.26	0.26	0.00	0.26
2	1.26	0.00	1.26	1.60	0.00	1.60	1.60	0.00	1.60	1.44	0.00	1.44	1.06	0.00	1.06
3	0.65	0.00	0.65	0.50	0.00	0.50	0.85	0.00	0.85	0.85	0.00	0.85	0.89	0.00	0.89
Dec. 1	1.21	0.00	1.21	1.38	0.00	1.38	1.24	0.00	1.24	1.58	0.00	1.58	1.58	0.00	1.58
2	0.35	0.00	0.35	0.17	0.00	0.17	0.35	0.00	0.35	0.17	0.00	0.17	0.29	0.00	0.29
3	0.32	0.00	0.32	0.32	0.00	0.32	0.15	0.00	0.15	0.15	0.00	0.15	0.16	0.00	0.16
Remarks	Adopted														

File name : TABLE-1.WJ2

Table 3.9 Unit Water Requirements on Block Basis (Case 4)
(Paddy + Palawija)

Period	Block 1		Block 2		Block 3	
	Paddy	Palawija	Paddy	Palawija	Paddy	Palawija
Jan. 1	0.81	0.00	0.35	0.00	0.39	0.00
2	0.00	0.00	1.48	0.00	1.55	0.00
3	0.00	0.00	1.58	0.05	1.63	0.05
Feb. 1	0.00	0.00	0.00	0.00	0.61	0.00
2	0.00	0.00	0.00	0.00	1.87	0.12
3	0.00	0.00	0.00	0.00	1.66	0.00
Mar. 1	0.00	0.00	0.00	0.00	0.00	0.00
2	1.56	0.00	1.56	0.00	0.00	0.00
3	1.68	0.00	1.68	0.00	0.00	0.00
Apr. 1	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.29	0.00	0.29	0.00
3	0.28	0.00	0.28	0.00	1.24	0.00
May 1	0.53	0.00	0.00	0.00	0.74	0.00
2	1.26	0.05	1.31	0.78	1.77	0.00
3	0.82	0.07	1.30	0.00	0.86	0.00
Jun. 1	0.70	0.35	0.78	0.35	1.13	0.12
2	1.30	0.20	1.50	0.85	0.90	0.14
3	0.00	0.22	1.68	0.39	1.77	0.39
Jul. 1	0.00	0.00	1.03	0.16	1.19	0.35
2	0.00	0.00	0.00	0.05	1.38	0.21
3	0.00	0.00	0.00	0.00	1.37	0.07
Aug. 1	0.00	0.00	0.00	0.00	1.48	0.07
2	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00
Sep. 1	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00
Oct. 1	1.26	0.00	1.26	0.00	0.00	0.00
2	1.01	0.00	1.01	0.00	1.01	0.00
3	1.07	0.00	1.07	0.00	2.17	0.00
Nov. 1	0.00	0.00	0.78	0.00	0.78	0.00
2	1.11	0.00	1.11	0.00	1.11	0.00
3	0.84	0.00	0.84	0.00	0.35	0.00
Dec. 1	1.53	0.00	1.53	0.00	1.04	0.00
2	0.00	0.00	0.00	0.00	0.53	0.00
3	0.48	0.00	0.48	0.00	0.48	0.00
Remarks						

File name : TABLE-3.WJ2

Table 3.10 Unit Water Requirements on Block Basis (Case 1)
(Paddy)

Period	Block 1			Block 2			Block 3		
	Paddy	Palawija	Total	Paddy	Palawija	Total	Paddy	Palawija	Total
Jan. 1	0.00		0.00	0.00		0.00	0.35		0.35
2	0.00		0.00	0.00		0.00	1.48		1.48
3	0.00		0.00	0.00		0.00	1.58		1.58
Feb. 1	0.00		0.00	0.00		0.00	0.00		0.00
2	2.45		2.45	2.45		2.45	0.00		0.00
3	2.25		2.25	2.25		2.25	0.00		0.00
Mar. 1	0.00		0.00	0.84		0.84	0.00		0.00
2	0.59		0.59	1.56		1.56	0.00		0.00
3	0.72		0.72	0.72		0.72	1.68		1.68
Apr. 1	0.53		0.53	0.00		0.00	0.00		0.00
2	0.53		0.53	0.00		0.00	0.29		0.29
3	0.23		0.23	0.76		0.76	0.28		0.28
May 1	0.53		0.53	0.53		0.53	0.00		0.00
2	1.18		1.18	0.74		0.74	0.78		0.78
3	0.00		0.00	1.22		1.22	1.30		1.30
Jun. 1	0.00		0.00	0.70		0.70	0.78		0.78
2	0.00		0.00	0.00		0.00	0.86		0.86
3	0.00		0.00	0.00		0.00	1.68		1.68
Jul. 1	0.00		0.00	0.00		0.00	1.03		1.03
2	0.00		0.00	0.00		0.00	0.00		0.00
3	0.00		0.00	0.00		0.00	0.00		0.00
Aug. 1	0.00		0.00	0.00		0.00	0.00		0.00
2	0.00		0.00	0.00		0.00	0.00		0.00
3	0.00		0.00	0.00		0.00	0.00		0.00
Sep. 1	2.25		2.25	2.25		2.25	0.00		0.00
2	1.47		1.47	1.47		1.47	0.00		0.00
3	0.31		0.31	1.30		1.30	0.00		0.00
Oct. 1	0.27		0.27	1.26		1.26	0.00		0.00
2	0.02		0.02	0.02		0.02	1.01		1.01
3	1.62		1.62	1.17		1.17	2.17		2.17
Nov. 1	0.53		0.53	0.00		0.00	0.78		0.78
2	1.07		1.07	1.60		1.60	1.11		1.11
3	0.76		0.76	0.84		0.84	0.35		0.35
Dec. 1	1.50		1.50	1.05		1.05	1.08		1.08
2	0.00		0.00	0.53		0.53	0.53		0.53
3	0.00		0.00	0.48		0.48	0.48		0.48
Remarks									

File name : TABLE-31.WJ2

Table 3.10 Unit Water Requirements on Block Basis (Case 2)
(Paddy)

Period	Block 1			Block 2			Block 3		
	Paddy	Palawija	Total	Paddy	Palawija	Total	Paddy	Palawija	Total
Jan. 1	0.00		0.00	0.81		0.81	0.88		0.88
2	0.00		0.00	0.00		0.00	1.02		1.02
3	0.00		0.00	0.00		0.00	1.58		1.58
Feb. 1	0.00		0.00	0.00		0.00	1.05		1.05
2	0.00		0.00	0.00		0.00	0.00		0.00
3	2.25		2.25	2.25		2.25	0.00		0.00
Mar. 1	0.84		0.84	0.84		0.84	0.00		0.00
2	0.59		0.59	1.56		1.56	0.00		0.00
3	0.72		0.72	1.68		1.68	0.00		0.00
Apr. 1	0.00		0.00	0.00		0.00	0.00		0.00
2	0.53		0.53	0.00		0.00	0.29		0.29
3	0.76		0.76	0.28		0.28	1.24		1.24
May 1	0.00		0.00	0.53		0.53	0.00		0.00
2	1.18		1.18	1.26		1.26	0.78		0.78
3	1.22		1.22	0.82		0.82	0.86		0.86
Jun. 1	0.00		0.00	0.70		0.70	0.78		0.78
2	0.00		0.00	1.30		1.30	1.39		1.39
3	0.00		0.00	0.00		0.00	1.24		1.24
Jul. 1	0.00		0.00	0.00		0.00	1.03		1.03
2	0.00		0.00	0.00		0.00	1.83		1.83
3	0.00		0.00	0.00		0.00	0.00		0.00
Aug. 1	0.00		0.00	0.00		0.00	0.00		0.00
2	0.00		0.00	0.00		0.00	0.00		0.00
3	0.00		0.00	0.00		0.00	0.00		0.00
Sep. 1	0.00		0.00	0.00		0.00	0.00		0.00
2	1.47		1.47	1.47		1.47	0.00		0.00
3	1.30		1.30	1.30		1.30	0.00		0.00
Oct. 1	0.27		0.27	1.26		1.26	0.00		0.00
2	0.02		0.02	1.01		1.01	0.00		0.00
3	1.17		1.17	1.17		1.17	2.17		2.17
Nov. 1	0.53		0.53	0.00		0.00	0.78		0.78
2	1.60		1.60	1.11		1.11	2.10		2.10
3	0.31		0.31	0.84		0.84	0.35		0.35
Dec. 1	1.50		1.50	1.57		1.57	1.08		1.08
2	0.53		0.53	0.00		0.00	0.00		0.00
3	0.00		0.00	0.48		0.48	0.48		0.48
Remarks									

File name : TABLE-32.WJ2

Table 3.10 Unit Water Requirements on Block Basis (Case 3)
(Paddy)

Period	Block 1			Block 2			Block 3		
	Paddy	Palawija	Total	Paddy	Palawija	Total	Paddy	Palawija	Total
Jan. 1	0.00		0.00	0.00		0.00	0.00		0.00
2	0.00		0.00	1.48		1.48	1.55		1.55
3	0.00		0.00	1.58		1.58	1.66		1.66
Feb. 1	0.00		0.00	0.00		0.00	0.61		0.61
2	0.00		0.00	0.00		0.00	1.87		1.87
3	0.00		0.00	0.00		0.00	1.66		1.66
Mar. 1	0.84		0.84	0.84		0.84	0.00		0.00
2	1.56		1.56	1.56		1.56	0.00		0.00
3	0.72		0.72	1.68		1.68	0.00		0.00
Apr. 1	0.00		0.00	0.00		0.00	0.00		0.00
2	0.00		0.00	0.00		0.00	0.29		0.29
3	0.76		0.76	0.28		0.28	1.24		1.24
May 1	0.53		0.53	0.00		0.00	0.74		0.74
2	0.74		0.74	1.26		1.26	0.78		0.78
3	1.22		1.22	1.30		1.30	0.66		0.66
Jun. 1	0.70		0.70	0.25		0.25	0.29		0.29
2	0.00		0.00	1.30		1.30	1.39		1.39
3	0.00		0.00	1.68		1.68	1.77		1.77
Jul. 1	0.00		0.00	0.00		0.00	0.59		0.59
2	0.00		0.00	0.00		0.00	1.83		1.83
3	0.00		0.00	0.00		0.00	1.37		1.37
Aug. 1	0.00		0.00	0.00		0.00	0.00		0.00
2	0.00		0.00	0.00		0.00	0.00		0.00
3	0.00		0.00	0.00		0.00	0.00		0.00
Sep. 1	0.00		0.00	0.00		0.00	0.00		0.00
2	0.00		0.00	0.00		0.00	0.00		0.00
3	1.30		1.30	1.30		1.30	0.00		0.00
Oct. 1	1.26		1.26	1.26		1.26	0.00		0.00
2	0.02		0.02	1.01		1.01	0.00		0.00
3	1.17		1.17	2.17		2.17	0.00		0.00
Nov. 1	0.00		0.00	0.00		0.00	0.78		0.78
2	1.60		1.60	1.11		1.11	2.10		2.10
3	0.84		0.84	0.35		0.35	1.37		1.37
Dec. 1	1.05		1.05	1.57		1.57	1.08		1.08
2	0.53		0.53	0.53		0.53	0.00		0.00
3	0.48		0.48	0.00		0.00	0.00		0.00
Remarks									

File name : TABLE-33.WJ2

Table 3.10 Unit Water Requirements on Block Basis (Case 4)
(Paddy)

Period	Block 1			Block 2			Block 3		
	Paddy	Palawija	Total	Paddy	Palawija	Total	Paddy	Palawija	Total
Jan. 1	0.81		0.81	0.35		0.35			
Jan. 2	0.00		0.00	1.48		1.48	1.55		1.55
Jan. 3	0.00		0.00	1.58		1.58	1.66		1.66
Feb. 1	0.00		0.00	0.00		0.00	0.61		0.61
Feb. 2	0.00		0.00	0.00		0.00	1.87		1.87
Feb. 3	0.00		0.00	0.00		0.00	1.66		1.66
Mar. 1	0.00		0.00	0.00		0.00	0.00		0.00
Mar. 2	1.56		1.56	1.56		1.56	0.00		0.00
Mar. 3	1.68		1.68	1.68		1.68	0.00		0.00
Apr. 1	0.00		0.00	0.00		0.00	0.00		0.00
Apr. 2	0.00		0.00	0.29		0.29	0.00		0.00
Apr. 3	0.28		0.28	0.28		0.28	0.00		0.00
May 1	0.53		0.53	0.00		0.00	0.74		0.74
May 2	1.26		1.26	0.78		0.78	1.77		1.77
May 3	0.82		0.82	1.30		1.30	0.86		0.86
Jun. 1	0.70		0.70	0.78		0.78	0.29		0.29
Jun. 2	1.30		1.30	0.86		0.86	0.90		0.90
Jun. 3	0.00		0.00	1.68		1.68	1.77		1.77
Jul. 1	0.00		0.00	1.03		1.03	1.12		1.12
Jul. 2	0.00		0.00	0.00		0.00	1.39		1.39
Jul. 3	0.00		0.00	0.00		0.00	1.37		1.37
Aug. 1	0.00		0.00	0.00		0.00	1.48		1.48
Aug. 2	0.00		0.00	0.00		0.00	0.00		0.00
Aug. 3	0.00		0.00	0.00		0.00	0.00		0.00
Sep. 1	0.00		0.00	0.00		0.00	0.00		0.00
Sep. 2	0.00		0.00	0.00		0.00	0.00		0.00
Sep. 3	0.00		0.00	0.00		0.00	0.00		0.00
Oct. 1	1.26		1.26	1.26		1.26	0.00		0.00
Oct. 2	1.01		1.01	1.01		1.01	0.00		0.00
Oct. 3	1.07		1.07	2.17		2.17	0.00		0.00
Nov. 1	0.00		0.00	0.78		0.78	0.00		0.00
Nov. 2	1.11		1.11	1.11		1.11	2.10		2.10
Nov. 3	0.84		0.84	0.35		0.35	1.37		1.37
Dec. 1	1.53		1.53	1.04		1.04	2.10		2.10
Dec. 2	0.00		0.00	0.53		0.53	0.00		0.00
Dec. 3	0.48		0.48	0.48		0.48	0.00		0.00
REMARKS									

File name : TABLE-34.WJ2

Table 3.10 Unit Water Requirements on Block Basis (Case 5)
(Paddy)

Period	Block 1		Block 2		Block 3	
	Paddy	Palawija	Paddy	Palawija	Paddy	Palawija
Jan. 1	0.81	0.81	0.88	0.88	0.88	0.39
2	1.48	1.48	1.02	1.06	1.02	1.06
3	0.00	0.00	1.58	1.58	1.58	1.66
Feb. 1	0.00	0.00	1.05	1.05	1.05	1.13
2	0.00	0.00	0.00	0.00	0.00	1.43
3	0.00	0.00	0.00	0.00	0.00	1.66
Mar. 1	0.00	0.00	0.00	0.00	0.00	0.53
2	0.00	0.00	0.00	0.00	0.00	0.00
3	1.68	1.68	0.00	0.00	1.68	0.00
Apr. 1	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.29	0.29	0.29	0.00
3	0.28	0.28	1.24	1.24	1.24	0.00
May 1	0.00	0.00	0.00	0.00	0.00	0.74
2	1.26	1.26	0.78	0.78	0.78	1.77
3	1.30	1.30	0.86	0.86	0.86	1.85
Jun. 1	0.25	0.25	0.78	0.78	0.78	0.29
2	1.30	1.30	1.39	1.39	1.39	0.90
3	1.68	1.68	1.24	1.24	1.24	1.29
Jul. 1	0.00	0.00	1.03	1.03	1.03	1.12
2	0.00	0.00	1.83	1.83	1.83	1.91
3	0.00	0.00	0.00	0.00	0.00	0.97
Aug. 1	0.00	0.00	0.00	0.00	0.00	1.48
2	0.00	0.00	0.00	0.00	0.00	1.71
3	0.00	0.00	0.00	0.00	0.00	0.00
Sep. 1	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00
Oct. 1	0.00	0.00	0.00	0.00	0.00	0.00
2	1.01	1.01	1.01	1.01	1.01	0.00
3	2.17	2.17	2.17	2.17	2.17	0.00
Nov. 1	0.00	0.00	0.78	0.78	0.78	0.00
2	1.11	1.11	2.10	2.10	2.10	0.00
3	0.35	0.35	0.35	0.35	0.35	1.37
Dec. 1	1.57	1.57	1.08	1.08	1.08	2.10
2	0.53	0.53	0.00	0.00	0.00	0.34
3	0.00	0.00	0.48	0.48	0.48	0.00
Remarks						

File name : TABLE-35.WJ2

Table 3.11 Estimation of Potential Irrigabl Area
(Diversion Req.=Diversion Requirements for Paddy and Palawija)

Period	Case 1			Case 2			Case 3			Case 4			Case 5		
	River Discharge (m ³ /sec)	Diversion Req. (l/sec/ha)	Potential Area (ha)	Diversion Req. (l/sec/ha)	Potential Area (ha)	Potential Area (ha)	Diversion Req. (l/sec/ha)	Potential Area (ha)	Potential Area (ha)	Diversion Req. (l/sec/ha)	Potential Area (ha)	Potential Area (ha)	Diversion Req. (l/sec/ha)	Potential Area (ha)	Potential Area (ha)
Jan. 1	140.00	0.11	1,272,727	0.36	250,000	-	0.00	-	0.51	274,510	-	0.59	202,899		
2	108.00	0.49	220,408	0.34	317,647	106,931	1.01	106,931	1.01	106,931	106,931	1.18	91,525		
3	106.70	0.52	205,192	0.52	205,192	98,796	1.08	98,796	1.08	98,796	98,796	1.08	98,796		
Feb. 1	99.80	0.00	51,636	0.00	284,571	474,286	0.21	474,286	0.20	498,000	498,000	0.77	129,351		
2	85.20	1.65	62,384	0.00	62,384	137,419	0.62	137,419	0.64	133,125	133,125	0.47	181,277		
3	94.20	1.51	62,384	1.51	62,384	171,273	0.55	171,273	0.55	171,273	171,273	0.59	159,661		
Mar. 1	109.70	0.28	391,786	0.36	195,893	195,893	0.56	195,893	0.00	-	-	0.00	-		
2	97.00	0.71	136,620	0.71	136,620	93,269	1.04	93,269	1.04	93,269	93,269	0.00	-		
3	103.30	1.04	99,327	0.79	130,759	130,759	0.79	130,759	1.13	91,416	91,416	1.13	91,416		
Apr. 1	122.00	0.17	717,647	0.00	-	-	0.00	-	0.00	-	-	0.00	-		
2	111.80	0.27	414,074	0.27	414,074	1,118,000	0.10	1,118,000	0.10	1,118,000	1,118,000	0.10	1,118,000		
3	107.40	0.42	255,714	0.76	141,316	141,316	0.76	141,316	0.59	182,034	182,034	0.50	214,800		
May 1	131.70	0.35	376,286	1.17	774,706	313,571	0.42	313,571	0.42	313,571	313,571	0.24	548,750		
2	106.00	0.89	119,101	1.07	99,065	115,217	0.92	115,217	1.27	83,465	83,465	1.27	83,465		
3	86.00	0.85	101,176	0.96	89,583	76,786	1.12	76,786	1.00	86,000	86,000	1.34	64,179		
Jun. 1	81.40	0.62	131,290	0.78	104,359	129,206	0.63	129,206	0.86	94,651	94,651	0.56	145,357		
2	65.70	0.47	139,787	1.05	62,571	54,298	1.21	54,298	1.26	52,143	52,143	1.50	43,800		
3	60.90	0.58	105,000	0.62	98,226	46,136	1.32	46,136	1.48	41,149	41,149	1.66	35,687		
Jul. 1	58.50	0.39	150,000	0.34	172,059	162,500	0.36	162,500	0.82	71,341	71,341	1.01	57,921		
2	57.10	0.00	-	0.63	93,607	93,607	0.81	93,607	0.54	109,741	109,741	1.25	45,680		
3	54.40	0.00	-	0.00	-	115,745	0.47	115,745	0.45	120,689	120,689	0.42	129,524		
Avg. 1	50.70	0.00	-	0.00	-	-	0.00	-	0.51	99,412	-	0.43	103,469		
2	49.50	0.00	-	0.00	-	-	0.00	-	0.00	-	-	0.58	85,345		
3	49.30	0.00	-	0.00	-	-	0.00	-	0.00	-	-	0.00	-		
Sep. 1	57.30	1.51	37,947	0.00	-	-	0.00	-	0.00	-	-	0.00	-		
2	61.70	0.99	62,323	0.99	62,323	62,323	0.00	-	0.00	-	-	0.00	-		
3	69.20	0.53	130,566	0.87	79,540	79,540	0.87	79,540	0.00	-	-	0.00	-		
Oct. 1	67.40	0.51	132,157	0.51	132,157	80,238	0.84	80,238	0.84	80,238	80,238	0.00	-		
2	72.60	0.34	213,529	0.34	213,529	213,529	0.34	213,529	0.68	106,765	106,765	0.68	106,765		
3	90.20	1.65	54,667	1.50	60,133	82,000	1.10	82,000	1.03	87,573	87,573	1.45	62,207		
Nov. 1	113.60	0.43	264,185	0.43	264,185	436,923	0.26	436,923	0.26	436,923	436,923	0.26	436,923		
2	90.90	1.26	72,143	1.60	56,813	56,813	1.60	56,813	1.44	63,125	63,125	1.06	85,755		
3	108.90	0.65	167,538	0.50	217,800	128,118	0.85	128,118	0.85	128,118	128,118	0.69	157,826		
Dec. 1	165.60	1.21	136,860	1.38	120,000	133,548	1.24	133,548	1.58	104,810	104,810	1.58	104,810		
2	151.80	0.35	433,714	0.17	692,941	433,714	0.35	433,714	0.17	892,941	892,941	0.23	523,448		
3	128.40	0.32	401,250	0.32	401,250	401,250	0.16	401,250	0.32	401,250	401,250	0.16	802,500		
Remarks															

File name : TABLE-2.WJ2

Table 4.1 HYDRAUTIC CALCULATION OF COUPURE SECTION

h(m)	A(m ²)	P(m)	R(m)	R ^{2/3}	V(m/s)	Q(m ³ /s)
0.50	59.500	120.236	0.495	0.626	0.614	36.6
1.00	120.000	122.472	0.980	0.986	0.969	116.2
1.50	181.500	124.708	1.455	1.284	1.261	228.9
2.00	244.000	126.944	1.922	1.546	1.518	370.4
2.50	307.500	129.180	2.380	1.783	1.751	538.3
3.00	372.000	131.416	2.831	2.001	1.965	731.0
3.50	437.500	133.652	3.273	2.205	2.165	947.1
4.00	504.000	135.889	3.709	2.396	2.353	1185.9
4.50	571.500	138.125	4.138	2.577	2.531	1446.4
5.00	640.000	140.361	4.560	2.750	2.700	1728.1
5.50	709.500	142.597	4.976	2.914	2.862	2030.6
5.77	747.446	143.804	5.198	3.001	2.947	2202.4 *
6.00	780.000	144.833	5.386	3.072	3.017	2353.3
7.00	924.000	149.305	6.189	3.371	3.310	3058.5
8.00	1072.000	153.777	6.971	3.649	3.583	3841.5
9.00	1224.000	158.249	7.735	3.911	3.841	4700.9

Note: * means the case of 1/100 flood discharge

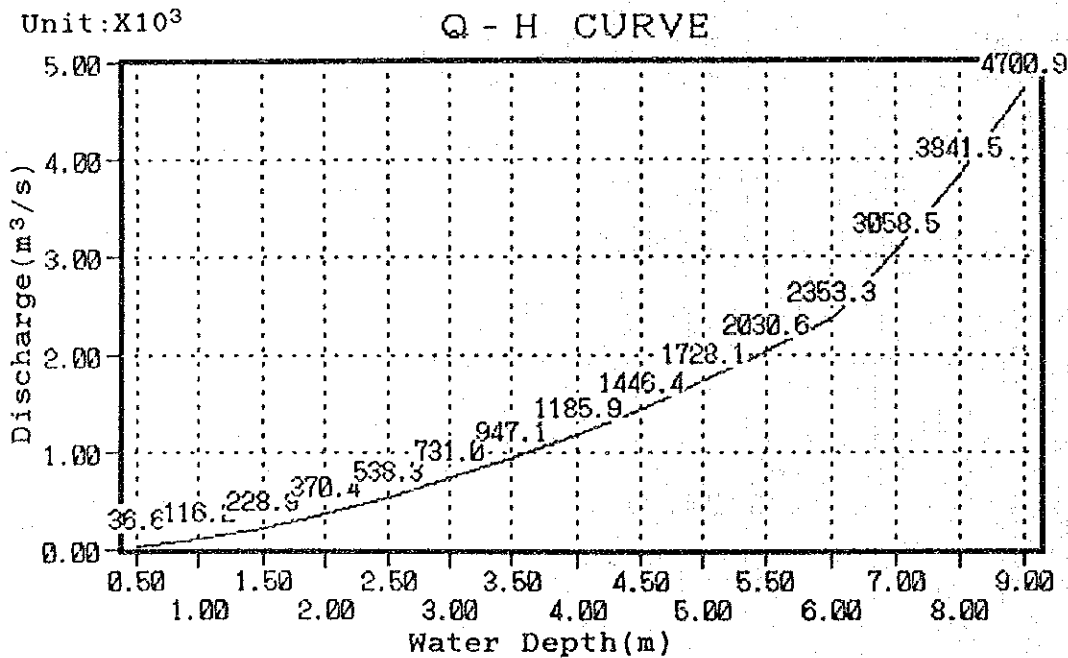


Table 4.2 CALCULATION OF CANAL SLOPE GRADIENT UNLINED CANAL

TYPE	Q (m ³ /s)	h (m)	B/h	B (m)	Bl (m)	m	k	Fb (m)	h+fb (m)	A (m ²)	V (m/s)	P (m)	R (m)	R ^{4/3} (m)	I/K	I	I/I
HRC	9.35	1.65	3.8	6.26	6.20	2.0	42.5	0.75	2.40	15.644	0.598	13.568	1.153	1.209	0.0235	0.060163	6.113
LM-1	8.48	1.60	3.7	5.93	5.80	2.0	42.5	0.75	2.35	14.444	0.587	12.971	1.113	1.154	0.0235	0.060165	6.048
LM-2	7.50	1.55	3.5	5.42	5.40	2.0	42.5	0.75	2.30	13.174	0.569	12.332	1.068	1.092	0.0235	0.060164	6.087
LM-3	6.71	1.50	3.3	4.96	4.90	2.0	42.5	0.80	2.30	11.881	0.565	11.621	1.022	1.030	0.0235	0.060171	5.833
LM-4	5.61	1.43	3.1	4.43	4.40	2.0	42.5	0.77	2.20	10.363	0.540	10.796	0.962	0.949	0.0235	0.060170	5.875
RN-1	4.36	1.33	2.7	3.60	3.50	1.5	40.0	0.62	1.95	7.336	0.594	8.309	0.863	0.847	0.025	0.060260	3.837
SC-1	4.09	1.31	2.6	3.41	3.40	1.5	40.0	0.64	1.95	7.030	0.582	8.124	0.865	0.825	0.025	0.060256	3.898
RM-2	3.79	1.28	2.5	3.21	3.20	1.5	40.0	0.62	1.90	6.574	0.576	7.826	0.840	0.793	0.025	0.060262	3.817
SC-2	3.49	1.25	2.5	3.13	3.10	1.5	40.0	0.60	1.85	6.246	0.559	7.621	0.820	0.767	0.025	0.060254	3.931
RM-3	2.94	1.20	2.3	2.75	2.70	1.5	40.0	0.60	1.80	5.374	0.547	7.011	0.766	0.701	0.025	0.060266	3.749
SC-3	2.87	1.19	2.2	2.61	2.60	1.5	40.0	0.61	1.80	5.205	0.551	6.883	0.756	0.689	0.025	0.060275	3.626
RM-4	2.64	1.16	2.1	2.44	2.40	1.5	40.0	0.64	1.80	4.806	0.549	6.585	0.730	0.657	0.025	0.060286	3.486
RM-5	2.18	1.10	2.0	2.20	2.20	1.5	40.0	0.65	1.75	4.239	0.514	6.169	0.687	0.606	0.025	0.060272	3.669
RN-6	1.61	1.01	1.8	1.82	1.80	1.5	40.0	0.54	1.55	3.358	0.479	5.449	0.616	0.525	0.025	0.060273	3.651
SC-4	1.20	0.93	1.6	1.49	1.50	1.5	40.0	0.52	1.45	2.705	0.444	4.864	0.556	0.457	0.025	0.060268	3.719
SC-5	1.09	0.91	1.6	1.45	1.40	1.5	40.0	0.54	1.45	2.510	0.434	4.675	0.537	0.436	0.025	0.060270	3.701
SC-6	1.00	0.89	1.5	1.33	1.30	1.5	40.0	0.56	1.45	2.333	0.429	4.498	0.519	0.417	0.025	0.060275	3.631
RM-7	0.95	0.87	1.5	1.31	1.30	1.5	35.0	0.53	1.40	2.284	0.416	4.453	0.513	0.411	0.0285	0.060343	2.907
SC-7	0.90	0.86	1.3	1.12	1.10	1.5	35.0	0.54	1.40	2.061	0.437	4.206	0.490	0.386	0.0285	0.060402	2.482
SC-8	0.80	0.83	1.2	1.00	1.00	1.5	35.0	0.52	1.35	1.877	0.426	4.006	0.468	0.364	0.0285	0.060407	2.453
SC-9	0.70	0.80	1.0	0.80	1.10	1.0	35.0	0.50	1.30	1.530	0.458	3.373	0.454	0.349	0.0285	0.060490	2.039
SC-10	0.60	0.77	1.0	0.77	1.00	1.0	35.0	0.53	1.30	1.363	0.440	3.178	0.429	0.323	0.0285	0.060489	2.044
SC-11	0.50	0.73	1.0	0.73	0.90	1.0	35.0	0.52	1.25	1.195	0.419	2.971	0.402	0.297	0.0285	0.060481	2.077
SC-12	0.40	0.69	1.0	0.69	0.80	1.0	35.0	0.41	1.10	1.024	0.391	2.746	0.373	0.268	0.0285	0.060463	2.156
SC-13	0.30	0.64	1.0	0.64	0.70	1.0	35.0	0.41	1.05	0.849	0.354	2.497	0.340	0.237	0.0285	0.060430	2.325
SC-14	0.20	0.57	1.0	0.57	0.60	1.0	35.0	0.43	1.00	0.663	0.302	2.206	0.301	0.201	0.0285	0.060368	2.715
SC-15	0.15	0.52	1.0	0.52	0.50	1.0	35.0	0.28	0.80	0.537	0.279	1.983	0.271	0.175	0.0285	0.060362	2.756

CALCULATION OF CANAL SLOPE GRADIENT LINED CANAL

TYPE	Q (m ³ /s)	h (m)	B/h	B (m)	Bl (m)	m	k	Fb (m)	h+fb (m)	A (m ²)	V (m/s)	P (m)	R (m)	R ^{4/3} (m)	I/K	I	I/I
HRC	9.35	1.65	-	-	3.60	1.5	55.0	0.75	2.40	10.003	0.935	9.540	1.048	1.065	0.0181	0.000271	3.688
LM-2	7.50	1.55	-	-	3.10	1.5	55.0	0.75	2.30	8.408	0.892	8.688	0.968	0.957	0.0181	0.000274	3.640
LM-3	6.71	1.50	-	-	2.80	1.5	55.0	0.75	2.25	7.596	0.883	8.219	0.924	0.900	0.0181	0.000286	3.490
LM-4	5.61	1.43	-	-	2.40	1.5	55.0	0.77	2.20	6.500	0.863	7.557	0.860	0.818	0.0181	0.000300	3.323

Table 4.3 Principal Irrigation System Components

Canal	Length (m)	Number of Structures (nos)						
		Brdg.	Dr. Culvert	Div. & Turn-out	Spill -way	Drop	Check	Siphon
HRC	12,973	5	15	1	1	0	0	0
LMC	16,074	8	13	13	4	2	3	0
RMC	19,056	9	11	21	6	4	6	1
Sub-total	35,130	17	24	34	10	6	9	1
LSC1	1,484	0	0	2	0	1	0	0
LSC2	1,304	1	0	1	0	1	0	0
LSC3	2,090	2	2	3	0	0	0	0
LSC4	3,012	1	1	2	0	0	0	0
LSC5	11,951	6	7	13	3	4	5	0
LSC6	1,854	1	0	2	0	0	0	0
LSC7	1,510	1	1	1	0	0	0	0
LSC8	1,113	1	0	1	0	0	0	0
Sub-total	24,318	13	11	25	3	6	5	0
RSC1	1,672	0	0	2	0	1	0	0
RSC2	907	1	0	1	0	0	0	0
RSC3	2,083	1	1	2	0	0	0	0
RSC4	500	0	0	1	0	0	0	0
Sub-total	5,162	2	1	6	0	1	0	0
Total	77,583	37	51	66	14	13	14	1

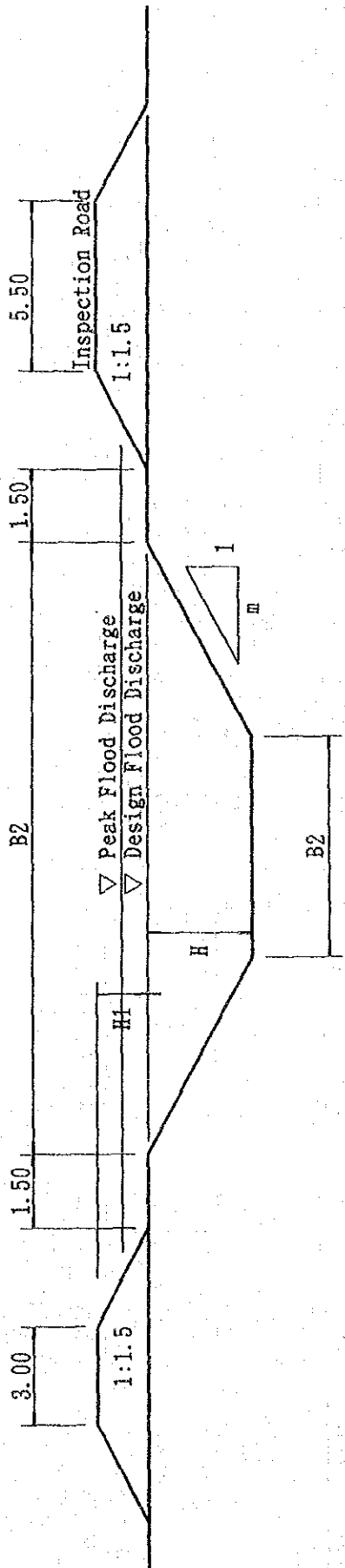


Table 4.4 TABLE OF DIMENSION FOR DRAINAGE CANAL

Name of D. Canal	Discharge Q (m ³ /s)	B1 (m)	B2 (m)	H (m)	H1 (m)	m	I	Remarks
DL-1	3.20	7.16	3.50	1.22	0.50	1.5	0.00050	
DL-2	1.40	4.44	2.50	0.97	0.50	1.0	0.00049	
DL-3	2.60	6.48	3.00	1.16	0.50	1.5	0.00052	
DL-4	6.90	9.03	4.50	1.51	0.60	1.5	0.00048	
DL-5-1	50.90	38.00	30.00	2.00	1.00	2.0	0.00080	
DL-5-2	47.10	33.00	25.00	2.00	1.00	2.0	0.00029	
DL-5-3	32.20	23.00	15.00	2.00	0.90	2.0	0.00031	
DL-6	8.80	10.86	6.00	1.62	0.70	1.5	0.00038	
DL-7-1	19.80	18.00	10.00	2.00	0.80	1.5	0.00037	
DL-7-2	11.20	12.19	7.00	1.73	0.70	1.5	0.00037	
DR-1	6.30	8.94	4.50	1.48	0.60	1.5	0.00064	
DR-2	4.00	7.40	3.50	1.30	0.50	1.5	0.00061	
DR-3	2.80	6.54	3.00	1.18	0.50	1.5	0.00056	
DR-4	7.50	9.65	5.00	1.55	0.70	1.5	0.00044	

Table 4.5

CALCULATION OF DRAINAGE CANAL SLOPE GRADIENT

UNLINED CANAL

TYPE	Q (m ³ /s)	h (m)	B/h	B (m)	Bl (m)	m	k	Bank H.Total (m)	A (m ²)	V (m/s)	P (m)	R (m)	R ⁴ /3	1/K	I	I/I	
DL-1	3.20	1.22	2.0	2.45	3.50	1.5	25.0	0.50	1.72	6.533	0.490	7.914	0.825	0.774	0.0400	0.00050	2,017
DL-2	1.40	0.97	2.0	1.95	2.50	1.0	25.0	0.50	1.47	3.382	0.414	5.254	0.644	0.556	0.0400	0.00049	2,028
DL-3	2.60	1.16	2.0	2.31	3.00	1.5	25.0	0.50	1.66	5.471	0.475	7.167	0.763	0.698	0.0400	0.00052	1,931
DL-4	6.90	1.51	2.5	3.79	4.50	1.5	30.0	0.60	2.11	10.256	0.673	9.961	1.030	1.040	0.0333	0.00048	2,068
DL-5-1	50.90	2.00	15.0	30.00	30.00	2.0	30.0	1.00	3.00	68.000	0.749	38.944	1.746	2.102	0.0333	0.00030	3,377
DL-5-2	47.10	2.00	12.5	25.00	28.00	2.0	30.0	1.00	3.00	64.000	0.736	36.944	1.732	2.080	0.0333	0.00029	3,457
DL-5-3	32.30	2.00	7.5	15.00	18.00	2.0	30.0	0.90	2.90	44.000	0.734	26.944	1.633	1.923	0.0333	0.00031	3,211
DL-6	8.80	1.62	3.0	4.86	6.00	1.5	30.0	0.70	2.32	13.658	0.644	11.841	1.153	1.210	0.0333	0.00038	2,622
DL-7-1	19.80	2.00	5.0	10.00	10.00	1.5	30.0	0.80	2.80	26.000	0.762	17.211	1.511	1.733	0.0333	0.00037	2,690
DL-7-2	11.20	1.73	4.0	6.93	7.00	1.5	30.0	0.70	2.43	16.624	0.674	13.245	1.255	1.354	0.0333	0.00037	2,684
RL-1	6.30	1.48	2.5	3.69	4.50	1.5	25.0	0.60	2.08	9.918	0.635	9.825	1.099	1.013	0.0400	0.00064	1,568
RL-2	4.00	1.30	2.0	2.60	3.50	1.5	25.0	0.50	1.80	7.102	0.563	8.195	0.867	0.826	0.0400	0.00061	1,628
RL-3	2.80	1.18	2.0	2.36	3.00	1.5	25.0	0.50	1.68	5.627	0.498	7.254	0.776	0.713	0.0400	0.00056	1,799
RL-4	7.50	1.55	2.5	3.87	5.00	1.5	30.0	0.70	2.25	11.353	0.661	10.588	1.072	1.097	0.0333	0.00044	2,263

Table 4.6 BILL OF QUANTITIES OF DRAINAGE CANAL

Name of Canal	Length (m)	B1 (m)	B2 (m)	H (m)	Hb (m)	Stripping		Excavation		Earthfill		Structure	
						Area (m ²)	Volume (m ³)	Area (m ²)	Volume (m ³)	Area (m ²)	Volume (m ³)	Bridge (nos)	Drop (nos)
DL-1	1,900	7.16	3.50	1.22	0.50	3.45	6,555	20.84	39,591	8.450	16,055	1	1
DL-2	1,800	4.44	2.50	0.97	0.50	3.45	6,210	15.25	27,447	8.450	15,210	1	1
DL-3	2,500	6.48	3.00	1.16	0.50	3.45	8,625	19.42	48,546	8.450	21,125	1	1
DL-4	3,500	9.03	4.50	1.51	0.60	3.63	12,705	27.20	95,209	9.810	34,335	0	0
DL-5-1	5,600	38.00	30.00	2.00	1.00	4.35	24,360	65.00	364,000	15.850	88,760	2	1
DL-5-2	5,100	33.00	25.00	2.00	1.00	4.35	22,185	60.00	306,000	15.850	80,835	1	0
DL-5-3	2,500	23.00	15.00	2.00	0.90	4.17	10,425	50.00	125,000	14.250	35,625	1	0
DL-6	6,100	10.86	6.00	1.62	0.70	3.81	23,241	30.67	187,066	11.230	68,503	2	1
DL-7-1	4,400	18.00	10.00	2.00	0.80	3.99	17,556	45.00	198,000	12.710	55,924	1	1
DL-7-2	4,900	12.19	7.00	1.73	0.70	3.81	18,669	33.90	166,107	11.230	55,027	1	0
SUB-TOTAL	38,300						150,531		1,556,967		471,399	11	6
DR-1	3,800	8.94	4.50	1.48	0.60	3.63	13,794	26.60	101,063	9.81	37,278	0	0
DR-2	4,100	7.40	3.50	1.30	0.50	3.45	14,145	22.36	91,676	8.45	34,645	0	0
DR-3	5,500	6.54	3.00	1.18	0.50	3.45	18,975	19.79	108,837	8.45	46,475	1	0
DR-4	4,500	9.65	5.00	1.55	0.70	3.81	17,145	28.40	127,817	11.23	50,535	1	0
SUB-TOTAL	17,900						64,059		429,393		168,933	2	0
TOTAL	56,200						214,590		1,986,360		640,332	13	6

Table 4.7

PERSONNEL REQUIREMENT OF O&M OFFICE

Description	Number
General Manager	1
I. Operation Section (Central Station)	
1) Irrigation Supervisor (Irri. Engineer)	1
2) Assistant Irrigation Supervisors	2
3) Hydrologist	1
4) Operator for Computer	2
5) Measurement Aide	2
(Field Station)	
6) Irrigation Inspectors*1	7
7) O & M personnel*2	57
8) Measurement Aide*3	5
II. Repaire and Maintenance Section	
1) Construction Engineer	1
2) Assist. Const. Engineer	2
3) Field Supervisor	4
4) Mechanic	2
5) Mechanic Aide	3
6) Driver/Operator	15
III. Farmer's Assistance Section	
1) Agronomist	1
2) Monitoring Expert/Assistant Agronomist	2
3) Enumerator*4	2
IV. Administrative Section	
1) Administrative Officer	1
2) Accountant	1
3) Clerk*5	2
4) Typist*6	2
5) Storekeeper	2
6) Janitor	2
Total	120

*1 Head of field station

*2 Refer to Table

*3 One field station is established at same place with central station, and rainfall obserbation is done by the measurement aid of meteorological station in central station.

*4 PBME survey will be carried out by an enumerator with several temporary enumerators to be employed.

*5 All of the documents and data to be collected and issued by the sections will be filled by the clerk.

*6 Including typing work for manager and other sections.

Table 4.8

NUMBER OF STAFF NECESSARY FOR O & M

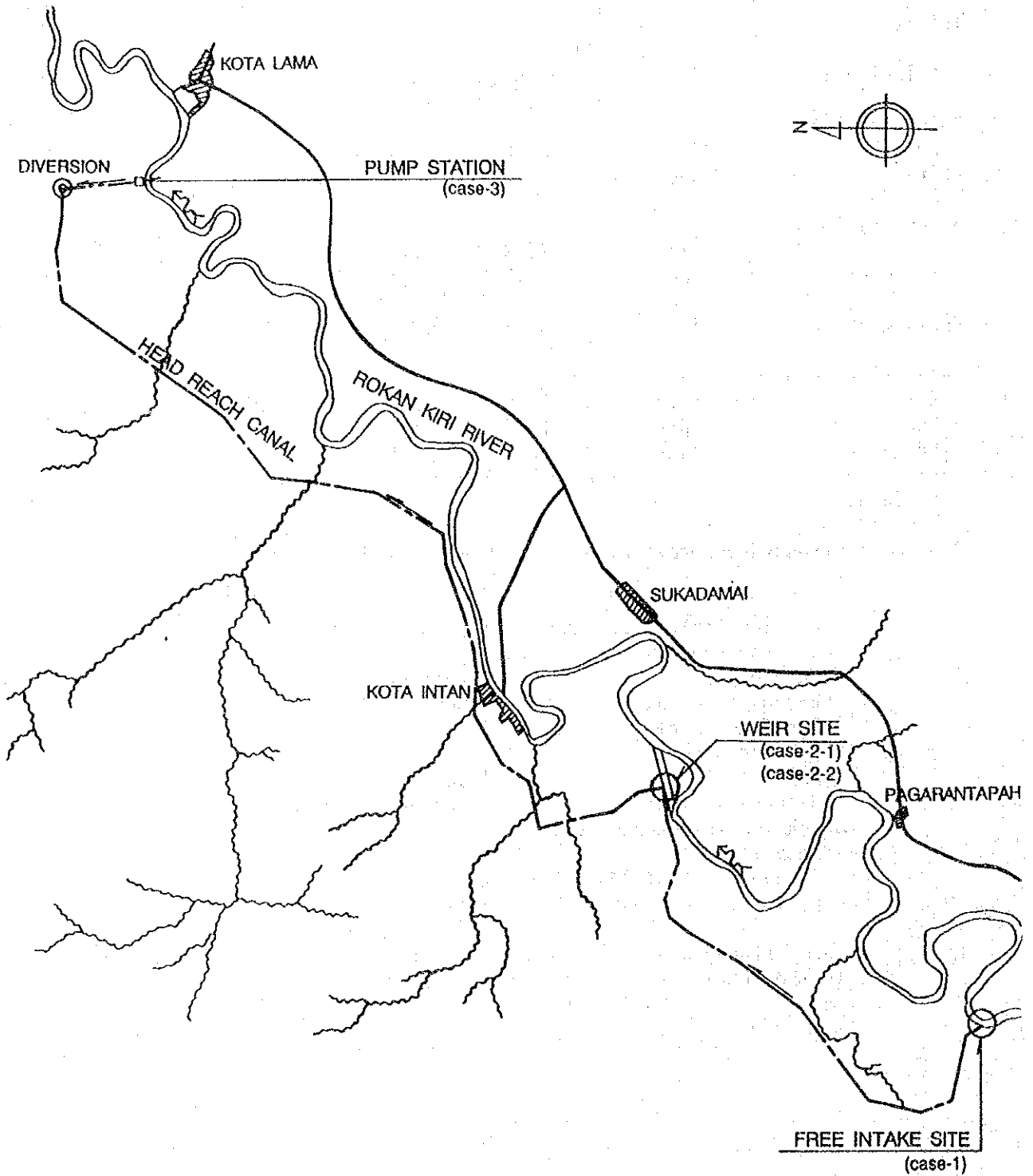
Items	Unit	Left Bank	Right Bank	No. of Staff Required		
				Left	Right	Total
				(persons)	(persons)	(persons)
Intake Weir	-	-	-	-	-	2
Net Irrigation Area	(ha)	5,485	2,815	8	4	12
Main Canal						
Length	(Km)	29.0	19.1	8	4	12
Structures	(nos)	65	58	3	2	5
Secondary Canal						
Length	(Km)	24.3	5.2	4	1	5
Structures	(nos)	63	10	4	1	5
Drainage Canal	(Km)	38.3	17.9	4	2	6
Inspection Road						
Main	(Km)	29.0	19.1	2	1	3
Secondary	(Km)	24.3	5.2	2	1	3
Drainage	(Km)	38.3	17.9	3	1	4
Total						57

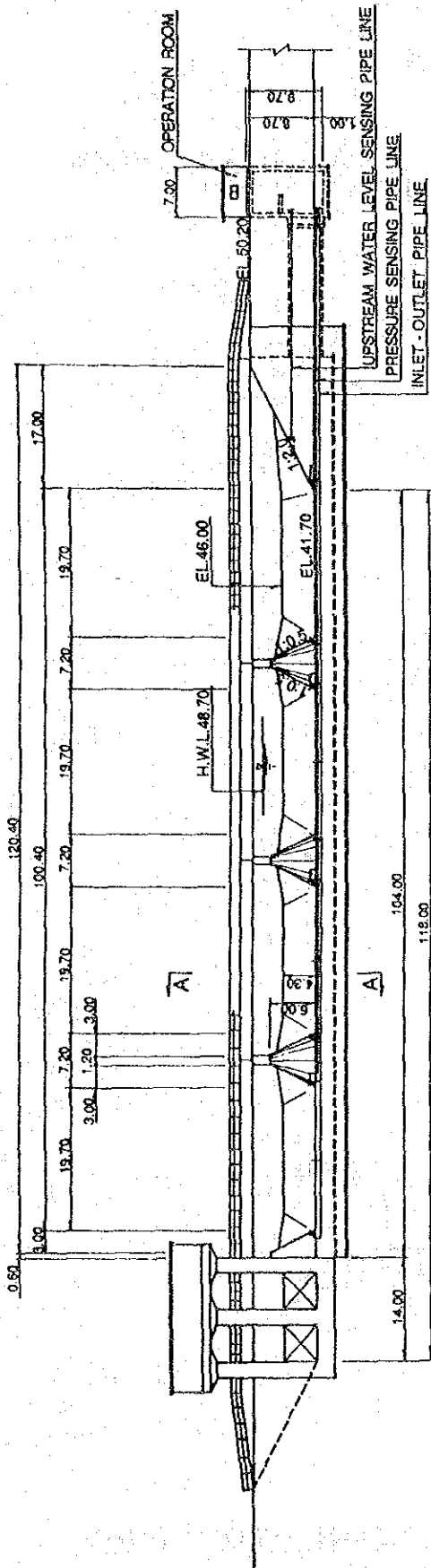
Remarks : Standard coverage of activities for O & M staff is as follows:

Intake Weir	1 person
Operation irrigation water	1 person/700 ha
Check for canal	
Main canal	1 person/ 5 Km
Secondary canal	1 person/ 6 Km
Drainage canal	1 person/10 Km
Check for structure	
Main canal	1 person/40 nos.
Secondary canal	1 person/60 nos.
Check for inspection road	
Main	1 person/18 Km
Secondary canal	1 person/15 Km
Drainage	1 person/15 Km

These standard are based on the density of the O & M personnel in the Section Public Works Office in Jawa.

Fig.2.1 LOCATION OF INTAKES FOR ALTERNATIVE PLANNING





CROSS SECTION

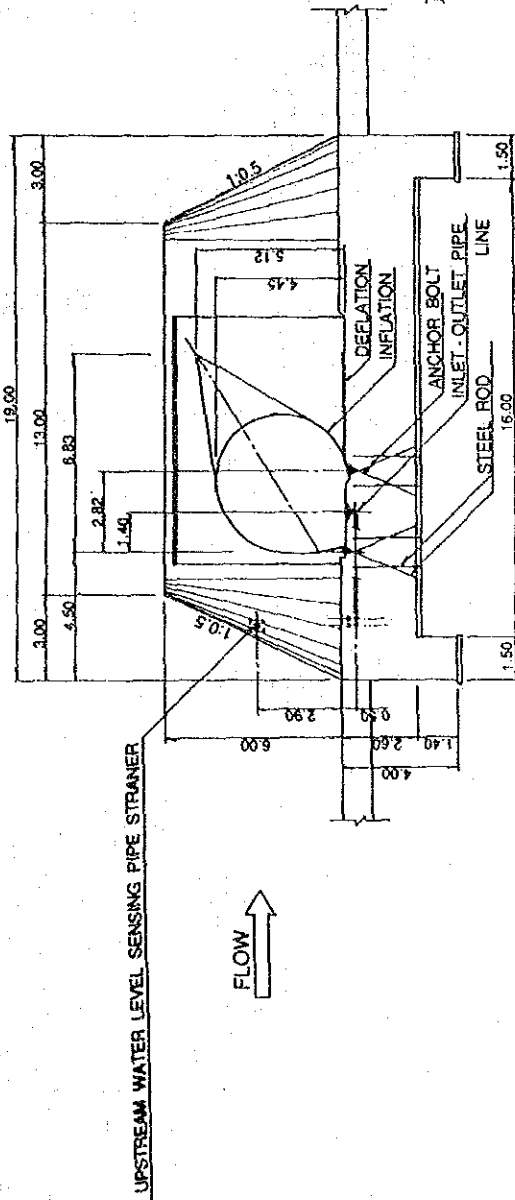
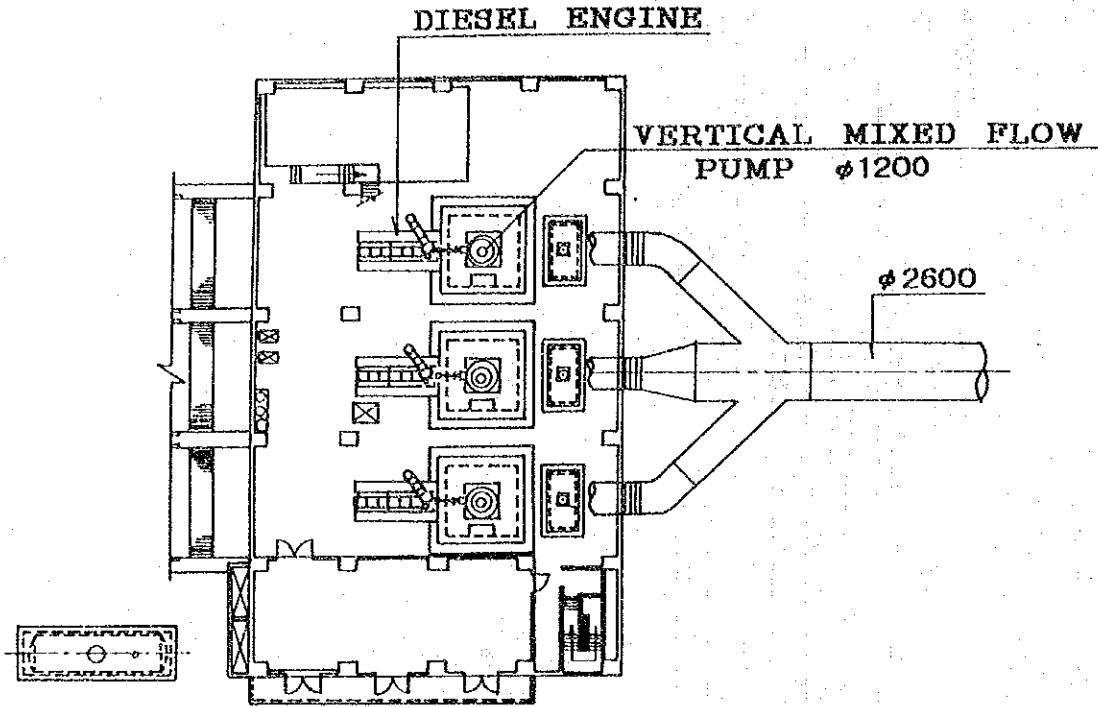
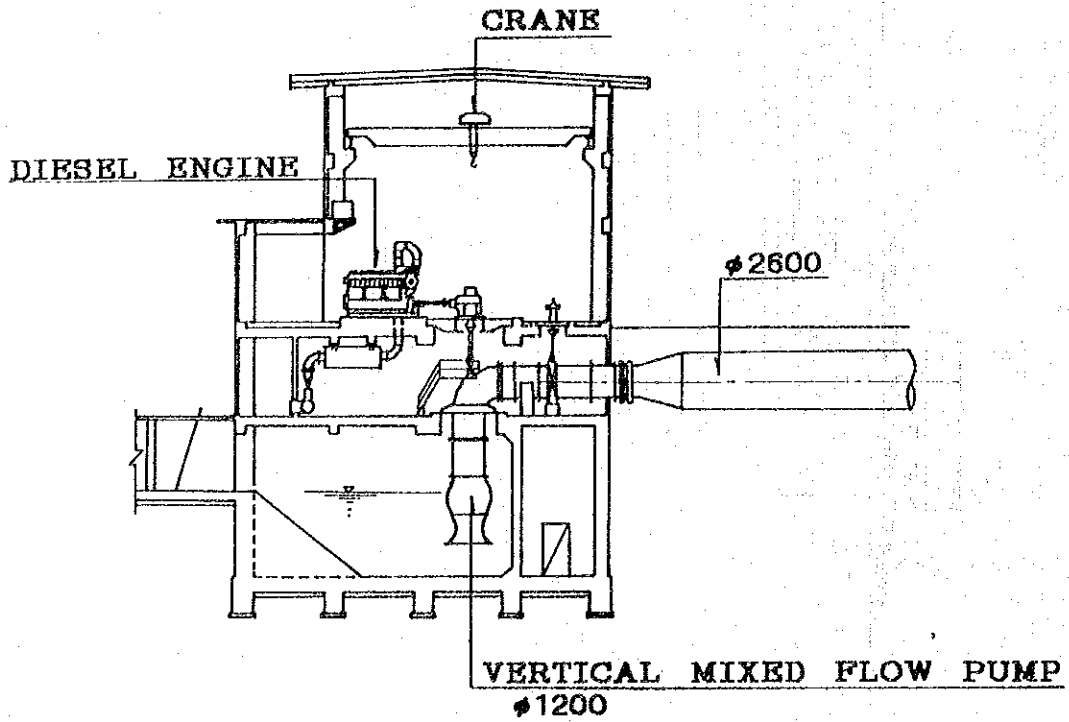


FIG. 2.2 LAYOUT OF RUBBER DAM

Fig.2.3 LAYOUT OF PUMP STATION



PLAN



PROFILE

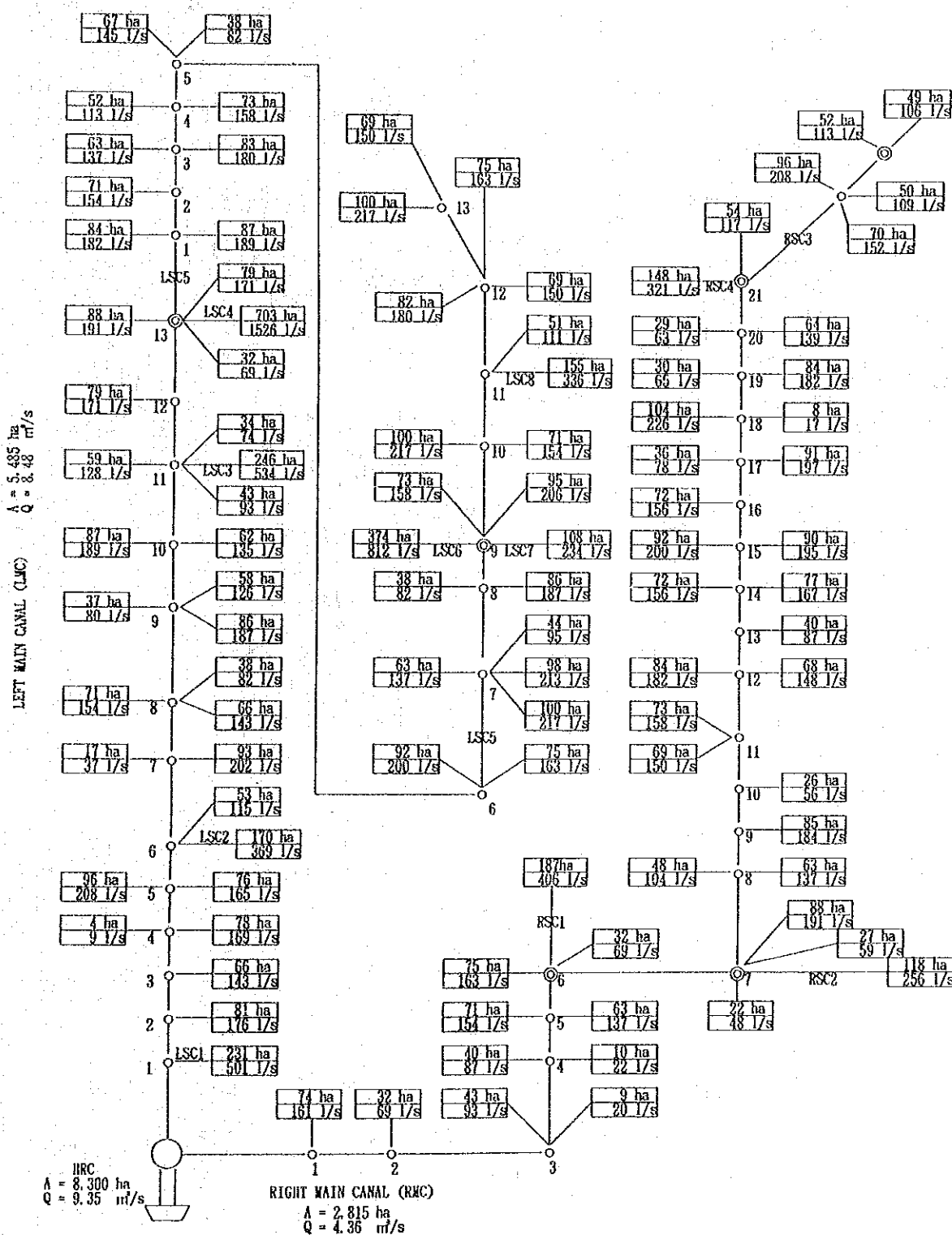


Fig.4.1 IRRIGATION WATER DISTRIBUTION DIAGRAM

REPUBLIC OF INDONESIA MINISTRY OF PUBLIC WORKS DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT FEASIBILITY STUDY ON LOWER ROKAN KIRI IRRIGATION PROJECT	
IRRIGATION WATER DISTRIBUTION DIAGRAM	
JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO (JICA)	DWG NO.

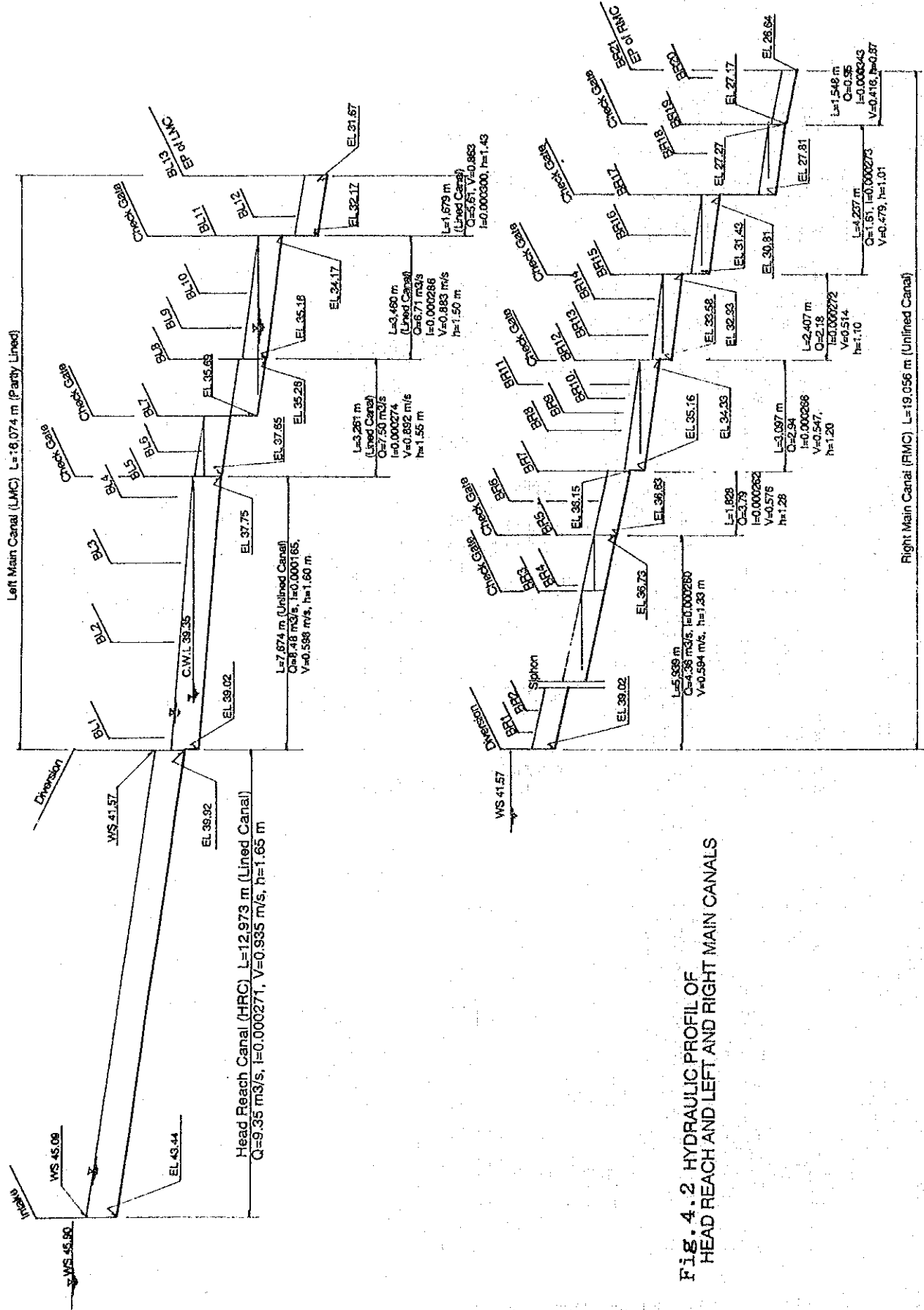


Fig. 4.2 HYDRAULIC PROFILE OF HEAD REACH AND LEFT AND RIGHT MAIN CANALS

ANNEX F

COST ESTIMATES

ANNEX F COST ESTIMATE

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ANNEX F COST ESTIMATES

1. General

Necessary cost for development works for the project is calculated on the basis of the following conditions:

- 1) Unit prices are based on "Basic Price in October and November, 1991" published by CIPTA KARYA DPUP in Riau.
- 2) Costs of miscellaneous works of 10%, general items of 15% and value added tax of 10% is taken into consideration.
- 3) As to land acquisition, Rp.300/m² is considered for irrigation and drainage systems. However, land acquisition for tertiary systems is excluded from consideration.
- 4) Costs for land development is considered as Rp.500,000/ha.

2. Basic Price and Unit Price

The basic prices and major unit prices used for the estimate of the direct construction costs are shown in the Table 1 and Table 2 respectively.

3. Cost Estimate

The summary of the project cost is shown in Table 3 and the direct construction cost for each work division is presented in Table 4(1) to Table 4(6).

Work Divisions for Construction

Work Division	Main Works	Construction Year
I	Access road (2.5 Km), Gated weir with intake	1996/97 - 1998/99
	Flood gate : 24 m x 4 nos.	
	Sand flush gate : 5 m x 2 nos.	
	Intake : 1 nos (Left)	
	Sand trap : 1 nos.	
II	Head reach canal (13.0 Km) Related structures	1996/97 - 1998/99
	Bridge : 5 nos.	
	Drainage culvert: 17 nos.	
	Diversion : 1 no.	
	Spillway : 1 no.	
III (Left bank)	Main canal (16.1 Km) Secondary canal (4.9 Km) Tertiary network (2,130 ha) Related structures	1996/97 - 1999/2000
	Bridge : 11 nos.	
	Drainage culvert: 15 nos.	
	Diversion & turnout : 19 nos.	
	Spillway : 4 nos.	
	Drop : 4 nos.	
	Check : 3 nos.	
IV (Left bank)	Secondary canal (19.4 Km) Tertiary network (3,355 ha) Related structures	1997/98 - 2000/01
	Bridge : 10 nos.	
	Drainage culvert: 9 nos.	
	Diversion & turnout : 19 nos.	
	Spillway : 3 nos.	
	Drop : 4 nos.	
	Check : 5 nos.	
V (Right bank)	Main canal (19.1 Km) Secondary canal (5.2 Km) Tertiary network (2,815 ha) Related structures	1997/98 - 1999/2000
	Bridge : 11 nos.	
	Drainage culvert: 12 nos.	
	Diversion & turnout : 27 nos.	
	Spillway : 6 nos.	
	Drop : 5 nos.	
	Check : 6 nos.	
	Siphon : 1 no.	
VI (Both banks)	Drainage canal (56.2 Km) Related structures	1996/97 - 1998/99
	Bridge : 13 nos.	
	Drop : 6 nos.	

Table 1 Basic Prices

ITEM NO.	WORK ITEM	UNIT	UNIT PRICE (Rp.)	TYPE OFF CLASS
L A B O U R				
A.	Plant operator I	m-d	10,000	
1.	Operator			
B.	Plant operator II	m-d	8,000	
1.	Driver			
2.	Assistant operator			
C.	Tradesman I	m-d	10,000	
1.	Chief of carpenter			
2.	Chief of blacksmith			
3.	Chief of bricklayer			
4.	Chief of painter			
D.	Tradesman II	m-d	85,500	SKILLED LABOUR
1.	Carpenter			
2.	Blacksmith			
3.	Bricklayer			
4.	Painter			
5.	Chief of driller			
6.	Welder			
7.	Digger			
8.	Electrician			
9.	Mason			
10.	Mechanic			
E.	Tradesman III	m-d	5,000	ASSISTANT SKILLED LABOUR
1.	Driller			
2.	Asphaltman			
3.	Assistant mechanic			
4.	Guard			
5.	Assistant driver			
F.	Common labour	m-d	5,000	
1.	Common labour			

Table 2 List of Unit Price

Work Items	Unit	Unit Price (Rp.)	Remarks
A. EARTH WORKS			
1. Site Clearing	100 m ²	16,100	(Man power)
2. Stripping	m ³	1,600	(Bulldozer 1lt)
2.2 Swamp	m ³	5,100	(Swamp dozer 3t, Backhoe 0.55m ³)
3. Excavation			
3.1 Less than 2.00m	m ³	2,600	(Backhoe 0.55m ³ , Bulldozer 1lt)
3.2 More than 2.00m	m ³	2,900	(Backhoe 0.55m ³ , Bulldozer 1lt)
3.3 Man power	m ³	2,100	
3.4 Swamp area	m ³	2,700	(Backhoe 0.55m ³)
3.5 Canal trimming	m ²	1,500	(Man power, Rammer 60kg)
3.6 Rock excavation	m ³	10,400	Less than 2.00m #4
4. Hauling			
4.1 L=30-100m	m ³	710	(Bulldozer 1lt)
4.2 L=100-500m	m ³	1,200	(Dumtruck 6-8t)
4.3 L=500-1,000m	m ³	1,500	(Dumtruck 6-8t)
4.4 L=1,000-2,000m	m ³	1,900	(Dumtruck 6-8t)
4.5 L=2,000-3,000m	m ³	2,500	(Dumtruck 6-8t)
4.6 More than 3,000m	m ³	3,500	Average 4,000m (Dumtruck 6-8t)
5. Earthfill			
5.1 Reuse of excavated materials	m ³	2,300	See Note 1.
(a). Main and secondary canals	m ³	2,200	See Note 2.
(b). Tertiary canal	m ³	2,300	(Bulldozer 1lt, Hand roller, Rammer 60kg)
(c). Canal bed	m ³		
5.2 Use of borrow pit materials	m ³	4,000	See Note 1.
(a). Main and secondary canals	m ³	3,900	See Note 2.
(b). Tertiary canal	m ³	3,600	(Rammer 60kg)
6. Backfill	m ³	900	Grass, not Pait-Paitan
7. Sod facins	m ²	3,700	t=0.15m, use of river stone (Motorgrader w=3.7m, Compactor 15ton)
8. Road metalling	m ²		
B. CONCRETE WORKS			
1. Concrete			
1.1 Watertight	m ³	202,200	(reinforced) K=275
1.2 Reinforced	m ³	157,800	K=225
1.3 Plain	m ³	99,800	K=180
1.4 Concrete pad	m ³	81,100	K=120
2. Reinforcement bar			
2.1 Deformed	ton	1,371,200	
2.2 Round	ton	1,227,500	
C. OTHERS			
1. Gabion			
1.1 Gabion	m	15,500	
1.2 Mattress	m ²	32,400	
2. Stop log			
3. Gate	m ³	734,400	
3.1 Sluice gate			
3.2 Roman gate	m ²	2,200,000	per m ²
	m	2,700,000	per m (width)

File name : LSTUNITP.WJ2

Note 1 : (Bulldozer 1lt, Water tank 3.8m³, Motorgrader w=3.7m, Compactor 15ton)

Note 2 : (Bulldozer 1lt, Water tank 3.8m³, Compactor 15ton)

Table 3 Summary of Project Cost

(Unit in Million Rp.)

Work Item	Amount
1. Preparatory Work	2,351
2. Irrigation & Drainage Construction	65,303
2.1 Work Division - I	19,941
2.2 Work Division - II	8,316
2.3 Work Division - III	11,705
2.4 Work Division - IV	7,138
2.5 Work Division - V	9,144
2.6 Work Division - VI	9,059
3. Land Development Cost	3,830
4. O & M Facility Cost	1,633
5. Land Acquisition Cost	888
6. Administration Cost	1,698
7. Training Cost for WUA	49
8. Engineering Services	5,244
Sub Total (1 to 8)	80,976
9. Physical Contingency	4,049
Sub Total (1 to 9)	85,025
10. Value Added Tax	8,503
Total (1 to 10)	93,528
11. Price Contingency	31,423
Grand Total	124,951

Table 4-(1) Breakdown of Direct Construction Cost for
Work Division - I (Access Road & Head Works)

Works	Unit	Quantity	Amount (Rp *1000)
1. Access Road			
1.1 General Expencc	L.S.	1	76,926
1.2 Earth Works			
1.2.1 Site Clearance	100m2	5,381	86,634
1.2.2 Stripping	m3	66,545	106,472
1.2.3 Earthfill	m3	83,470	191,981
1.3 Sod Facing	m2	32,589	29,330
1.4 Road Metalling	m2	14,000	51,800
1.5 Miscellaneous Works	L.S.	1	46,622
Total			589,765
2. Head Works			
2.1 General Expencc	L.S.	1	2,524,121
2.2 Earth Works			
2.2.1 Site Clearance	100m2	2,218	35,710
2.2.2 Stripping	m3	66,545	106,472
2.2.3 Excavation	m3	374,424	1,902,622
2.2.4 Hauling	m3	682,923	652,191
2.2.5 Earthfill	m3	82,462	189,663
2.2.6 Backfill	m3	5,652	20,347
2.3 Concrete Works			
2.3.1 Reinforced Concrete	m3	12,796	2,019,209
2.3.2 Plain Concrete	m3	10,159	1,012,185
2.3.3 Reinforcement	t	770	1,055,824
2.4 Related Works			
2.4.1 Sod Facing	m2	26,024	23,422
2.4.2 Road Metalling	m2	3,590	13,283
2.4.3 Stilling Basin	L.S.	1	215,877
2.4.4 Gate	L.S.	1	8,050,901
2.5 Miscellaneous Works	L.S.	1	1,529,771
Total			19,351,598
Grand Total			19,941,363

Table 4-(2) Breakdown of Direct Construction Cost for
Work Division -II (Head Reach Canal)

Works	Unit	Quantity	Amount (Rp *1000)
1.Head Reach Canal			
1.1 General Expencc	L.S.	1	1,084,770
1.2 Earth Works			
1.2.1 Site Clearance	100m2	4,541	73,110
1.2.2 Stripping	m3	55,128	88,205
1.2.3 Excavation(Normal)	m3	788,316	2,167,867
1.2.4 Excavation(Rock)	m3	7,962	82,803
1.2.5 Hauling	m3	970,790	784,398
1.2.6 Earthfill	m3	417,209	959,581
1.3 Sod Facing	m2	128,299	115,469
1.4 Road Metalling	m2	45,406	168,002
1.5 Concrete Works			
1.5.1 Plain Concrete	m3	14,544	1,451,491
1.6 Related Structure			
1.6.1 Spillway	L.S.	1	123,461
1.6.2 Bridge	L.S.	1	94,113
1.6.3 Washing Place	L.S.	1	11,663
1.6.4 Drainage Culvert	L.S.	1	454,201
1.5 Miscellaneous Works	L.S.	1	657,436
Total			8,316,570

Table 4-(3) Breakdown of Direct Construction Cost for
Work Division -III (Left Main Irri. System -I)

Works	Unit	Quantity	Amount (Rp *1000)
1. Main Canal			
1.1 General Expencc	L.S.	1	1,090,693
1.2 Earth Works			
1.2.1 Site Clearance	100m2	4,822	77,634
1.2.2 Stripping	m3	62,432	121,742
1.2.3 Excavation	m3	907,833	2,373,983
1.2.4 Hauling	m3	1,027,599	992,660
1.2.5 Earthfill	m3	376,665	866,330
1.3 Sod Facing	m2	170,954	153,859
1.4 Road Metalling	m2	56,259	208,158
1.5 Concrete Works			
1.5.1 Plain Concrete	m3	8,489	847,202
1.6 Related Structure			
1.6.1 Diversion	L.S.	1	245,575
1.6.2 Check	L.S.	1	52,407
1.6.3 Spillway	L.S.	1	88,016
1.6.4 Drop	L.S.	1	18,595
1.6.5 Bridge	L.S.	1	181,119
1.6.6 Washing Place	L.S.	1	18,096
1.6.7 Drainage Culvert	L.S.	1	364,885
1.7 Miscellaneous Works	L.S.	1	661,026
Total			8,361,980
2. Secondary Canal			
2.1 General Expencc	L.S.	1	100,659
2.2 Earth Works			
2.2.1 Site Clearance	100m2	730	11,747
2.2.2 Stripping	m3	15,345	46,036
2.2.3 Excavation	m3	24,376	63,377
2.2.4 Hauling	m3	79,532	81,918
2.2.5 Earthfill	m3	75,039	172,589
2.3 Sod Facing	m2	28,177	25,359
2.4 Road Metalling	m2	12,159	44,988
2.5 Related Structure			
2.5.1 Diversion	L.S.	1	58,014
2.5.2 Check	L.S.	1	10,962
2.5.3 Spillway	L.S.	1	8,630
2.5.4 Bridge	L.S.	1	39,034
2.5.5 Washing Place	L.S.	1	6,048
2.5.6 Drainage Culvert	L.S.	1	41,356
2.6 Miscellaneous Works	L.S.	1	61,006
Total			771,723
3. Tertiary System			
3.1 Tertiary System	ha	2,130	2,571,975
Total			2,571,975
Grand Total			11,705,678

Table 4-(4) Breakdown of Direct Construction Cost for
Work Division -IV (Left Main Irri. System -II)

Works	Unit	Quantity	Amount (Rp *1000)
1. Secondary Canal			
1.1 General Expence	L.S.	1	402,638
1.2 Earth Works			
1.2.1 Site Clearance	100m2	2,918	46,986
1.2.2 Stripping	m3	61,381	184,142
1.2.3 Excavation	m3	97,503	253,508
1.2.4 Hauling	m3	318,127	327,670
1.2.5 Earthfill	m3	300,154	690,355
1.3 Sod Facing	m2	112,708	101,438
1.4 Road Metalling	m2	48,636	179,954
1.5 Related Structure			
1.5.1 Diversion	L.S.	1	232,055
1.5.2 Check	L.S.	1	43,848
1.5.3 Spillway	L.S.	1	34,518
1.5.4 Bridge	L.S.	1	156,137
1.5.5 Washing Place	L.S.	1	24,194
1.5.6 Drainage Culvert	L.S.	1	165,424
1.6 Miscellaneous Works	L.S.	1	244,023
Total			3,086,890
2. Tertiary System			
2.1 Tertiary System	ha	3,355	4,051,163
Total			4,051,163
Grand Total			7,138,053

Table 4-(5) Breakdown of Direct Construction Cost for
Work Division -V (Right Main Irri. System)

Works	Unit	Quantity	Amount (Rp *1000)
1. Main Canal			
1.1 General Expence	L. S.	1	654,433
1.2 Earth Works			
1.2.1 Site Clearance	100m2	5,717	92,044
1.2.2 Stripping	m3	75,156	146,552
1.2.3 Excavation	m3	119,383	310,396
1.2.4 Hauling	m3	389,514	445,214
1.2.5 Earthfill	m3	367,510	845,273
1.3 Sod Facing	m2	138,000	124,200
1.4 Road Metalling	m2	66,696	246,775
1.5 Related Structure			
1.5.1 Siphon	L. S.	1	672,723
1.5.2 Diversion	L. S.	1	339,513
1.5.3 Check	L. S.	1	96,075
1.5.4 Spillway	L. S.	1	76,380
1.5.5 Drop	L. S.	1	31,554
1.5.6 Bridge	L. S.	1	203,656
1.5.7 Washing Place	L. S.	1	27,265
1.5.8 Drainage Culvert	L. S.	1	308,641
1.6 Miscellaneous Works	L. S.	1	396,626
Total			5,017,320
2. Secondary Canal			
2.1 General Expence	L. S.	1	94,943
2.2 Earth Works			
2.2.1 Site Clearance	100m2	774	12,461
2.2.2 Stripping	m3	14,251	37,765
2.2.3 Excavation	m3	22,637	58,856
2.2.4 Hauling	m3	73,860	110,790
2.2.5 Earthfill	m3	69,687	160,280
2.3 Sod Facing	m2	26,168	23,551
2.4 Road Metalling	m2	12,905	47,749
2.5 Related Structure			
2.5.1 Diversion	L. S.	1	75,805
2.5.2 Bridge	L. S.	1	26,736
2.5.3 Washing Place	L. S.	1	5,471
2.5.4 Drainage Culvert	L. S.	1	15,949
2.6 Miscellaneous Works	L. S.	1	57,541
Total			727,897
3. Tertiary System			
3.1 Tertiary System	ha	2,815	3,399,113
Total			3,399,113
Grand Total			9,144,330

Table 4-(6) Breakdown of Direct Construction Cost for
Work Division -VI (Drainage System)

Works	Unit	Quantity	Amount (Rp *1000)
1. Drainage Canal			
1.1 General Expencc	L.S.	1	1,181,689
1.2 Earth Works			
1.2.1 Site Clearance	100m2	13,155	211,795
1.2.2 Stripping	m3	214,590	793,983
1.2.3 Excavation	m3	1,244,455	3,235,582
1.2.4 Hauling	m3	924,289	882,696
1.2.5 Earthfill	m3	320,166	736,382
1.3 Road Metalling	m2	196,700	727,790
1.4 Related Structure			
1.4.1 Bridge	L.S.	1	573,525
1.5 Miscellaneous Works	L.S.	1	716,175
Total			9,059,617

ANNEX G

ENVIRONMENTAL IMPACT ASSESSMENT

ANNEX G ENVIRONMENTAL IMPACT ASSESSMENT

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ANNEXE G ENVIRONMENTAL IMPACT ASSESSMENT

1. System of Environmental Impact Assessment (AMDAL)

The system of Environmental Impact Assessment (AMDAL) on the activity plan in Ministry of Public Works is indicated in Fig.1. AMDAL procedure provides three steps, namely, PIL, ANDAL and RKL/RPL corresponding to the activity stage. On the first stage, survey/ reconnaissance stage, it is decided whether Environmental Impact Assessment (AMDAL) is necessary by screening of the activity plan. If AMDAL is required, necessity of Environmental Information Presentation (PIL) is examined. PIL study is carried out on the pre-feasibility study, if it is necessary.

Environmental Impact Analysis (ANDAL) is put into practice on the feasibility study, if the result of PIL study is concluded that there are important impacts and it is necessary to analyze them. On the Engineering Design stage, Environmental Management Plan (RKL) and Environmental Monitoring Plan (RPL) are embodied and they are put into practice in Construction stage and Operation and Maintenance stage, respectively.

The study carried out in this stage is the Environmental Information Presentation (PIL) in AMDAL procedure. PIL study is supposed to clarify the image of environmental impact resulting from the project activities and to make recommendation of a further study Environmental Impact Analysis (ANDAL), if it will be required. The purpose of the PIL study are :

- Identification of activities program, mainly those estimated to cause impact.
- Identification of the initial environmental conditions, mainly those estimated to be affected by the impact.
- Prediction and evaluation of important impact on the environment and method of remedy.
- Formulation of recommendation on the approach for the management and monitoring of impacts that may be occur.

This PIL study was done in a short time and detailed data have not fully gained. Considering the purpose of the PIL study above mentioned, it is thought that this report meet the purpose. As a result several negative impacts of importance are predicted to occur accompanied by the project and the further study of ANDAL is recommended.

2. Protected Flora and Fauna

Protected flora and fauna are decided by Ministry of Agriculture and Ministry of Forestry over many times. In Riau Province including the survey area, the protected flora and fauna shown in Table 1 are existing.

2.1 Protected Flora

Protected flora are composed of trees useful for resin, fruit, bark, coloring matter and timber. Trees under a certain diameter decided for each species are protected. So it has meanings of conserving natural resources. These decision is applied for only forest area exclude Conversion Forest area.

On the basis of field observation, Land Use/Vegetation map was made up using the aerial photographs of scale ca. 1:20,000 taken in November 1991 by JICA. As a result, vegetation in the study area is physiognomically divided into six types: primary forests, secondary forests, bush lands, farm and grass lands, residential areas and plantation area. Among them primary forests are natural forest. In these forest, available and big trees such as *Shorea* sp. have been already cut and they are not virgin in the strict sense. But these forests are estimated to be physiognomically same with primary forests because tree cutting is selective and artificial disturbance is small in size. These primary forests are classified as swampy forests or seasonal wetland forests and compose of tall trees about 30-35m in height with low density and of trees under 20m occupying densely middle layer. This type of forests is distributed low and northern part of the survey area and attains about 60% in the study area. Although detailed field survey has not carried out, it is estimated that many protected fauna will exist in these primary forests.

As for land use, forest area is decided by Governor as a part of regulation for land use and it is divided into five categories: Protection Forest, Reservation Forest, Limited Production Forest, Fixed Production Forest and Conversion Forest. In these forest area, while the former two are strictly protected, only Conversion Forest area can be used for agriculture. These division of land use are suitably reconsidered by Governor and related government agencies, Forestry, Agriculture, Public Works, Transmigration and Land Rights Agency/ Agrarian.

In the survey area, only conversion forest areas are recognizes

among forest area mentioned above. As regulation for protected flora is not applied in the study area, there is legally no problems clearing primary forest exclude Conversion Forest area.

2.2 Protected Fauna

Protected fauna including water biota list up mammalia, aves, reptile and fish and are applied all over Indonesia. In the survey area, Sungkai/ Jati Seberang (*Penomena conescrns*) as flora and elephant (*Elephan maximus*), butterfly (Lepidoptera spp.), long-tailed black monkey/ lutung (*Presbytis pyrrtius*) were found. Moreover, footprints of elephant and sumatran tiger (*Panthera tigris sumatrea*) were looked at in the field observation. As protected water biota, patin fish, kayangan (arawana), galah shurimp fry, pinus monodor shurimp fry (udung windu) are found in Rokan Kiri river. If detailed survey will be done, more protected flora and fauna may be recognized in the survey area owing to wide distribution of primary forests.

Primary forests in the study area will be cut and burned accompanied by implementation of the project. Habitat of wild animals including protected fauna are destroyed and they will run away to the surroundings.

As existing density in the surroundings become higher, population in the surroundings might decrease. In same case, they might wander through the dwelling area and farmland and injure people or damage food crops.

For the purpose to predict the impact to vegetation, flora and fauna, the further detailed survey is needed.

Table 1 Protected Flora and Fauna in Riau Province

A. Flora

- | | |
|-------------------|--------------------|
| 1. Kulim | 2. Giam |
| 3. Jelutung | 4. Keruing |
| 5. Balam merah | 6. Sialang |
| 7. Kapur | 8. Meranti kunyit |
| 9. Meranti rawang | 10. Meranti sorga |
| 11. Meranti bunga | 12. Meranti merah |
| 13. Meranti udang | 14. Meranti rambai |

B. Mamalia

- | | |
|-------------------|---------------------|
| 1. Gajah | 2. Harimau Sumatera |
| 3. Tapir | 4. Beruang |
| 5. Kancil | 6. Kijang |
| 7. Rusa | 8. Tringgiling |
| 9. Siamang | 10. Owa |
| 11. Kucing hutan | 12. Badak Sumatera |
| 13. Kukang | 14. Baging terbang |
| 15. Landak | 16. Kucing hutan |
| 17. Harimau Dahan | |

C. Aves

- | | |
|-----------------|--------------------|
| 1. Rangkong | 2. Raja udang |
| 3. Pelatuk besi | 4. Kuau |
| 5. Elang | 6. Enggang |
| 7. Kuntul | 8. Bangau tongtong |
| 9. Sesepe madu | 10. Bayan |

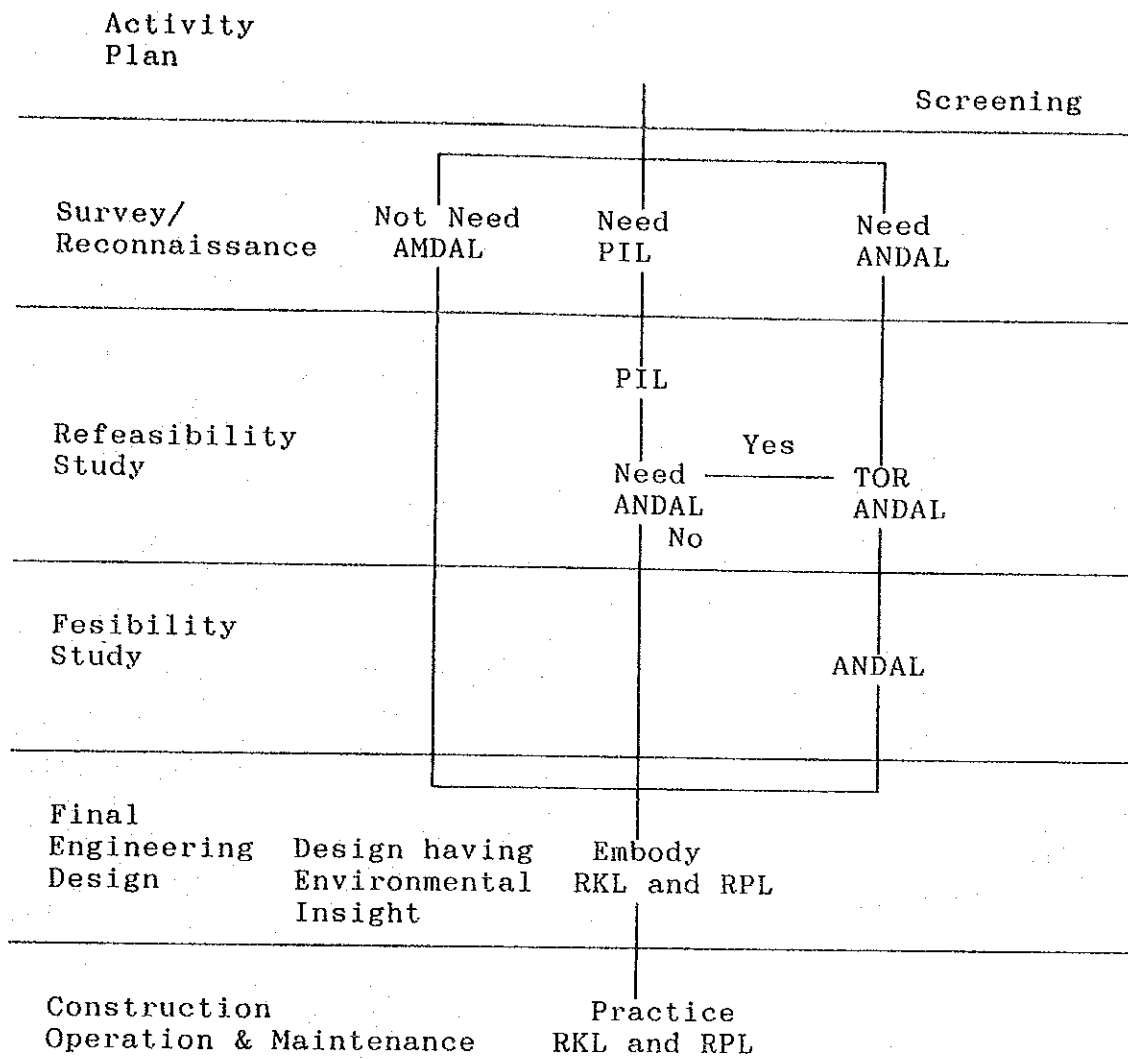
D. Reptil

- | | |
|---------------------|----------------|
| 1. Buaya senyulong | 2. Buaya muara |
| 3. Ular sanca bodoh | 4. Biawak |

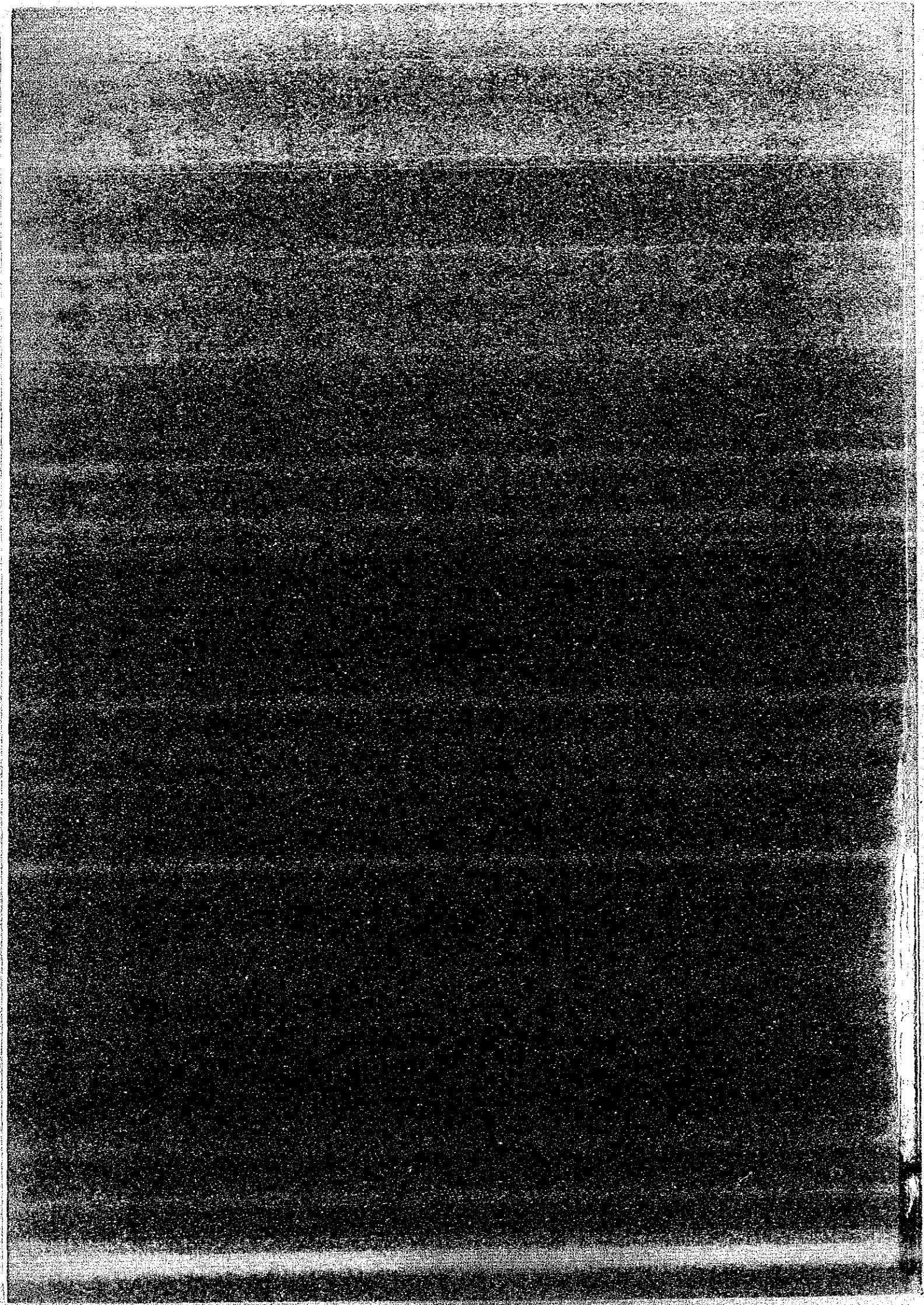
E. Fish

- | | |
|---------------|------------------|
| 1. Ikan siluk | 2. Dugong-dugong |
|---------------|------------------|

Fig. 1 Procedure of AMDAL for Activity Plan



- AMDAL : Environmental Impact Assessment
- PLI : Environmental Information Presentation
- ANDAL : Environmental Impact Analysis
- RKL : Environmental Management Plan
- RPL : Environmental Monitorung Plan



JICA