Table VII-23 Cost Estimate for Improvement of System Infrastructures in Kerian

(1/2)

No	Item	Unit	Qunatity	Unit Price (RM/unit)	Total (RM.)
1	**Concrete Lining of Canals**				
1-1	Main Canal Terusan Besar from diversion point of Terusan Alor Pongsu to downstream, about 10km	m	10,000	577.3	5,773,000
1-2	Main Canal other than above	m	52,000	377.2	19,614,400
1-3	Secondary canals	m	40,000	126.2	19,614,400
1-4	Proposed Control and Monitoring Points, 30m long each				
	5 key control points				
	Intake,Bukit Merak Resorvoir	m	15	677.0	10,155
	Offtake toTerusan Alor Pongsu	m	15	431.1	6,467
	Offtake toTerusan Tg. Piandang	m	45	408.9	18,401
	Offtake to TA.218	m	45	281.2	12,654
	Bogak Pump Station	m	15	528.9	7,934
	Secondary control points				
	Offtake to TA Kolam 1167	m	45	472.9	21,281
	Offtake to TA 74	m	45	373.4	16,803
	Offtake to TA 136	m	45	360.9	16,241
	7 key monitoring points				
	Lower reach, Offtake to TA Haji Ali on Terusan Besar	m	0	592.6	0
	Lower reach, Offtake to TA 804KI, KN on Terusan Besar	m	0	528.9	0
	Lower reach, Offtake to TA Sg. Dungan 1088 on Terusan Besar	m	30	532.1	15,963
	Lower reach, Offtake to TA 303 on Terusan T.A Serong	m	30	281.2	8,436
	Lower reach, Offtake to TA 195 on Terusan Selinsing	m	30	383.2	11,496
	Upper reach, Offtake to TA 1B on Terusan Selinsing	m	30	243.4	7,302
	Lower reach, Offtake to TA Alor Pongsu 3 on Terusan Alor Pongsu	m	30	186.3	5,589
	Secondary monitoring points				
	B.P. TA 315	m	30	103.6	3,109
	B.P. TA 1B	m	30	73.5	2,205
	B.P. TA 539Ki	m	30	83.2	2,495
	B.P. TA Alor Pongsu 3	m	30	108.6	3,257
	B.P. TA Panchor 2/1	m	30	115.5	3,465
	B.P. TA 310A	m	30	83.2	2,495
	B.P. TA 303	m	30	110.1	3,303
	B.P. TA Air Hitam	m	30	110.1	3,303
	Third monitoring points	m	390	126.2	49,218
	Sub-total -1				45,233,370
2	**Related Structures**				
2-1	Provision of Check Structures				
	On Main Canals	nos.	7	30913.3	216,393
	On Muda Secondary Canals	nos.	8	12656.3	101,250
2-2	Replacement of CHO and Offtake Gate	nos.	14	10892.3	152,492
	Sub-total-2				470,136

Table VII-23 Cost Estimate for Improvement of System Infrastructures in Kerian

(2/2)

No	Item	Unit	Qunatity	Unit Price	Total
3	**Improvement of Drainage Facilities**			(RM/unit)	(RM.)
3-1	Draiange control gate at Sg. Bharu	nos.	1	30913.3	30,913
3-2	Repair of draiange control gate at Sg.Burong	nos.	2	12055.5	24,111
3-3	Desilting of drains in Compartment D-F:110km	m3	275000	4.1	1,127,500
3-4	Desilting of drains in Compartment A-C:472km	m3	1,180,000	4.1	4,838,000
3-5	Construction of outlet pipes	m	800	50	40,000
3-6	Construction of control structures	nos.	120	14000.0	1,680,000
3-7	Construction of bund	m	153000	22	3,366,000
3-8	Construction of new drains	m	17,000	17.0	289,000
3-9	Drainage pumps	nos.	10	125000.0	1,250,000
3-10	Others	LS			1,896,829
	Sub-total-3				14,542,353
4	**Farm Road Improvement**				
4-1	Aspahlt Pavement for farm roads along main canals, Terusan Besar, Terusan Selinsing, Terusan Alor Pongsu Terusan Tg. Piandang, Terusan T.Serong	m2	172,000	17.5	3,010,000
4-2	Widening of farm roads to 2.5m along tertiary canals	m3	96,000	8.5	816,000
	Laterite Pavement	m2	250,000	1.4	350,000
	Sub-total-4				4,176,000
	Total				64,421,859

Table VII-24 Cost Estimate for Improvement of System Infrastructures in Besut

(1/2)

No	Item	Unit	Qunatity	Unit Price (RM/unit)	Total (RM)
1	**Repair of Existing Barrages**				
1-1	Replacement of roller gates (Besut Barrage)	LS		8,000,000	8,000,000
1-2	Construction of new Angga Barrage	LS		1,800,000	1,800,000
	Sub-total-1				9,800,000
2	**Concrete Lining of Canals**				
2-1	Canals in Besut System				
	Besut main canal point B-E	m	3,600	674.2	2,427,120
	Main canal, TA, Telaga Nibong	m	1,800	276.4	497,520
	Besut Secondary Canals				
	TA Lubok Kawah	m	3,800	254.4	966,720
	TA Pulau Panjang	m	3,100	254.4	788,640
	TA Tok Bugis	m	2,500	254.4	636,000
	Besut Tertiary Canals	m	2,500	102.7	256,750
2-2	Canals in Angga System				
	Angga Secondary canals				
	TA Paddang Baloh	m	4,000	254.4	1,017,600
	TA Awek	m	3,500	254.4	890,400
	Angga Tertiary canals	m	500	102.7	51,350
2-3	Raise of canal lining height				
	Besut Main Canal Point E-H	m	4,800	31.84	152,832
	Besut Main Canal Point G-M-N-O	m	4,000	31.84	127,360
	Besut Secondary Canals				
	TA Pulau Ribu	m	2,800	31.84	89,152
2-4	Raise of existing canal banks and lining replacement				
	Angga Main Canal CH3700~4600	m	900	675.2	607,680
2-5	Proposed Control and Monitoring Points, 30 m long each				
	<u>key control points</u>				
	Intake Besut Barrage	m	0	788.1	0
	Offtake Point G on Besut Main Canal	m	0	287.7	0
	<u>Secondary control points</u>				
	Offtake Point E on Besut Main Canal	m	0	276.4	0
	Offtake Point M on Besut Main Canal	m	0	265.2	0
	<u>4 key monitoring points</u>				
	Lower reach, Point E, Besut Main Canal	m	0	276.4	0
	Lower reach Point M, Besut Main Canal	m	0	265.2	0
	Offtake, Point O, Besut main canal	m	0	106.0	0
	Upper reach, Point R, Angga Main Canal	m	0	301.9	0
	<u>Secondary monitoring points</u>				
	B.P. TA Lubuk Lawah (Point B Besut Main Canal)	m	0	788.0	0
	Upper reach, Point E, Besut Main Canal	m	0	276.4	0
	Lower reach, Point N on Besut Main Canal	m	0	125.8	0
	Lower reach, Point H on Besut Main Canal	m	0	167.2	0
	Lower reach, Point R on Angga Main Canal	m	0	215.4	0
	Sub-total-2				8,509,124

Table VII-24 Cost Estimate for Improvement of System Infrastructures in Besut

(2/2)

No	Item	Unit	Qunatity	Unit Price	Total
3	**Related Structures**			(RM/unit)	(RM)
3-1	Provision of Check Structures				
	On Besut Main Canal	nos.	3	32332.2	96,997
	On Angga Main Canal	nos.	2	32332.2	64,664
	On Besut Secondary Canals	nos.	1	13889.3	13,889
3-2	Replacement of CHO and Offtake Gates				
	On Besut Main Canal	nos.	34	17,000	578,000
	On Besut Secondary Canals	nos.	18	17,000	306,000
	On Angga Main Canal	nos.	2	17,000	34,000
	On Angga Secondary Canal	nos.	5	17,000	85,000
3-3	Replacement of Check Gates and Control Drop Gate				
	On Besut Main Canal	nos.	10		
	On Angga Main Canal	nos.	4		
	Sub-total-3				1,178,550
4	**Improvement of Drainage Facilities**				
	Desilting of Drains	m3	24,000	4.1	98,400
	Provision of drainage end control structures	nos	15	28,992	434,879
	Sub-total-4				533,279
5	**Improvement of Farm Roads**				
	Asphalt Pavement along Besut main canals	m2	27,500	17.5	481,250
	Asphalt Pavement along Angga main canals	m2	12,500	17.5	218,750
	Widening along Besut tertiary canals	m3	13,440	10.3	138,432
	Laterite Pavement along Besut tertiary canals	m2	35,000	7.0	245,000
	Widening along Angga tertiary canals	m3	12,480	10.3	128,544
	Laterite Pavement along Angga tertiary canals	m2	32,500	7.0	227,500
	Sub-total-5				1,439,476
	Total				21,460,429

Table VII-25 Cost Estimate for Improvement of System Infrastructures in Pulau Pinang

(1/2)

No	Item	Unit	Qunatity	Unit Price (RM./unit)	Total (RM.)
1	**Concrete Lining of Canals**				
1-1	Main and Secondary				
	Main canal in Sg.Muda Sub-Scheme	m	7,500	458.9	3,441,750
	Main canal in Sg.Kulim Sub-Scheme	m	7,500	386.2	2,896,500
	Pinang Tunggal Main Canal	m	14,000	458.9	6,424,600
	Sg. Jarak Main Canal	m	6,000	126.2	757,200
	Sg Muda Secondary Canals	m	68,000	126.2	8,581,600
	Sg Kulim Secondary Canals	m	8,000	126.2	1,009,600
	Sg Jarak Secondary Canals	m	3,000	126.2	378,600
1-2	Proposed Control and Monitoring Points, 30 m long each				
	Key Control points				
	Sungai Muda sub-scheme				
	Bunbong Lima Pump Station	m	0	744.3	0
	Offtake point to TA.B	m	15	490.7	7,361
	Offtake point to TA.C	m	15	480.7	7,211
	Offtake point to TA.G	m	15	253.0	3,795
	Offtake point to TA.H	m	15	252.7	3,791
	Pinang Tunggal Sub -Scheme				
	Pump Station	m	15	261.2	3,918
	Sungai Kulim Sub-Sceme				
	Kulim Headworks	m		505.8	
	Secondary control points				
	Sungai Muda Sub-Scheme				
	Offtake point to TA.CA	m	15	126.2	1,893
	Offtake point to TA.D	m	15	498.3	7,475
	Offtake point to TA.E	m	15	384.8	5,772
	Sungai Kulim Sub-Scheme				
	Offtake point to TA.I	m		412.4	
	Key Monitoring points				
	Sungai Muda Sub-Scheme				
	Lower reach of offtake of TA.A on Main Canal	m		533.7	
	Lower reach of offtake of TA.F on Main Canal	m		318.4	
	Pinang Tunggal Sub -Scheme				
	Begenning of TA PS	m	30	237.0	7,110

Table VII-25 Cost Estimate for Improvement of System Infrastructures in Pulau Pinang

(2/2)

No	Item	Unit	Qunatity	Unit Price	Total
	Sungai Kulim Sub-Scheme				
	Lower reach, Offtake, TA 2 on Main Canal	m		357.45	
	Sg.Jarak Sub-Scheme				
	Sg. Jarak Headworks	m	30	126.2	3,786
	Padang Cempedak Pump Station	m	30	126.2	3,786
	Sg.Kreh Headworks	m	30	126.2	3,786
	Kreh Pump Station	m	30	126.2	3,786
	Secondary Monitoring points				
	Sungai Muda Sub-Scheme				
	Lower reach, TA. A9L on TA.A	m	30	352.4	10,572
	B.P of TA A3	m	30	125.5	3,765
	B.P of TA B2	m	30	120.9	3,627
	Lower reach, Offtake, TA.CL on T.A. C	m	30	191.2	5,736
	B.P. TA F1	m	30	102.5	3,075
	Lower reach, Offtake, TA F8R on TA.F	m	30	191.2	5,736
	Lower reach, Offtake, TA H2R on TA.H	m	30	191.2	5,736
	Lower reach, Offtake, TA H3 3R on TA.H3	m	30	102.5	3,075
	Third monitoring points	m	360	126.2	45,432
	Sub-total-1				23,640,072
2	**Related Structures**				
2-1	Provision of Check Structures				
	On Sg.Muda Main Canal	nos.	2	30,913.3	61,827
	On P Tunggal Main Canal	nos.	1	26,092.9	26,093
	On Sungai Kulim Main Canal	nos.	1	18,742.0	18,742
	On Sungai Muda Secondary Canals	nos.	8	12,656.3	101,250
2-2	Replacement of CHO gate	nos.	2	10,892.3	21,785
	Sub-total-2				229,697
3	**Improvement of Drainage Facilities**				
	Desilting of Tertiary Drains	m3	24,000	4.1	98,400
	Sub-total-3				98,400
4	**Improvement of Farm Roads**				
	Asphalt Pavement along Sungai Muda Main Canal	m2	40,000	17.3	692,000
	Asphalt Pavement along upper reach of P. Tunggal Main Canal	m2	15,000	17.3	259,500
	Widening of tertiary farm road	m3	90,000	8.5	765,000
	Laterite pavement	m2	250,000	1.4	350,000
	Sub-total-4				2,066,500
	Total				26,034,668

Table VII-26 Cost Estimate for Improvement of System Infrastructures in Sungai Manik

No	Item	Unit	Qunatity	Unit Price (RM/unit)	Total (RM)
1	**Construction of settling basin at downstream of intake structure**	LS			112,125.2
	subtotal-1				112,125
2	**Concrete Lining of Canals**				
2-1	Sg Manik sub-scheme Secondary Canals	m	94,000	126.2	11,862,800
2-2	Labu Lubong sub-scheme Secondary Canals	m	41,000	126.2	5,174,200
2-3	Sg Manik sub-scheme Tertiary Canals	m	32,000	28.8	921,600
2-4	Labu Lubong sub-scheme Tertiary Canals	m	19,000	28.8	547,200
2-5	Key control points				
	Intake at Headworks	m	15	400	6,000
	Downstream of diversion weir on left main canal	m	30	400	12,000
	Offtake point to TA.2	m	30	400	12,000
	Offtake point to TA.4	m	30	400	12,000
	Offtake point to TA.7	m	30	400	12,000
	Key Monitoring points				
	Cikus Pump station	m	15	400	6,000
	Lower reach of offtake to TA6-6L on TA No.6	m	30	126.2	3,786
	Secondary monitoring points				
	Lower reach of offtake TA1-8R on TA No.1	m	30	126.2	3,786
	Lower reach of offtake TA7-4R on TA No.7	m	30	126.2	3,786
	Third monitoring points	m	180	126.2	22,716
	subtotal-2				18,599,874
3	**Related Structures**				
3-1	Provision of Check Structures				
	On Secondary Canal	nos.	2	30913.3	61,827
3-2	Replacement of CHO and Offtake Gates	nos.	29	10892.3	315,877
	Replacement of Check Gate and Control Gate	nos.	13	12055.6	156,723
	Replacement of Crossing Structure	nos.	16	17055.0	272,880
	subtotal-3				807,306
4	**Improvement of Drainage Facilities**				
	Desilting of Drains	m3	18,000	4.1	73,800
	subtotal-5				73,800
5	**Improvement of Farm Roads**				
	Asphalt Pavement main canal	m2	102,700	17.5	1,797,250
	Widening of tertiary roads	m3	17,640	8.5	149,940
	Laterite Pavement	m2	105,000	1.4	147,000
	subtotal-4				2,094,190
	Total				21,687,295

Table VII-27 Cost Estimate for Improvement of System Infrastructures in Seberang Perak

No	Item	Unit	Qunatity	Unit Price	Total
1	**Concrete Lining of Canals**				
1-1	Branch canal	m	52,000	126.2	6,562,400
1-2	Left Branch sub-scheme Secondary canals	m	12,000	126.2	1,514,400
	Left Branch sub-scheme Tertiary canals	m	69,000	28.8	1,987,200
1-3	Key control points				
	Teluk Sena Intake	m	15	350.0	5,250
	Bifurcation	m	45	350.0	15,750
	Offtake point to Branch Canal L1 on Right Branch Canal	m	45	350.0	15,750
	Offtake point to Branch Canal R4 on Right Branch Canal	m	45	350.0	15,750
	Secondary control points				
	Offtake point to secondary canal S3L on Left Branch	m	45	350.0	15,750
	Offtake point to secondary canal R7 on Right Branch	m	30	350.0	10,500
	Offtake point to secondary canal R4b3 on Branch R4	m	30	350.0	10,500
	Key monitoring points				
	Lower reach of offtake for secondary S4L on Left Branch	m	30	350.0	10,500
	Lower reach of offtake for secondary S5L on Left Branch	m	30	350.0	10,500
	Lower reach of offtake for secondary R4 on Right Branch	m	30	350.0	10,500
	Lower reach of offtake for secondary S4L on Left Branch canal L1b	m	30	350.0	10,500
	Secondary monitoring points				
	Lower reach of offtake forT15L on Left Branch	m	30	350.0	10,500
	Lower reach of offtake forT5S3L on secondary S3L	m	30	126.2	3,786
	Lower reach of offtake for L1b4 on branch L1b	m	30	350.0	10,500
	Lower reach of offtake for secondary R7 on Right Branch	m	30	350.0	10,500
	Lower reach of offtake for secondary R4b1 on branch R4	m	30	350.0	10,500
	Third monitoring points		90	126.2	11,358
	subtotal-1				10,252,394
2	**Desilting of Irrigation canals**				
	Main Canals	m3	12,000	4.1	49,200
	Left branch sub-scheme Secondary canals	m3	13,200	4.1	54,120
	Left branch sub-scheme Tertiary canals	m3	24,000	4.1	98,400
	subtotal-2				201,720
3	**Related Structures**			(RM/unit)	(RM)
3-1	Provision of Check Structures	nos.	5	30,913.3	154,567
3-2	Replacement of CHO and Offtake Gates	nos.	42	10,892.3	457,477
3-3	Replacement of Check gate and contorl gate	nos.	11	20,654.3	227,197
3-4	Provision of spillway on Main and Left branch canal	nos.	3	20,162.3	60,487
	subtotal-3				899,727
4	**Improvement of Drainage Facilities**				
	Desilting of Drains	m3	7,800	4.1	31,980
	subtotal-4				31,980
5	**Improvement of Farm Roads**				
	Widening of tertiary roads	m3	31,500	8.5	267,750
	Construction of farm road	m3	9,000	7.0	63,000
	subtotal-5				330,750
6	**Replacement of Intake Gate (motorization)**	nos.	6	648,000	3,888,000
	Total				15,604,571

Table VII-28 Cost Estimate for Improvement of System Infrastructures in Kemasin/Semerak

No	Item	Unit	Qunatity	Unit Price	Total
1	**Lining of canals**				
	Key monitoring points				
	Pumpstation for Jerawat Rusa sub-scheme Block A0	m	15	243.2	3,648
	Pumpstation for Jerawat Rusa sub-scheme Block B0	m	15	256.2	3,842
	Pumpstation for Jerawat Rusa sub-scheme Block C0	m	15	256.2	3,842
	Secondary monitoring points				
	Booster pump station for Jerawat Rusa, Block B1	m	15	243.2	3,648
	Booster pump station for Jerawat Rusa, Block C1	m	15	243.2	3,648
	Pump staion for Kemasin Hilir sub-scheme Block-A	m	15	254.4	3,815
	Pump staion for Kemasin Hilir sub-scheme Block-B	m	15	254.4	3,815
	Pump staion for Kemasin Hilir sub-scheme Block-C	m	15	254.4	3,815
	Pump staion for Kemasin Hilir sub-scheme Block-D	m	15	254.4	3,815
	Pump staion for Kemasin Hilir sub-scheme Block-E	m	15	254.4	3,815
	subtotal-1				37,707
2	**Related Structures**				
2-1	Replacement of CHO and Offtake Gates	nos.	9	17000	153,000
	subtotal-2				153,000
3	**Improvement of Drainage Facilities**				
	Desilting of Drains	m3	30,000	5.1	153,000
	subtotal-3				153,000
4	**Improvement of Farm Roads**				
	Widening of tertiary road	m3	32,400	10.3	333,720
	Laterite Pavement	m2	90,000	7.0	630,000
	subtotal-4				963,720
	Total				1,307,427

Table VII-29 Cost Estimate for In-field Infrastructure Improvement works

(1/2)

IADP/ Scheme	Work Item	Quantity	Unit	Unit Price (RM)	Total Cost (RM)
Kerian	Land leveling (DOA)	7,356	ha.	250	1,839,000
	Land leveling (Private Sector)	11,033	ha.	350	3,861,550
	Land leveling (Total)	18,389	ha.		5,700,550
	Infield Channel	2,757,000	m	0.35	964,950
	Control boxes	7,356	nos	60	508,920
	Provision of tramlines	2,050	ha	5,890	12,074,500
	Total infield infra cost				19,248,920
Ketara (Besut)	Land leveling (DOA)	1,863	ha.	250	465,750
	Land leveling (Private Sector)	2,793	ha.	350	977,550
	Land leveling (Total)	4,656	ha.		1,443,300
	Infield Channel	699,000	m	0.35	244,650
	Control boxes	3,105	nos	60	186,300
	Total infield infra cost				1,874,250
Pulau Pinang	Land leveling (DOA)	3,439	ha.	250	859,750
	Land leveling (Private Sector)	5,158	ha.	350	1,805,300
	Land leveling (Total)	8,597	ha.		2,665,050
	Infield Channel	1,290,000	m	0.35	451,500
	Control boxes	3,439	nos	60	204,180
	Total infield infra cost				3,320,730

Table VII-29 Cost Estimate for In-field Infrastructure Improvement works

(2/2)

IADP/ Scheme	Work Item	Quantity	Unit	Unit Price (RM)	Total Cost (RM)
Sg Manik	Land leveling (DOA)	2,313	ha.	250	578,250
	Land leveling (Private Sector)	3,470	ha.	350	1,214,500
	Land leveling (Total)	5,783	ha.		1,792,750
	Infield Channel	876,000	m	0.35	306,600
	Control boxes	2,313	nos	60	138,780
	Total infield infra cost				2,238,130
Sb Perak	Land leveling (DOA)	1,442	ha.	250	360,500
	Land leveling (Private Sector)	2,163	ha.	350	757,050
	Land leveling (Total)	3,605	ha.		1,117,550
	Infield Channel	541,000	m	0.35	189,350
	Control boxes	1,442	nos	60	86,520
	Total infield infra cost				1,393,420
Kemasin-Semerak	Land leveling (DOA)	658	ha.	250	164,500
	Land leveling (Private Sector)	987	ha.	350	345,450
	Land leveling (Total)	1,645	ha.		509,950
	Infield Channel	246,654	m	0.35	86,329
	Control boxes	1,097	nos	60	65,796
	Total infield infra cost				662,075

Table VII-30 Cost Estimate for Remote Control Gate and Pump (1/2)

Kerian Scheme

Point	Size / Numbers	Cost (RM)		
		Gate Replacement	Remote Control Equipment	Total
Key Control point				
KC1	1.83 m x 2.13 m x 6 nos.	1,239,532	274,000	1,513,532
KC2	1.50m x 2.00m x 8 nos.	1,272,000	288,000	1,560,000
KC3	Bogak P/S 4 nos.		93,000	93,000
KC4	3.40 m x 3.20 m x 2 nos.	1,153,280	144,000	1,297,280
KC5	1.65 m x 2.60 m x 6 nos.	1,364,220	216,000	1,580,220
Total		**5,029,032**	**1,015,000**	**6,044,032**
Second Control Point				
SC1	1.20 m x 2.00 m x 3 nos.	381,600	108,000	489,600
SC2	1.65 m x 2.60 m x 6 nos.	1,364,220	216,000	1,580,220
SC3	1.65 m x 2.60 m x 6 nos.	1,364,220	216,000	1,580,220
Total		**3,110,040**	**540,000**	**3,650,040**

Besut Scheme

Point	Size / Numbers	Cost (RM)		
		Gate Replacement	Remote Control Equipment	Total
Key Control point				
KC1	1.93 m x 2.49 m x 3 nos.	764,106	108,000	872,106
KC2	1.60 m x 2.00 m x 1 no.	169,600	36,000	205,600
KC3	1.32 m x 1.52 m x 2 nos.	212,678	72,000	284,678
Total		**1,146,385**	**216,000**	**1,362,385**
Second Control Point				
SC1	1.60 m x 2.00 m x 1 no.	169,600	36,000	205,600
SC2	1.20 m x 1.70 m x 1 no.	108,120	36,000	144,120
Total		**277,720**	**72,000**	**349,720**

Table VII-30 Cost Estimate for Remote Control Gate and Pump (2/2)

Pulau Pinang Scheme

Point	Size / Numbers	Cost (RM)		
		Gate Replacement	Remote Control Equipment	Total
Key Control point				
KC1	Bumbong Lima P/S 8 nos.		161,000	161,000
KC2	2.00 m x 2.00 m x 4 nos.	848,000	144,000	992,000
KC3	2.00 m x 2.00 m x 4 nos.	848,000	144,000	992,000
KC4	1.25 m x 1.70 m x 2 nos.	225,250	72,000	297,250
KC5	1.00 m x 0.60 m x 2 nos.	79,500	72,000	151,500
KC6	Pinang Tunggal P/S 3 nos.		76,000	76,000
KC7	1.00 m x 2.00 m x 4 nos.	424,000	144,000	568,000
Total		**2,424,750**	**652,000**	**3,076,750**
Second Control Point				
SC1	1.70 m x 1.70 m x 4 nos.	612,680	144,000	756,680
SC2	1.70 m x 1.70 m x 4 nos.	612,680	144,000	756,680
SC3	2.00 m x 2.00 m x 4 nos.	848,000	144,000	992,000
Total		**2,073,360**	**432,000**	**2,505,360**

Sungai Manik Scheme

Point	Size / Numbers	Cost (RM)		
		Gate Replacement	Remote Control Equipment	Total
Key Control point				
KC1	1.50 m x 2.50 m x 6 nos.	1,192,500	216,000	1,408,500
KC2	2.13 m x 2.00 m x 3 nos.	677,340	108,000	785,340
KC3	1.00 m x 1.50 m x 6 nos.	477,000	216,000	693,000
KC4	3.05 m x 1.80 m x 1 no.	290,970	72,000	362,970
KC5	1.15 m x 1.30 m x 3 nos.	237,705	108,000	345,705
Total		**2,875,515**	**720,000**	**3,595,515**

Seberang Perak Scheme

Point	Size / Numbers	Cost (RM)		
		Gate Replacement	Remote Control Equipment	Total
Key Control point				
KC1	3.00 m x 2.00 m x 6 nos.		216,000	216,000
KC2	1.50 m x 2.00 m x 5 nos.	795,000	180,000	975,000
KC3	1.70 m x 2.50 m x 8 nos.	1,802,000	288,000	2,090,000
KC4	1.65 m x 1.80 m x 2 nos.	314,820	72,000	386,820
Total		**2,911,820**	**756,000**	**3,667,820**
Second Control Point				
SC1	1.30 m x 1.80 m x 4 nos.	496,080	144,000	640,080
SC2	1.35 m x 1.50 m x 2 nos.	214,650	72,000	286,650
SC3	1.00 m x 1.50 m x 2 nos.	159,000	72,000	231,000
Total		**869,730**	**288,000**	**1,157,730**

Table VII-31 Cost Estimate for Water Level Gauge and RTU on Control and Monitoring Point

Kerian Scheme (1/6)

Point	Number of Water Level Gauge	Cost (RM)			Remarks
		Water level gauge	RTU	Total	
Key Control point					
KC1	2	19,600	21,715	41,315	
KC2	2	19,600	21,715	41,315	
KC3	2	19,600	21,715	41,315	
KC4	2	19,600	21,715	41,315	
KC5	2	19,600	21,715	41,315	
Total		98,000	108,575	206,575	
Key Monitoring Point					
KM1	1	9,800	21,715	31,515	
KM2	1	9,800	21,715	31,515	
KM3	1	9,800	21,715	31,515	
KM4	1	9,800	21,715	31,515	
KM5	1	9,800	21,715	31,515	
KM6	1	9,800	21,715	31,515	
KM7	1	9,800	21,715	31,515	
Total		68,600	152,005	220,605	
Key Point total		**166,600**	**260,580**	**427,180**	
Second Control Point					
SC1	2	19,600	21,715	41,315	
SC2	2	19,600	21,715	41,315	
SC3	2	19,600	21,715	41,315	
Total		58,800	65,145	123,945	
Second Monitoring Point					
SM1	1	9,800	21,715	31,515	
SM2	1	9,800	21,715	31,515	
SM3	1	9,800	21,715	31,515	
SM4	1	9,800	21,715	31,515	
SM5	1	9,800	21,715	31,515	
SM6	1	9,800	21,715	31,515	
SM7	1	9,800	21,715	31,515	
SM8	1	9,800	21,715	31,515	
Total		78,400	173,720	252,120	
Second Point Total		**137,200**	**238,865**	**376,065**	
Third Monitoring Point					
TM1	1	9,800	21,715	31,515	
TM2	1	9,800	21,715	31,515	
TM3	1	9,800	21,715	31,515	
TM4	1	9,800	21,715	31,515	
TM5	1	9,800	21,715	31,515	
TM6	1	9,800	21,715	31,515	
TM7	1	9,800	21,715	31,515	
TM8	1	9,800	21,715	31,515	
TM9	1	9,800	21,715	31,515	
TM10	1	9,800	21,715	31,515	
TM11	1	9,800	21,715	31,515	
TM12	1	9,800	21,715	31,515	
TM13	1	9,800	21,715	31,515	
Third Point Total		**127,400**	**282,295**	**409,695**	

Table VII-31 Cost Estimate for Water Level Gauge and RTU on Control and Monitoring Point

Besut Scheme (2/6)

Point	Number of Water Level Gauge	Cost (RM)			Remarks
		Water level gauge	RTU	Total	
Key Control point					
KC1	2				installed in Pilot Project
KC2	2				installed in Pilot Project
KC3	2	19,600	21,715	41,315	
Total		19,600	21,715	41,315	
Key Monitoring Point					
KM1	1	9,800	21,715	31,515	
KM2	1	9,800	21,715	31,515	
KM3	1				installed in Pilot Project
KM4	1	9,800	21,715	31,515	
Total		29,400	65,145	94,545	
Key Point total		**49,000**	**86,860**	**135,860**	
Second Control Point					
SC1	2	19,600	21,715	41,315	
SC2	2	19,600	21,715	41,315	
Total		39,200	43,430	82,630	
Second Monitoring Point					
SM1	1	9,800	21,715	31,515	
SM2	1	9,800	21,715	31,515	
SM3	1	9,800	21,715	31,515	
SM4	1	9,800	21,715	31,515	
SM5	1	9,800	21,715	31,515	
Total		49,000	108,575	157,575	
Second Point Total		**88,200**	**152,005**	**240,205**	
Third Monitoring Point					
TM1	1	9,800	21,715	31,515	
TM2	1	9,800	21,715	31,515	
TM3	1	9,800	21,715	31,515	
TM4	1	9,800	21,715	31,515	
TM5	1	9,800	21,715	31,515	
TM6	1	9,800	21,715	31,515	
TM7	1	9,800	21,715	31,515	
TM8	1	9,800	21,715	31,515	
TM9	1	9,800	21,715	31,515	
TM10	1	9,800	21,715	31,515	
TM11	1	9,800	21,715	31,515	
TM12	1	9,800	21,715	31,515	
TM13	1	9,800	21,715	31,515	
TM14	1	9,800	21,715	31,515	
TM15	1	9,800	21,715	31,515	
TM16	1	9,800	21,715	31,515	
TM17	1	9,800	21,715	31,515	
TM18	1	9,800	21,715	31,515	
TM19	1	9,800	21,715	31,515	
Third Point Total		**186,200**	**412,585**	**598,785**	

Table VII-31 Cost Estimate for Water Level Gauge and RTU on Control and Monitoring Point

Pulau Pinang Scheme (3/6)

Point	Number of Water Level Gauge	Cost (RM)			Remarks
		Water level gauge	RTU	Total	
Key Control point					
KC1	2	19,600		19,600	use existing RTU
KC2	2	19,600	21,715	41,315	
KC3	2	19,600	21,715	41,315	
KC4	2	19,600	21,715	41,315	
KC5	2	19,600	21,715	41,315	
KC6	1	9,800		9,800	use existing RTU
KC7	2	19,600	21,715	41,315	
Total		127,400	108,575	235,975	
Key Monitoring Point					
KM1	1	9,800	21,715	31,515	
KM2	1	9,800	21,715	31,515	
KM3	1	9,800	21,715	31,515	
KM4	2	19,600	21,715	41,315	
KM5	2	19,600	21,715	41,315	
KM6	2	19,600	21,715	41,315	
KM7	1	9,800	21,715	31,515	
KM8	1	9,800	21,715	31,515	
Total		107,800	173,720	281,520	
Key Point total		235,200	282,295	517,495	
Second Control Point					
SC1	2	19,600	21,715	41,315	
SC2	2	19,600	21,715	41,315	
SC3	2	19,600	21,715	41,315	
SC4	2	19,600	21,715	41,315	
Total		78,400	86,860	165,260	
Second Monitoring Point					
SM1	1	9,800	21,715	31,515	
SM2	1	9,800	21,715	31,515	
SM3	1	9,800	21,715	31,515	
SM4	1	9,800	21,715	31,515	
SM5	1	9,800	21,715	31,515	
SM6	1	9,800	21,715	31,515	
SM7	1	9,800	21,715	31,515	
SM8	1	9,800	21,715	31,515	
Total		78,400	173,720	252,120	
Second Point Total		156,800	260,580	417,380	
Third Monitoring Point					
TM1	1	9,800	21,715	31,515	
TM2	1	9,800	21,715	31,515	
TM3	1	9,800	21,715	31,515	
TM4	1	9,800	21,715	31,515	
TM5	1	9,800	21,715	31,515	
TM6	1	9,800	21,715	31,515	
TM7	1	9,800	21,715	31,515	
TM8	1	9,800	21,715	31,515	
TM9	1	9,800	21,715	31,515	
TM10	1	9,800	21,715	31,515	
TM11	1	9,800	21,715	31,515	
TM12	1	9,800	21,715	31,515	
TM13	1	9,800	21,715	31,515	
Third Point Total		127,400	282,295	409,695	

Table VII-31 Cost Estimate for Water Level Gauge and RTU on Control and Monitoring Point

Sungai Manik Scheme

(4/6)

Point	Number of Water Level Gauge	Cost (RM)			Remarks
		Water level gauge	RTU	Total	
Key Control point					
KC1	2	19,600	21,715	41,315	
KC2	2	19,600	21,715	41,315	
KC3	2	19,600	21,715	41,315	
KC4	2	19,600	21,715	41,315	
KC5	2	19,600	21,715	41,315	
Total		98,000	108,575	206,575	
Key Monitoring Point					
KM1	2	19,600	21,715	41,315	
KM2	1	9,800	21,715	31,515	
Total		29,400	43,430	72,830	
Key Point total		**127,400**	**152,005**	**279,405**	
Second Monitoring Point					
SC1	1	9,800	21,715	31,515	
SC2	1	9,800	21,715	31,515	
Second Point Total		**19,600**	**43,430**	**63,030**	
Third Monitoring Point					
TM1	1	9,800	21,715	31,515	
TM2	1	9,800	21,715	31,515	
TM3	1	9,800	21,715	31,515	
TM4	1	9,800	21,715	31,515	
TM5	1	9,800	21,715	31,515	
TM6	1	9,800	21,715	31,515	
Third Point Total		**58,800**	**130,290**	**189,090**	

Table VII-31 Cost Estimate for Water Level Gauge and RTU on Control and Monitoring Point

Seberang Perak Scheme (5/6)

Point	Number of Water Level Gauge	Cost (RM)			Remarks
		Water level gauge	RTU	Total	
Key Control point					
KC1	2	19,600	21,715	41,315	
KC2	3	29,400	21,715	51,115	
KC3	2	19,600	21,715	41,315	
KC4	2	19,600	21,715	41,315	
Total		88,200	86,860	175,060	
Key Monitoring Point					
KM1	1	9,800	21,715	31,515	
KM2	1	9,800	21,715	31,515	
KM3	1	9,800	21,715	31,515	
KM4	1	9,800	21,715	31,515	
Total		39,200	86,860	126,060	
Key Point total		**127,400**	**173,720**	**301,120**	
Second Control Point					
SC1	2	19,600	21,715	41,315	
SC2	2	19,600	21,715	41,315	
SC3	2	19,600	21,715	41,315	
Total		58,800	65,145	123,945	
Second Monitoring Point					
SM1	1	9,800	21,715	31,515	
SM2	1	9,800	21,715	31,515	
SM3	1	9,800	21,715	31,515	
SM4	1	9,800	21,715	31,515	
SM5	1	9,800	21,715	31,515	
Total		49,000	108,575	157,575	
Second Point Total		**107,800**	**173,720**	**281,520**	
Third Monitoring Point					
TM1	1	9,800	21,715	31,515	
TM2	1	9,800	21,715	31,515	
TM3	1	9,800	21,715	31,515	
TM4	1	9,800	21,715	31,515	
TM5	1	9,800	21,715	31,515	
TM6	1	9,800	21,715	31,515	
TM7	1	9,800	21,715	31,515	
TM8	1	9,800	21,715	31,515	
TM9	1	9,800	21,715	31,515	
TM10	1	9,800	21,715	31,515	
TM11	1	9,800	21,715	31,515	
TM12	1	9,800	21,715	31,515	
TM13	1	9,800	21,715	31,515	
TM14	1	9,800	21,715	31,515	
TM15	1	9,800	21,715	31,515	
TM16	1	9,800	21,715	31,515	
TM17	1	9,800	21,715	31,515	
TM18	1	9,800	21,715	31,515	
Third Point Total		**176,400**	**390,870**	**567,270**	

Table VII-31 Cost Estimate for Water Level Gauge and RTU on Control and Monitoring Point

Kemasin Semerak (6/6)

Point	Number of Water Level Gauge	Cost (RM)			Remarks
		Water level gauge	RTU	Total	
Key Monitoring point					
KM1	2	19,600	21,715	41,315	
KM2	2	19,600	21,715	41,315	
KM3	2	19,600	21,715	41,315	
Key Point total		58,800	65,145	123,945	
Second Monitoring Point					
SC1	1	9,800	21,715	31,515	
SC2	1	9,800	21,715	31,515	
SC3	1	9,800	21,715	31,515	
SC4	1	9,800	21,715	31,515	
SC5	1	9,800	21,715	31,515	
SC6	1	9,800	21,715	31,515	
SC7	1	9,800	21,715	31,515	
Second Point Total		68,600	152,005	220,605	

Table VII-32 Cost Estimate for Rainfall Station

Location	Cost (RM)			Remarks
	Rainfall Gauge	RTU	Total	
Pulau Pinang Scheme				
1. Station R 5503034 (existing)	2,500	21,715	24,215	
2. Pinang Tunggal Pump Station			0	use existing
3. Padang Cempedak Pump Station	2,500		2,500	RTU includes in KM5
4. Offtake for TA.2	2,500		2,500	RTU includes in KM8
Total	**7,500**	**21,715**	**29,215**	
Kerian Scheme				
1. Station Jalan Bharu (existing)			0	RTU includes in KC4
2. Station Alor Pancor (existing)		21,715	21,715	
3. Station FCD Simpang Empat (existing)		21,715	21,715	
4. Station Bukit Merah (existing)			0	RTU includes in KC1
Total	**0**	**43,430**	**43,430**	
Sungai Manik Scheme				
1. Station R 4010138 (existing)	2,500	21,715	24,215	
2. Offtake point to TA. 7-4R	2,500	21,715	24,215	
Total	**5,000**	**43,430**	**48,430**	
Seberang Peark Scheme				
1. Offtake point for secondary canal S4L	2,500		2,500	RTU includes in KM1
2. Offtake point for branch canal R4	2,500		2,500	RTU includes in KC3
Total	**5,000**	**0**	**5,000**	
Kemasin/Semerak Scheme				
1. Pump station for Block C0	2,500		2,500	RTU includes in KM3
2. Station R 6024074 (existing)	2,500	21,715	24,215	
Total	**5,000**	**21,715**	**26,715**	
Besut Scheme				
1. Besut Barrage				installed in Pilot Project
2. Point O of Besut Main Canal				installed in Pilot Project
3. Point R of Angga Main Canal	2,500	21,715	24,215	
Total	**2,500**	**21,715**	**24,215**	

Table VII-33 Cost for Central Station for Radio Link

Item	Quantity	Unit Price (RM)
1. Master Equipment with Data Processing Unit and Printer	1	32,000
2. Radio Equipment	1	2,800
3. Mast 30m with Installation	1	13,300
4. Brown Antenna	1	650
5. Coaxial Cable 40 m	1	650
6. Coaxial Arrester	1	915
7. Software and Hardware	1	205,000
8. Installation, Commisioning and Maintenance for Six Months	1	11,000
Total		**266,315**

Table VII-34 Cost for Remote Station for Radio Link (9-ele Yagi Antenna)

Item	Quantity	Unit Price (RM)
1. Remote Equipment	1	5,000
2. Solar Power Equipment	1	5,000
3. Radio Equipment	1	2,800
4. Mast 10m with Installation	1	1,300
5. 9-ele Yagi Antenna	1	850
6. Coaxial Cable 20 m	1	350
7. Coaxial Arrester	1	915
8. Installation, Commisioning and Maintenance for Six Months	1	5,500
Total		**21,715**

Table VII-35 Cost for Repeater Station

Item	Quantity	Unit Price (RM)	Amount (RM)
1. Radio Equipment for Repeater Station (Rockmount, AC 240V)	2	14,000	28,000
2. Cardioide Antenna	2	1,300	2,600
3. Coaxial Cable 40m	2	650	1,300
4. Coaxial Antenna	2	915	1,830
5. Installation, Commisioning and Maintenance for Six Months	1	5,000	5,000
Total			**38,730**

Table VII-36 Cost for Rainfall Gauge

Item	Quantity	Unit Price (RM)
1. Tipping Bucket with Wind Shield and Cable 20m	1	2,500
Total		**2,500**

Table VII-37 Cost for Water Level Gauge

Item	Quantity	Unit Price (RM)
1. Float Type Water Level Gauge with Power Supply and Cable 20m	1	5,800
2. Well and Gauge Housing with Installation	1	4,000
Total		**9,800**

Table VII-38 Modification of Pump Station for Telecontrol

	Item	Price/Pump	Price/System
1.	System Design		15,000
2.	Software		10,000
3.	Site Control Board Modification	10,000	
4.	Lightning Protection	2,000	
5.	Installation, Carribration, Commisioning	5,000	

Table VII-39 Modification of Gate (Radial, Roller) Station for Telecontrol

	Item	Price/Gate	Price/System
1.	System Design		15,000
2.	Software		10,000
3.	Site Control Board Modification	10,000	
4.	Gate Opening Gauge	15,000	
5.	Lightning Protection	2,000	
6.	Installation, Carribration, Commisioning	5,000	

Table VII-40 Modification of Slide Gate for Telecontrol

	Item	Price/Gate	Price/System
1.	System Design	1,500	
2.	Actuator	30,000	
3.	Lightning Protection	1,500	
4.	Installation, Carribration, Commisioning	3,000	

Table VII-41 Modification of Bukit Merah Intake for Telecontrol

	Item	Quantity	Price/Gate	Price/System
1.	System Design	1 Lot		15,000
2.	Software	1 Lot		10,000
3.	Actuator	6	30,000	180,000
4.	Site Control Board	6	5,000	30,000
5.	Lightning Protection	6	1,500	9,000
6.	Installation, Carribration, Commisioning	6	5,000	30,000
	Total			274,000

Table VII-42 Software and Hardware Cost Estimate for Telemetry / Telecontrol System

Item		Unit	Rate	Quantity	Amount
1 Hardware			RM		RM
1.1 Computer (CPU)		Set	8,100	1	8,100
CPU	MMX 200MHz				
Motherboard	512K Pipeline Cache				
RAM	64MB				
Network Interface	Ethernet / 10BASE-T				
Interface	RS232C				
Hard Disk Interface	SCSI-II				
Strage	4GB				
CD ROM	16x				
Monitor	17 inch				
Attachments	Keyboard+FD+Mouse				
	DAT Drive				
Operating System	Windows 95				
1.2 Printer		Set	18,000	1	18,000
Network Color Printer (A4)					
Network Interface	IEEE802.3 10BASE-T				
1.3 Network Hub 8port		Set	800	1	800
Network Interface	IEEE802.3 10 BASE-T				
1.4 Support Software	Visual Basec 5.0	Set	1,500	1	1,500
for Computer (CPU)	Professional Edition				
	Microsoft Office 95	Set	1,500	1	1,500
	Professional Edition				
1.5 File Server		Set	9,100	1	9,100
CPU	MMX 200MHz				
Motherboard	512K Pipeline Cache				
RAM	64MB				
Network Interface	Ethernet / 10BASE-T				
Interface	RS232C				
Hard Disk Interface	SCSI-II				
Strage	8GB				
CD ROM	16x				
Monitor	15 inch				
Attachments	Keyboard+FD+Mouse				
	DAT Drive				
Operating System	Windows 95				
1.5 Support Software	Microsoft Office 95	Set	1,500	1	1,500
for File Server	Professional Edition				
1.6 Video Converter		Set	9,000	1	9,000
Input	VGA DB15HD				
Output	VGA DB15HD				
S-video	4pin miniDIN				
Composit	RCA				
RGB	DB9				
Video Output	NTSC/PAL				
1.7 Projection TV		Set	18,000	1	18,000
CRT size	61-inch				
Input	S-video 4pin miniDIN				
(1291 x 1543 x 647) (W x H x D)					
2 Software Development					
2.1 Project Data Preparation		Month	7,000	2	14,000
Senior Engineer		Month	4,000	2	8,000
Junior Engineer					
2.2 Content Development		Month	7,000	2	14,000
Senior Engineer		Month	4,000	2	8,000
Junior Engineer					
2.3 Programming		Month	7,000	4	28,000
Senior Engineer		Month	4,000	4	16,000
Junior Engineer					
2.4 Staff Training (1 month)				Sum	49,500
Total					205,000

Note : Cost does not include electrical / telecom wiring

Table VII-43 Cost for Irrigation Monitoring and Feedback System

IADP/Scheme	Location	Quantity			Unit Cost			Amount				Total
		Master (Set)	Player & TV (Set)	AdditionalTV (Set)	Master (RM)	Player & TV (RM)	AdditionalTV (RM)	Master (RM)	Player & TV (RM)	AdditionalTV (RM)	Wiring (RM)	(RM)
1. Kerian	PMU			1								
	DID Component			1								
	DOA Component (Spg Tiga)		1	1								
	DID O&M Central Control	1	1									
	Farmers Development Centres		6									
	PPK		2									
		1	10	3	227,000	35,500	2,000	227,000	355,000	6,000	56,900	646,900
2. Ketara (Besut)	PMU			1								
	DID Component			1								
	DOA Component			1								
	DID O&M Central Control	1	1	1								
	DID District Office		1									
	Besut Barrage		1									
	DID Compartment Stations		4									
	PPK											
	Farmers Centres		4									
		1	11	4	227,000	35,500	2,000	227,000	390,500	8,000	62,550	688,050
3. Pulau Pinang	PMU			1								
	DID Component			1								
	DOA Bumbung Lima		1									
	DID O&M Central Control	1	1	1								
	DID Field Office		2									
	Farmers Development Centres		4									
	PPK		3									
		1	11	3	227,000	35,500	2,000	227,000	390,500	6,000	62,350	695,850
4. Sungai Manik	PMU Sub-Office		1	1								
	DID O&M Tk Iman	1	1									
	Farmers Development Centres		3									
		1	5	1	227,000	35,500	2,000	227,000	177,500	2,000	40,950	467,150
5. Seberang Perak	DID O&M Central Control	1	1	1								
	Telok Sena Intake		1									
	DOA		1									
	FELCRA		1									
	Farmers Development Centres		6									
		1	10	1	227,000	35,500	2,000	227,000	355,000	2,000	58,400	642,400
6. Kemasin-Semerak	PMU			1								
	DID Component			1								
	DOA Component			1								
	DID O&M Central Control	1	1	1								
	DID Pasir Puuh		1									
	PPK											
	Farmers Development Centres		7									
		1	9	4	227,000	35,500	2,000	227,000	319,500	8,000	55,450	609,950
Min. of Agriculture	Strategic Planning Unit		1	2	227,000	35,500	2,000	0	35,500	4,000	39,500	43,450
DID HQ	Irrigation Division		1	2	227,000	35,500	2,000	0	35,500	4,000	39,500	43,450
DOA HQ	Paddy Division		1	2	227,000	35,500	2,000	0	35,500	4,000	39,500	43,450
	Grand Total	6	59	22	227,000	35,500	2,000	1,362,000	2,094,500	44,000	3,500,500	3,850,550

Table VII-44 Software and Hardware for Monitoring and Feedback System

Item	Unit	Rate	Quantity	Amount
A Set-up cost		RM		RM
Software, content development, training				
1. Scala InfoChannel Master and Player Software (Incl. installation and testing)	Set	49,500	1	49,500
2. Content Development Template development incl. elements of digital data comprising pictures, video, audio			Sum	45,000
3. Staff Training (1 month) Creating, authoring, distribution			Sum	49,500
4. Support software for Master Station Adobe Premier, SCALA MM200, Photoshop 4.0 Microsoft Office, Microsoft Explorer, Anit-Virus			Sum	9,500
5. Support software for Player Station Microsoft Office, Microsoft Explorer, Anti-Virus			Sum	3,500
Hardware				
6. Master Station (Computer and peripherals) MMX200, 512K pipeline cache, 64MB,SCSI-II, H/D 4.1GB, 24X CD-ROM Monitor, Scanner, Digital Camera, Modem, Printer, Drawing Pad, Netrwrok Card, UPS, OS			Sum	49,500
7. InfoChannel Player Station (Desktop Computer) 166 MMX, 256KB Cache, Monitor, 32 MB, Graphic Card, 3.0GB, Disk drive, CD-ROM, Modem, Audio, Video Encoder, PCMCIA Card, UPS, OS			Sum	15,000
8. Television 21"	Unit			2,000
9. Support software for Player Station Microsoft Office, Microsoft Explorer, Anti-Virus	Sum		Sum	3,500
Total Start-up cost				**227,000**
B Additional Player Station				
1. InfoChannel Player Software Incl installation and testing	Unit	15,000	1	15,000
2. InfoChannel Player Station (Computer) 166 MMX, 256KB Cache, Monitor, 32 MB, Graphic Card, 3.0GB, Disk drive, CD-ROM, Modem, Audio, Video Encoder, PCMCIA Card, UPS, OS	Unit	15,000	1	15,000
3. Television Set 21"	Unit	2,000	1	2,000
4. Support software	Sum		Sum	3,500
Total per Player Station				**35,500**

Note: Each Player Station can have more than one display points (TVs)
Cost does not include electrical and telecom wiring

Table VII-45 Cost Estimate for WUG Off-site and On-site Training Programs

IADP	Training	WUGs (Nos)	Training Sessions (Nos)	Total Cost (RM)	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	Notes
Pulau Pinang	On-site training	125	500	73,010		14,602	14,602	14,602	14,602	14,602								Off-site program: at NWMTC @ 2 leaders/WUG @RM400/day/person
	Off-site training	125	7	300,000		85,714	85,714	128,572										
	Total	125		373,010		100,316	100,316	143,174	14,602	14,602								On-site program: All WUG members 2 x 1-day sessions @RM5/person/day
Besut	On-site training	30	153	30,540		6,200	6,200	6,200	6,200	5,740								
	Off-site training	30	2	72,000		36,000	0	36,000										
	Total			102,540		42,200	6,200	42,200	6,200	5,740								
Kerian	On-site training	84	676	134,850		26,720	26,720	26,720	26,720	27,970								
	Off-site training	84	4	201,600		50,400	50,400	100,800										
	Total	84		336,450		77,120	77,120	127,520	26,720	27,970								
Sg. Manik	On-site training	36	184	40,300		8,121	8,121	8,121	8,121	7,816								
	Off-site training	36	2	86,400		0	43,200	43,200										
	Total	36		126,700		8,121	51,321	51,321	8,121	7,816								
Sbg Perak	On-site training	20	102	23,330		4,575	4,575	4,575	4,575	5,030								
	Off-site training	20	1	48,000		0	48,000	0										
	Total	20		71,330		4,575	52,575	4,575	4,575	5,030								
Kemasin-Semerak	On-site training	39	199	118,890		23,910	23,910	23,910	23,910	23,250								
	Off-site training	39	2	93,600		0	46,800	46,800										
	Total	39		212,490		23,910	70,710	70,710	23,910	23,250								
	Overall total																	
	On-site training	334	1,814	420,920		84,128	84,128	84,128	84,128	84,408								
	Off-site training	334	18	801,600		172,114	274,114	355,372	0	0								
	Total	334		1,222,520		256,242	358,242	439,500	84,128	84,408								

Table VII-46 Estimated training cost for WUG On-site Training Programs for the Granaries

IADP/ Scheme	Blocks	Farmers (Nos)	WUGs (Nos)	Farmers/WUG (No/WUG)	On-site Training Groups/WUG	Nos of 1-day sessions	Total Cost (RM)	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	Notes
Pulau Pinang	Sungai Muda		105		2	420	60,900		12,180	12,180	12,180	12,180	12,180								Max size/training group 40 Cost @RM5/person
	Sungai Kulim		10		2	40	5,800		1,160	1,160	1,160	1,160	1,160								Av.group size= (No/WUG)/(Group/WUG)
	Pinang Tunggal		7		2	28	4,060		870	870	870	870	580								
	Padang Menora & Pokok Tampang		3		2	12	2,250		392	392	392	392	682								
	Total	7,301	125	58		500	73,010		14,602	14,602	14,602	14,602	14,602								
Besut	Compartment 1	659	8	82	2	33	6,590		1,400	1,400	1,400	1,400	990								
	Compartment 2	509	5	102	3	25	5,090		1,000	1,000	1,000	1,000	1,090								
	Compartment 3	858	8	107	3	43	8,580		1,800	1,800	1,800	1,800	1,380								
	Compartment 4	1,028	9	114	3	51	10,280		2,000	2,000	2,000	2,000	2,280								
	Total	3,054	30			153	30,540		6,200	6,200	6,200	6,200	5,740								
Kerian	Compartment A&B		20		4	161	32,401		6,440	6,440	6,440	6,440	6,641								
	Compartment C		4		4	32	6,440		1,200	1,200	1,200	1,200	1,640								
	Compartment D		17		4	137	27,571		5,440	5,440	5,440	5,440	5,811								
	Compartment E&F		22		4	177	35,621		7,040	7,040	7,040	7,040	7,461								
	Compartment G&H		21		4	169	32,817		6,600	6,600	6,600	6,600	6,417								
	Total	13,485	84	161		676	134,850		26,720	26,720	26,720	26,720	27,970								
Sg. Manik	Sg. Manik	4,030	36	102	3	184	40,300		8,104	8,121	8,121	8,121	7,833								
Sbg Perak	IADP Seberang Perak	2,333	20	102	3	102	23,330		4,575	4,575	4,575	4,575	5,030								
Kemasin-Semerak	IADP Kemasin-Semerak	11,889	39	102	3	199	118,890		23,897	23,910	23,910	23,910	23,263								On site av. cost/WUG (RM/WUG)= 1,260
	Overall total	42,092	334			1,814	420,920		84,097	84,128	84,128	84,128	84,438								

Table VII-47 Estimated cost for WUG Off-site Training Programs for the Granaries

IADP	Blocks	WUGs (Nos)	Total WUG Leaders	Off-site Training Groups	Nos of 3-day sessions	Total Cost (RM)	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	Notes
Pulau Pinang	Sungai Muda	105	210			252,000														@ 2 leaders/WUG
	Sungai Kulim	10	20			24,000														@ RM400/day/person
	Pinang Tunggal	7	14			16,800														
	Padang Menora & Pokok Tampang	3	6			7,200														
	Total	125	250	7	7	300,000		85,714	85,714	128,571										
Besut	Compartment 1	8	16			19,200														
	Compartment 2	5	10			12,000														
	Compartment 3	8	16			19,200														
	Compartment 4	9	18			21,600														
	Total	30	60	2	2	72,000		36,000	0	36,000										
Kenan	Compartment A&B	20	40			48,000														
	Compartment C	4	8			9,600														
	Compartment D	17	34			40,800														
	Compartment E&F	22	44			52,800														
	Compartment G&H	21	42			50,400														
	Total	84	168	4	4	201,600		50,400	50,400	100,800										
Sg. Manik	Sg. Manik	36	72	2	2	86,400		0	43,200	43,200										
Shg Perak	IADP Sebarang Perak	20	40	1	1	48,000		0	48,000	0										
Kemasin-Semerak	IADP Kemasin-Semerak	39	78	2	2	93,600		0	46,800	46,800										
	Overall total	334	668	18	18	801,600		172,114	274,114	355,371										Off site training cost/WUG (RM/WUG) 2,400

ANNEX-VIII

PROJECT EVALUATION

ANNEX - VIII

PROJECT EVALUATION

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VIII PROJECT EVALUATION

1 PRELIMINARY EVALUATION FOR MASTER PLAN

1.1 General

In order to assess the economic viability of the project, preliminary economic evaluation is carried out for each granary according to the conditions set as below. As for Kemasin/Semerak area, since flood mitigation project is still under the process and irrigation facility is not completed yet, evaluation is not carried out for this granary.

(i) The economic useful life of the project is 50 years,
(ii) All prices are expressed at 1997 price.
(iii) The exchange rate is fixed at US$1.00=RM4.4=Yen129.5 as of January 1997.
(iv) The Standard Conversion Factor is calculated to be 0.987 (The calculation is shown in Table VIII-1).

1.2 Economic Cost

The project cost to be used in the economic evaluation consists of construction cost, training cost, operation and maintenance cost and replacement cost. Economic cost is calculated by deducting the transfer payment from the financial project cost and multiplying with the Standard Conversion Factor. The economic cost of construction and training for each scheme are shown as below. Financial cost and economic cost for each scheme are shown in Table VIII-2.

(RM 10^3)

Items	Pulau Pinang	Kerian	Sungai Manik	Seberang Perak	Besut
I. System Infrastructure	30,661	74,958	26,967	19,403	25,626
II. In-field Structure	4,074	20,653	2,748	1,712	2,298
III. Water Management/Monitoring System					
1. Telemetry & Telecontrol System	9,211	14,356	5,667	7,969	3,458
2. Feedback System	903	853	598	848	906
IV. Training of Water Users Group	349	316	119	67	96
Total	45,198	111,136	36,099	29,999	32,384

Annual operation and maintenance cost is calculated by applying the Standard Conversion Factor to the financial cost, and the replacement cost is calculated by deducting the transfer payments and multiplying with the Standard Conversion Factor. The economic cost for operation and maintenance and for replacement are summarized as follows.

(RM 10^3)

Items	Pulau Pinang	Kerian	Sungai Manik	Seberang Perak	Besut	Remarks
1. O & M Cost	3,169	7,412	2,171	2,897	1,820	Annual
2. Replacement Cost						
- System Infrastructure	6,132	14,992	5,393	3,881	5,125	Every 20 years
- In-field Structure	815	1,761	550	342	460	Every 20 years
- Tram Line		2,370				Every 10 years
- Water Management	7,086	11,043	4,359	6,130	2,660	Every 10 years
- Feedback System	694	656	598	848	697	Every 10 years

1.3 Economic Benefit

The expected benefit from the project are increase of the production owing to the improvement of water management and farming practice, reduction of labor input owing to the mechanization. These benefit will be reflected by the increase of yield, increase of cropping intensity and reduction of labor cost. The comparison of "with-project case" and "without-project case" for each scheme is shown below.

(RM 10^3)

Items	Pulau Pinang	Kerian	Sungai Manik	Seberang Perak	Besut
1. Unit Yield (t/ha)					
without-case	2.80	2.94	3.05	3.53	3.18
with-case	5.50	5.50	5.50	5.50	5.50
2. Cropping Intensity (%)					
without-case	189	164	191	191	164
with-case	200	200	200	200	175
3. Labor Input (man-day)					
without-case*	13	10.9(58)	10.3	18.8	12.9
with-case	3.8	3.8	3.8	3.8	3.8

*:The figure in parenthesis indicates the labor input for transplanting.

The project benefit is defined as the difference between the net production value of "with-project case" and "without-project case" conditions. For the "without-project case", it is assumed that present condition will continue through the project life of 50 years and there will be no change in the yield, cost and return. The project benefit will start to realize after the completion of the construction of facilities and reach the target yield after 5 years of the completion. The benefit at the full developed stage is calculated as below and the detail for each scheme is shown in Table VIII-3.

(RM 10^3)

Scheme	Net Irrigation Area (ha)	Net Production Value (without)	Net Production Value (with)	Incremental Value
Pulau Pinang	9,601	19,960	49,660	29,700
Kerian	23,560	37,880	119,630	81,750
Sungai Manik	6,318	13,210	32,680	19,470
SeberangPerak	8,708	24,890	45,040	20,150
Besut	5,164	11,030	21,570	10,540

1.4 Economic Evaluation

Based on the project cost and benefit estimated above, benefit and cost flow is prepared for 5 schemes as in Table VIII-4~8 and the economic internal rate of return (EIRR) is calculated. The results are summarized as below.

	Pulau Pinang	Kerian	Sungai Manik	Seberang Perak	Besut
EIRR (%)	20.4	25.3	19.0	18.1	11.0

The result of preliminary evaluation indicates that all the schemes are economically viable with EIRR higher than 10%. Among the 5 schemes, Kerian scheme shows highest economic viability with 25.3% of EIRR, followed by Pulau Pinang and Sungai Manik.

2 PROJECT EVALUATION

2.1 General

The project evaluation is made from economic and financial viewpoints in order to assess the feasibility of the project in Kerian scheme. Economic evaluation is made by using Economic Internal Rate of Return (EIRR), Benefit-Cost Ratio (B/C) and Net Present Value (NPV). In addition, sensitivity analysis is made for the cases of (i) increase of construction cost, (ii) decrease of benefit by applying EIRR. For the financial aspect, farm budget of typical farm size is prepared and analyzed. In addition, repayment capacity of farmers is also examined for the procurement of agricultural machinery.

2.2 Economic Evaluation

2.2.1 Basic Condition

Economic evaluation is carried out based on the following conditions.

(i) The economic useful life of the project is 50 years from the start of the Project.
(ii) All prices are expressed in 1997 constant price (end of 1997).
(iii) The exchange rate is fixed at US$1.0=RM4.4=Yen129.5 as of January, 1998.
(iv) The economic price of local currency portions is calculated by applying the Standard Conversion Factor (0.987).
(v) Economic price or cost is calculated by omitting transfer payments such as tax, subsidy and interest.

(vi) Economic prices of farm input (Urea, TSP, Potash) and tradable farm produce (paddy) are estimated based on the World Bank projection of world market prices for 2005 in constant 1997 terms.

(vii) The part of unskilled labor is converted to the economic value by applying the conversion factor of 0.987 with considering labor scarcity in Malaysia.

(viii) The construction components are converted to economic value applying Construction Conversion Factors which are calculated on the basis of proportions of local and foreign costs, transfer payments and other local costs at the local portion.

(ix) The build-up period from the completion of land consolidation and construction of facilities is assumed to be five years. The benefit is assumed to increase year by year and reach its full value in the 12th year after the commencement of the project.

2.2.2 Economic Cost

The economic cost of the project is calculated based on the basic conditions mentioned above and by applying Construction Conversion Factors to the financial cost. The Construction Conversion Factors are calculated by following procedure. (See Table VIII-9~11).

(i) Financial foreign cost is taken as the economic cost.

(ii) Transfer payment in the local cost at the rate of 5% is excluded from the financial cost

(iii) The Standard Conversion Factor is applied to the rest of 95% of financial cost and,

(iv) The CCFs by the project components are calculated as the sum of economic shares by cost items after the conversion of those financial shares.

Based on this procedure, the financial cost and economic cost for each scheme are calculated as tabulated below.

(RM 10^3)

	Kerian		KETARA (Besut)		Pulau Pinang	
Items	Financial	Economic	Financial	Economic	Financial	Economic
I.System Infrastructure	83,749	80,093	27,899	26,681	33,846	32,368
II.In-field Structure	25,024	23,620	2,437	2,300	4,317	4,075
III. WMS / MS*						
1. Telemetry & Telecontrol	14,632	14,359	3,525	3,459	9,387	9,211
2. Feedback System	15,501	15,211	923	906	920	903
IV. Training for WUG	337	316	102	96	373	349

*: WMS; Water Management System, MS; Monitoring System

For the conversion of O&M cost, the standard conversion factor is applied. The economic cost of replacement cost are calculated by deductiing 5% of transfer payment from the financial cost and applying standard conversion factor. Summary of each cost item are shown below.

(RM 10^3)

Items	Kerian		KETARA (Besut)		Pulau Pinang	
	Financial	Economic	Financial	Economic	Financial	Economic
1. O & M Cost	7,907	7,804	1,577	1,557	3,584	3,537
2. Replacement Cost						
- Systm Infrastructure*1	16,750	16,019	5,580	5,336	6,412	6,132
- In-field structure*1	1,866	1,761	487	460	863	815
- Tram Line*2	3,139	2,963	-	-	-	-
- Water management system*2	11,256	11,045	2,711	2,661	7,221	7,086
- Feedback system*2	668	656	710	697	708	694

*1: Replaced every 20 years
*2: Replaced every 10 years

2.2.3 Economic Benefit

Economic price of tradable goods such as paddy and fertilizer is estimated based on the World Bank projection of world market prices (Table VIII-12). For non-tradable goods, present market price is applied as economic price. Value of unskilled labor is calculated by applying the Standard Conversion Factor with considering the labor scarcity in Malaysia. The list of economic and finacnial price of farm input and output are shown in Table VIII-13. The expected benefit from the project are increase of paddy production owing to improved farming practice and water management and reduction of labor input owing to farm mechanization. These benefits are assumed to be reflected in the increase of yield, increase of cropping intensity and reduction of labor cost. The project benefit is defined as the difference of the net production value between "with-project case" and "without-project case". For the "without-project case", it is assumed that present condition will continue through the project life of 50 years and there will be no change in the yield, cost and return. Based on these assumptions, the economic crop budget is prepared for "without-project" condition and "with-project" condition as in Table VIII-14~15. The benefit at the full developed stage is summarized below.

(RM 10^3)

	Kerian	KETARA (Besut)	Pulau Pinang
Net Production Value (without case)	37,876	11,031	19,957
Net Production Value (with case)	119,630	21,565	49,663
Incremental Benefit	81,750	10,534	29,705

2.2.4 Economic Evaluation

Based on the assumptions mentioned above and the flow of project cost shown in Table VIII-16~18, cost-benefit flow is prepared (Table VIII-19~21) and EIRR, B/C and NPV are calculated as below.

	Kerian	KETARA (Besut)	Pulau Pinang
EIRR (%)	24.1	11.2	19.5
B/C	2.59	1.14	2.08
NPV (RM 10^3)	277,028	6,178	80,131

The above results indicate that all three sheemes are economically viable showing higher than 10%. Among the 3 schemes, Kerian scheme shows highest economic viability with 20.7% of EIRR, followed by Pulau Pinang.

The sensitivity analysis is also made in terms of EIRR for the case of (i) 10% and 20% increase of construction cost and (ii) 10% and 20% of decrease of benefit. The results are shown in the following tables.

Kerian

Benefit	Construction Cost		
	0% Increase	10% Increase	20% Increase
0% decrease	24.1	22.9	21.8
10% decrease	22.3	21.1	20.1
20% decrease	20.3	19.2	18.3

KETARA (Besut)

Benefit	Construction Cost		
	0% Increase	10% Increase	20% Increase
0% decrease	11.2	10.6	10.1
10% decrease	10.2	9.6	9.1
20% decrease	9.1	8.6	8.1

Pulau Pinang

Benefit	Construction Cost		
	0% Increase	10% Increase	20% Increase
0% decrease	19.5	18.6	17.8
10% decrease	18.0	17.1	16.4
20% decrease	16.4	15.6	14.9

The sensitivity analysis indicated that the project viability of Kerian and Pulau Pinang Scheme is insensitive against adverse effects of cost increase and benefit decrease. However, in case of Besut , the viability is relatively sensitive against decrease of benefit while it is not so sensitive for the increase of construction cost.

2.3 Financial Analysis

2.3.1 Farm Budget Analysis

The farm budget analysis is made by assuming that average land holding size is equivalent to typical farm operation size of each scheme. After the implementation of the project, both gross farm income and net farm income are expected to increase to a great extent in all three schemes. Net reserves of farmers are also expected to increase from RM1,740/year to RM7,350/year in Kerian, from RM210/year to RM3,840/year in Besut, and from RM3,580/year to RM8,830/year in Pulau Pinang Scheme. The farm budget of present condition and "with-project case" in three schemes are shown in the following table.

(RM)

	Kerian		KETARA (Besut)		Pulau Pinang	
Items	Present	With	Present	With	Present	With
Average holding size (ha)	1.54	1.54	1.29	1.29	1.32	1.32
1. Gross Farm Income	5,930	12,170	5,370	9,910	5,580	11,590
2.Production Cost	3,020	4,360	2,010	3,900	2,360	4,030
3. Net Farm Income (1-2)	2,910	7,810	3,360	6,010	3,220	7,560
4. Non-farm Income	5,900	5,900	3,300	3,300	9,200	9,200
5. Total Income (3+4)	8,810	13,710	6,660	9,310	12,420	16,760
6. Living Expense	8,300	8,300	6,260	6,260	9,950	9,950
7. Net Reserve (5-6)	510	5,410	400	3,050	2,470	6,810

2.3.2 Repayment of Procurement Cost of Machinery

For the procurement of agricultural machinery, the loan scheme of BPM's agricultural machinery loan or FOA's KPPP loan would be utilized. Farmers will pay a rental fee for procured machinery and the loan repayment will be allotted from this rental fee. The fee will be set as equivalent to the present rental fee so that farmers are able to accept easily. For the examination of repayment capability, it is necessary to compare the present rental fee with repayment amount. In order for farmers to be able to repay, the present rantal fee should be higher than annual repayment amount.

Annual repayment amount is calculated by dividing the total loan amount (principal plus interest rate) by repayment period. Interest rate is calculated for each year, assuming that repaymant period is 5 years and annual interest rate is 6.5%. Procurement cost of machinery is estimated as RM31.1 million in Kerian, RM10.1 million in Besut and RM18.8 million in Pulau Pinang. Dividing these costs by 5 years of repayment period, annual repayment for principal is calculated as RM6.2 million, RM2.3 million and RM3.6 million for Kerian, Besut and Pulau Pinang, respectively. By adding interest rate to these principal repayment, annual repayment

amount is obtained for 5 years. Taking the average of annual repayment for 5 years, average annual repayment is calculated.

With these procedure, procurement cost, interest of loan and total repayment amount are estimated as in Table VIII-22 and the summary table are prepared as follows.

(RM 10^3)

Scheme	Kerian	KETARA (Besut)	Pulau Pinang
Procurement Cost of Machinery (Loan Principal)	31,927	10,057	18,805
Interest (Repayment period 5years, rate 6.5%)*	4,566	1,438	2,586
Total repayment amount	36,493	11,495	20,671
Average annual repayment	7,299	2,299	4,134
Annual Repayment per ha (RM/ha/year)	310	445	431
Annual machinery using cost in "with case" (RM)	529	523	600

From the above table, it is confirmed that average repayment amount per hectare is less than present rental fee in all schemes. Assuming that present rental fee will be unchanged under "with-project" condition, farmers still can earn RM2,660/ha to RM2,860/ha as in Table VIII-23. Therefore, it would be possible for farmers to pay back the loan by allotting from the rental fee, and rest of rental fee would be used for operation and maintenance of machinery.

TABLES

Table VIII-1 Import / Export Value and Standard Conversion Factor

(RM mil)

Item	Year					Average
	1992	1993	1994	1995	1996	
(1) Import Value (CIF)	101,440	117,405	155,921	194,344	197,280	142,278
(2) Export Value (FOB)	103,657	121,237	153,921	184,986	197,026	140,950
(3) Import Duty	4,445	4,548	5,656	5,626	6,198	5,069
(4) Export Duty	1,689	1,462	1,171	843	1,058	1,375
(5) Export Subsidy	0	0	0	0	0	0
(6) = (1) + (2)	205,097	238,642	309,842	379,330	394,306	283,228
(7) = (1) + (2) + (3) - (4) + (5)	207,853	241,728	314,327	384,113	399,446	287,005
(8) = (6) / (7)	0.987	0.987	0.986	0.988	0.987	0.987

Source: Department of Statistics

Table VIII-2 Fiancial and Economic Cost of Each Scheme

(RM '000)

Work Item	Pulau Pinang		Kerian		Sunagi Manik		Seberang Perak		KETARA (Besut)	
	Financial Cost	Economic Cost	Financial Cost	Economic Cost	Financial Cost	Economic Cost	Financial Cost	Economic Cost	Financial Cost	Economic Cost
I. Improvement of System Infrastructures										
1 Replacement of Besut Barrage Improvement	-	-	-	-	-	-	-	-	10,400	9,946
2 Construction of New Angga Barrage	-	-	-	-	-	-	-	-	2,340	2,238
3 Construction of settling basin	-	-	-	-	147	141	-	-	-	-
4 Concrete lining of canals	29,214	27,939	55,863	53,425	24,180	23,125	13,329	12,747	9,957	9,522
5 Desilting of irrigation canals	-	-	-	-	-	-	263	252	-	-
6 Replacement of intake gates	-	-	-	-	-	-	5,054	4,833	-	-
7 Improvement of drainage facilities	129	123	17,016	16,273	96	92	42	41	694	664
8 Improvement of farm road	2,418	2,312	4,887	4,674	2,724	2,605	430	411	1,872	1,790
9 Improvement of related strucures	299	286	613	587	1,051	1,005	1,170	1,119	1,533	1,466
Sub-total	32,060	30,661	78,379	74,958	28,198	26,967	20,288	19,403	26,796	25,626
II. Improvement of In-field Infrastructures										
1. Land leveling	3,464	3,270	19,967	18,847	2,331	2,200	1,454	1,372	1,876	1,771
2. In-field structures	852	804	1,914	1,807	580	547	360	340	559	528
Sub-total	4,316	4,074	21,881	20,653	2,911	2,748	1,814	1,712	2,435	2,298
III. Water Management/Monitoring System										
1. Telemerty and telecontrol system	9,387	9,211	14,630	14,356	5,775	5,667	8,121	7,969	3,524	3,458
2. Feedback system	920	903	869	853	610	598	864	848	923	906
Sub-total	10,307	10,114	15,499	15,209	6,385	6,265	8,985	8,817	4,447	4,364
IV. Training of Water Users Group	373	349	337	316	127	119	72	67	102	96

Table VIII-3 Net Production Value by Scheme (Full Developed Stage)

		Pulau Pinang	Kerian	Sg. Manik	Sb. Perak	Besut
Net Irrigation Area (ha)		9,601	23,560	6,318	8,708	5,164
Without Project Case						
Yield	(mt/ha)	2.8	2.91	3.05	3.53	3.18
Price	(RM/mt)	770	770	770	770	770
Gross Value	(RM/ha)	2,156	2,264	2,349	2,718	2,449
Cost	(RM/ha)	1,057	1284	1,127	1,231	1,147
Net Value	(RM/ha)	1,100	979	1,222	1,488	1,302
Cropping Intensity		189	164	171	192	164
Production Value		19,960	37,880	13,210	24,890	11,030
With Project Case						
Main-Wet						
Yield	(mt/ha)	5.50	5.50	5.50	5.50	5.50
Price	(RM/mt)	770	770	770	770	770
Gross Value	(RM/ha)	4,235	4,235	4,235	4,235	4,235
Cost	(RM/ha)	1,649	1,693	1,649	1,649	1,848
Net Value	(RM/ha)	2,586	2,542	2,586	2,586	2,387
Cropping Intensity	(%)	100	83	100	100	100
Production Value	(RM 10')	24,830	49,700	16,340	22,520	12,330
Main-Dry						
Yield	(mt/ha)	5.50	5.50	5.50	5.50	5.50
Price	(RM/mt)	770	770	770	770	770
Gross Value	(RM/ha)	4,235	4,235	4,235	4,235	4,235
Cost	(RM/ha)	1,653	1698	1,653	1,653	1,853
Net Value	(RM/ha)	2,582	2,537	2,582	2,582	2,382
Cropping Intensity	(%)	0	17	0	0	0
Production Value	(RM 10')	0	10,160	0	0	0
Off-Wet						
Yield	(mt/ha)	5.50	5.50	5.50	5.50	5.50
Price	(RM/mt)	770	770	770	770	770
Gross Value	(RM/ha)	4,235	4,235	4,235	4,235	4,235
Cost	(RM/ha)	1,649	1,693	1,649	1,649	1,848
Net Value	(RM/ha)	2,586	2,542	2,586	2,586	2,387
Cropping Intensity	(%)	100	0	100	100	60
Production Value	(RM 10')	24,830	0	16,340	22,520	7,400
Off-Dry						
Yield	(mt/ha)	5.50	5.50	5.50	5.50	5.50
Price	(RM/mt)	770	770	770	770	770
Gross Value	(RM/ha)	4,235	4,235	4,235	4,235	4,235
Cost	(RM/ha)	1,653	1,698	1,653	1,653	1,853
Net Value	(RM/ha)	2,582	2,537	2,582	2,582	2,382
Cropping Intensity	(%)	0	100	0	0	15
Production Value	(RM 10')	0	59,770	0	0	1,840
Net Production Value						
Without Case	(RM 10')	19,960	37,880	13,210	24,890	11,030
With Case	(RM 10')	49,660	119,630	32,680	45,040	21,570
Incremental Benefit	(RM 10')	29,700	81,750	19,470	20,150	10,540

Table VIII-4 Benefit and Cost Flow (Pulau Pinang Scheme)

(RM'000)

Year	Benefit							Cost							B-C
	Without			With			Increm.	System	Infield	Training	TM*	O&M	Replace	Total	
	Main	Off	Total	Main	Off	Total	Benefit	Infra.	Infra.	Cost	FB	Cost	-ment	Cost	
1	10,031	9,926	19,957	9,379	9,287	18,665	-1,292	8,550	509	94	3,562	929		13,644	-14,936
2	10,031	9,926	19,957	9,359	9,280	18,638	-1,319	8,141	509	94	3,277	1,805		13,825	-15,144
3	10,031	9,926	19,957	9,962	9,896	19,858	-99	6,985	509	134	3,173	2,584		13,384	-13,483
4	10,031	9,926	19,957	11,189	11,137	22,326	2,369	6,985	509	14	103	3,128		10,739	-8,370
5	10,031	9,926	19,957	13,040	13,001	26,041	6,084	0	509	14	0	3,128		3,651	2,433
6	10,031	9,926	19,957	14,892	14,865	29,757	9,799	0	509	0	0	3,128		3,637	6,163
7	10,031	9,926	19,957	16,743	16,729	33,472	13,515	0	509	0	0	3,128		3,637	9,878
8	10,031	9,926	19,957	18,594	18,594	37,187	17,230	0	509	0	0	3,128		3,637	13,593
9	10,031	9,926	19,957	21,089	21,089	42,177	22,220					3,128		3,128	19,093
10	10,031	9,926	19,957	22,960	22,960	45,920	25,963					3,128	7,780	10,908	15,055
11	10,031	9,926	19,957	24,207	24,207	48,415	28,458					3,128		3,128	25,330
12	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
13	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
14	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
15	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
16	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
17	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
18	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
19	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
20	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128	14,727	17,855	11,851
21	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
22	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
23	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
24	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
25	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
26	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
27	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
28	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
29	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
30	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128	7,780	10,908	18,798
31	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
32	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
33	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
34	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
35	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
36	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
37	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
38	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
39	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
40	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128	14,727	17,855	11,851
41	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
42	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
43	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
44	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
45	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
46	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
47	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
48	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
49	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128		3,128	26,578
50	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,128	7,780	10,908	18,798
								30,661	4,074	349	10,114			250,303	20.4%

*: TM; Telemetly, FB; Feedback System

Table VIII-5 Benefit and Cost Flow (Kerian Scheme)

(RM'000)

Year	Benefit							Cost							B-C
	Without			With			Increm.	System	Infield	Training	TM*	O&M	Replace	Total	
	Main	Off	Total	Main	Off	Total	Benefit	Infra.	Infra.	Cost	FB	Cost	-ment	Cost	
1	20,555	17,321	37,876	19,645	16,807	36,452	-1,424	21,411	2,582	72	5,226	2,161		31,452	-32,876
2	20,555	17,321	37,876	20,207	17,761	37,968	92	21,411	2,582	72	4,992	4,303		33,359	-33,267
3	20,555	17,321	37,876	22,221	20,166	42,387	4,511	18,781	2,582	120	4,940	6,228		32,650	-28,139
4	20,555	17,321	37,876	25,686	24,023	49,709	11,832	13,356	2,582	25	52	7,316		23,331	-11,499
5	20,555	17,321	37,876	30,602	29,331	59,933	22,056	0	2,582	26	0	7,316		9,924	12,132
6	20,555	17,321	37,876	35,518	34,639	70,157	32,280	0	2,582	0	0	7,316		9,898	22,383
7	20,555	17,321	37,876	40,434	39,947	80,381	42,504	0	2,582	0	0	7,316		9,898	32,607
8	20,555	17,321	37,876	45,350	45,255	90,604	52,728	0	2,582	0	0	7,316		9,898	42,831
9	20,555	17,321	37,876	51,155	51,060	102,215	64,339					7,316		7,316	57,023
10	20,555	17,321	37,876	55,509	55,414	110,923	73,046					7,316	14,070	21,386	51,661
11	20,555	17,321	37,876	58,412	58,316	116,728	78,852					7,316		7,316	71,536
12	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
13	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
14	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
15	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
16	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
17	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
18	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
19	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
20	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316	30,822	38,137	43,617
21	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
22	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
23	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
24	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
25	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
26	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
27	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
28	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
29	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
30	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316	14,070	21,386	60,368
31	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
32	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
33	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
34	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
35	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
36	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
37	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
38	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
39	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
40	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316	30,822	38,137	43,617
41	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
42	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
43	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
44	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
45	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
46	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
47	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
48	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
49	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316		7,316	74,438
50	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,316	14,070	21,386	60,368
								74,958	20,653	316	15,209				25.3%

*: TM; Telemetly, FB; Feedback System

Table VIII-6 Benefit and Cost Flow (Sungai Manik Scheme)

(RM'000)

Year	Benefit							Cost							B-C
	Without			With			Increm.	System	Infield	Training	TM*	O&M	Replace	Total	
	Main	Off	Total	Main	Off	Total	Benefit	Infra.	Infra.	Cost	FB	Cost	-ment	Cost	
1	7,336	5,869	13,205	6,967	5,684	12,651	-555	8,251	343	8	2,833	715		12,150	-12,705
2	7,336	5,869	13,205	6,976	5,876	12,852	-354	7,154	343	49	3,133	1,378		12,057	-12,411
3	7,336	5,869	13,205	7,357	6,441	13,797	592	5,781	343	48	299	1,770		8,241	-7,649
4	7,336	5,869	13,205	8,111	7,378	15,488	2,283	5,781	343	8	0	2,142		8,275	-5,992
5	7,336	5,869	13,205	9,237	8,687	17,924	4,719	0	343	8	0	2,142		2,493	2,225
6	7,336	5,869	13,205	10,363	9,997	20,360	7,154	0	343	0	0	2,142		2,486	4,668
7	7,336	5,869	13,205	11,489	11,306	22,796	9,590	0	343	0	0	2,142		2,486	7,104
8	7,336	5,869	13,205	12,616	12,616	25,231	12,026	0	343	0	0	2,142		2,486	9,540
9	7,336	5,869	13,205	14,106	14,106	28,211	15,006					2,142		2,142	12,863
10	7,336	5,869	13,205	15,223	15,223	30,446	17,240					2,142	4,958	7,100	10,140
11	7,336	5,869	13,205	15,968	15,968	31,936	18,730					2,142		2,142	16,588
12	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
13	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
14	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
15	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
16	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
17	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
18	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
19	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
20	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142	10,900	13,043	6,432
21	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
22	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
23	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
24	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
25	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
26	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
27	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
28	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
29	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
30	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142	4,958	7,100	12,375
31	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
32	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
33	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
34	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
35	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
36	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
37	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
38	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
39	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
40	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142	10,900	13,043	6,432
41	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
42	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
43	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
44	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
45	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
46	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
47	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
48	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
49	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142		2,142	17,333
50	7,336	5,869	13,205	16,340	16,340	32,681	19,475					2,142	4,958	7,100	12,375
								26,967	2,748	119	6,265				19.0%

*: TM; Telemetly, FB; Feedback System

Table VIII-7 Benefit and Cost Flow (Seberang Perak Scheme)

(RM'000)

Year	Benefit							Cost							B-C
	Without			With			Increm.	System	Infield	Training	TM*	O&M	Replace	Total	
	Main	Off	Total	Main	Off	Total	Benefit	Infra.	Infra.	Cost	FB	Cost	-ment	Cost	
1	12,183	12,702	24,885	11,816	12,269	24,085	-800	7,802	214	5	3,985	1,194		13,200	-14,000
2	12,183	12,702	24,885	11,871	12,260	24,131	-754	7,351	214	48	4,267	2,372		14,252	-15,006
3	12,183	12,702	24,885	12,339	12,663	25,002	117	4,249	214	5	283	2,831		7,581	-7,464
4	12,183	12,702	24,885	13,220	13,479	26,698	1,814	0	214	5	283	2,860		3,361	-1,547
5	12,183	12,702	24,885	14,513	14,708	29,221	4,336	0	214	5	0	2,860		3,078	1,258
6	12,183	12,702	24,885	15,807	15,936	31,743	6,858	0	214	0	0	2,860		3,074	3,785
7	12,183	12,702	24,885	17,100	17,165	34,265	9,381	0	214	0	0	2,860		3,074	6,307
8	12,183	12,702	24,885	18,394	18,394	36,788	11,903	0	214	0	0	2,860		3,074	8,829
9	12,183	12,702	24,885	20,045	20,045	40,090	15,205					2,860		2,860	12,346
10	12,183	12,702	24,885	21,283	21,283	42,567	17,682					2,860	6,978	9,837	7,845
11	12,183	12,702	24,885	22,109	22,109	44,218	19,333					2,860		2,860	16,474
12	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
13	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
14	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
15	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
16	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
17	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
18	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
19	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
20	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860	11,201	14,060	6,099
21	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
22	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
23	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
24	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
25	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
26	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
27	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
28	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
29	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
30	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860	6,978	9,837	10,322
31	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
32	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
33	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
34	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
35	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
36	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
37	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
38	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
39	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
40	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860	11,201	14,060	6,099
41	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
42	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
43	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
44	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
45	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
46	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
47	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
48	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
49	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860		2,860	17,299
50	12,183	12,702	24,885	22,522	22,522	45,043	20,159					2,860	6,978	9,837	10,322
								19,403	1,712	67	8,817				18.1%

*: TM; Telemetly, FB; Feedback System

Table VIII-8 Benefit and Cost Flow (KETARA (Besut) Scheme)

(RM'000)

Year	Benefit						Increm.	Cost							B-C
	Without			With				System	Infield	Training	TM*	O&M	Replace	Total	
	Main	Off	Total	Main	Off	Total	Benefit	Infra.	Infra.	Cost	FB	Cost	-ment	Cost	
1	5,852	5,179	11,031	5,504	4,818	10,322	-709	11,185	287	39	2,113	796		14,421	-15,130
2	5,852	5,179	11,031	5,449	4,678	10,127	-905	10,521	287	6	2,046	1,549		14,409	-15,314
3	5,852	5,179	11,031	5,682	4,754	10,435	-596	3,920	287	39	205	1,796		6,248	-6,844
4	5,852	5,179	11,031	6,203	5,045	11,249	217	0	287	6	0	1,796		2,089	-1,872
5	5,852	5,179	11,031	7,013	5,554	12,567	1,535	0	287	6	0	1,796		2,089	-554
6	5,852	5,179	11,031	7,823	6,062	13,884	2,853	0	287	0	0	1,796		2,083	770
7	5,852	5,179	11,031	8,632	6,570	15,202	4,171	0	287	0	0	1,796		2,083	2,087
8	5,852	5,179	11,031	9,442	7,078	16,520	5,489	0	287	0	0	1,796		2,083	3,405
9	5,852	5,179	11,031	10,595	7,913	18,538	7,507					1,796		1,796	5,711
10	5,852	5,179	11,031	11,460	8,591	20,051	9,020					1,796	3,357	5,153	3,867
11	5,852	5,179	11,031	12,037	9,024	21,060	10,029					1,796		1,796	8,233
12	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
13	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
14	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
15	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
16	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
17	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
18	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
19	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
20	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796	8,942	10,738	-204
21	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
22	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
23	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
24	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
25	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
26	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
27	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
28	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
29	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
30	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796	3,357	5,153	5,381
31	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
32	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
33	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
34	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
35	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
36	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
37	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
38	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
39	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
40	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796	8,942	10,738	-204
41	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
42	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
43	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
44	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
45	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
46	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
47	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
48	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
49	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796		1,796	8,737
50	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,796	3,357	5,153	5,381
								25,626	2,298	96	4,364				11.0%

*: TM: Telemetly, FB: Feedback System

Table VIII-9 Construction Conversion Factors (Kerian)

Work Item	Original (RM 10^3)		Distribution (RM 10^3)				Financial Cost (%)				Economic Cost (%)			
	Total		FC	LC		Total	FC	LC		Total	FC	LC		Total
	FC	LC		Transfer	Others			Transfer	Others			Transfer	Others	
I. Improvement of System Infrastructures														
1. Concrete lining of canals	17.641	41.162	17.641	2.058	39.104	58.803	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
2. Improvement of drainage facilities	5.672	13.234	5.672	662	12.572	18.906	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
3. Improvement of farm road	1.629	3.800	1.629	190	3.610	5.429	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
4. Improvement of related strucures	183	428	183	21	406	610	30.0	3.4	66.5	99.9	30.0	0.0	65.6	95.6
Sub-total	25.125	58.624	25.125	2.931	55.693	83.749	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
II. Improvement of In-field Infrastructures														
1. Land leveling	2.311	20.797	2.311	1.040	19.757	23.108	10.0	4.5	85.5	100.0	10.0	0.0	84.4	94.4
2. In-field structures	192	1.725	192	86	1.638	1.916	10.0	4.5	85.5	100.0	10.0	0.0	84.4	94.4
Sub-total	2.502	22.522	2.502	1.126	21.395	25.023	10.0	4.5	85.5	100.0	10.0	0.0	84.4	94.4
II. Water Management / Monitoring System														
1. Telemerty and telecontrol system	10.243	4.390	10.243	219	4.170	14.632	70.0	1.5	28.5	100.0	70.0	0.0	28.1	98.1
2. Feedback system	609	260	609	13	247	869	70.1	1.5	28.4	100.0	70.1	0.0	28.0	98.1
Sub-total	10.852	4.650	10.852	232	4.417	15.501	70.0	1.5	28.5	100.0	70.0	0.0	28.1	98.1
IV Training of Water Users Group	0	337	0	17	320	337	0.0	5.0	95.0	100.0	0.0	0.0	93.8	93.8

Table VIII-10 Construction Conversion Factors (KETARA (Besut))

Work Item	Original (RM 10^3)		Distribution (RM 10^3)				Financial Cost (%)				Economic Cost (%)			
	Total		FC	LC		Total	FC	LC		Total	FC	LC		Total
	FC	LC		Transfer	Others			Transfer	Others			Transfer	Others	
I. Improvement of System Infrastructures														
1. Replacement of Besut Barrage Improvement	3,120	7,280	3,120	364	6,916	10,400	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
2. Construction of New Angga Barrage	702	1,638	702	82	1,556	2,340	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
3. Concrete lining of canals	3,319	7,743	3,319	387	7,356	11,062	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
4. Improvement of drainage facilities	208	485	208	24	461	693	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
5. Improvement of farm road	561	1,310	561	65	1,244	1,870	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
6. Improvement of related strucures	460	1,073	460	54	1,019	1,533	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
Sub-total	8,370	19,529	8,370	976	18,553	27,899	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
II. Improvement of In-field Infrastructures														
1. Land leveling	188	1,689	188	84	1,604	1,876	10.0	4.5	85.5	100.0	10.0	0.0	84.4	94.4
2. In-field structures	56	504	56	25	479	560	10.0	4.5	85.5	100.0	10.0	0.0	84.4	94.4
Sub-total	244	2,193	244	110	2,083	2,437	10.0	4.5	85.5	100.0	10.0	0.0	84.4	94.4
II. Water Management / Monitoring System														
1. Telemerty and telecontrol system	2,467	1,057	2,467	53	1,005	3,525	70.0	1.5	28.5	100.0	70.0	0.0	28.1	98.1
2. Feedback system	645	278	645	14	264	923	69.9	1.5	28.6	100.0	69.9	0.0	28.2	98.1
Sub-total	3,112	1,335	3,112	67	1,269	4,448	70.0	1.5	28.5	100.0	70.0	0.0	28.1	98.1
IV Training of Water Users Group	0	102	0	5	97	102	0.0	4.9	95.1	100.0	0.0	0.0	93.9	93.9

Table VIII-11 Construction Conversion Factors (Pulau Pinang)

Work Item	Original (RM 10^3)		Distribution (RM 10^3)				Financial Cost (%)				Economic Cost (%)			
	Total		FC	LC		Total	FC	LC		Total	FC	LC		Total
	FC	LC		Transfer	Others			Transfer	Others			Transfer	Others	
I. Improvement of System Infrastructures														
1. Concrete lining of canals	8,764	20,450	8,764	1,022	19,427	29,213	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
2. Improvement of drainage facilities	39	90	39	5	86	130	29.8	3.9	66.3	100.0	29.8	0.0	65.4	95.2
3. Improvement of farm road	725	1,693	725	85	1,608	2,418	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
4. Improvement of related strucures	90	209	90	10	199	299	30.0	3.3	66.6	99.9	30.0	0.0	65.7	95.7
Sub-total	10,154	23,692	10,154	1,185	22,507	33,846	30.0	3.5	66.5	100.0	30.0	0.0	65.6	95.6
II. Improvement of In-field Infrastructures														
1. Land leveling	346	3,118	346	156	2,962	3,464	10.0	4.5	85.5	100.0	10.0	0.0	84.4	94.4
2. In-field structures	85	767	85	38	729	852	10.0	4.5	85.5	100.0	10.0	0.0	84.4	94.4
Sub-total	432	3,885	432	194	3,691	4,317	10.0	4.5	85.5	100.0	10.0	0.0	84.4	94.4
II. Water Management / Monitoring System														
1. Telemerty and telecontrol system	6,571	2,816	6,571	141	2,675	9,387	70.0	1.5	28.5	100.0	70.0	0.0	28.1	98.1
2. Feedback system	644	276	644	14	262	920	70.0	1.5	28.5	100.0	70.0	0.0	28.1	98.1
Sub-total	7,215	3,092	7,215	155	2,937	10,307	70.0	1.5	28.5	100.0	70.0	0.0	28.1	98.1
IV Training of Water Users Group	0	373	0	19	354	373	0.0	5.1	94.9	100.0	0.0	0.0	93.7	93.7

Table VIII-12 Price Structure of Paddy and Fertilizers

Price Structure of Rice (Import Parity, 1997)

Items	Operation	Unit	Price
Forecast 2010 world market price*		(US$/ton)	287
Grade differencial (less 10%)	10%	(US$/ton)	29
Freight and insurance	+	(US$/ton)	30
CIF price at port	=	(US$/ton)	289
Exchange rate (RM/$)	4.4	(RM/ton)	1,270
Landing charges, transport and margin	+	(RM/ton)	89
Wholesale price	=	(RM/ton)	1,359
Transport, mill to wholesaler	-	(RM/ton)	30
Exmill price	=	(RM/ton)	1,329
Paddy equivalent (65%)	65%	(RM/ton)	864
Milling Cost	-	(RM/ton)	64
Transport cost to mill	-	(RM/ton)	30
Farm gate price	=	(RM/ton)	770

*: WB Commodity Market and Developing Countries, August 1997

Price Structure of Fertilizer (Import Parity, 1997)

Item	Operation	Unit	Price
1) Urea			
Export price FOB Europe*		(US$/ton)	140
Freight and Insurance	+	(US$/ton)	50
CIF Price at Port Kelang	=	(US$/ton)	190
Exchange Rate (RM/$)	4.4	(RM/ton)	837
Port Handling Charge	+	(RM/ton)	85
Local Transport and Handling	+	(RM/ton)	122
Storage and Distribution Cost	+	(RM/ton)	48
Farm gate price	=	(RM/ton)	444
(Nutrient contents: Nitrogen 42%)	42%	(RM/ton)	1,057
2) T. Superposphate			
Export price FOB USA Gulf*		(US$/ton)	114
Freight and Insurance	+	(US$/ton)	50
CIF Price at Port Kelang	=	(US$/ton)	164
Exchange Rate (RM/$)	4.4	(RM/ton)	
Port Handling Charge	+	(RM/ton)	85
Local Transport and Handling	+	(RM/ton)	122
Storage and Distribution Cost	+	(RM/ton)	48
Farm gate price	=	(RM/ton)	417
(Nutrient contents: Phosphate 46%)	46%	(RM/ton)	907
3) Potassium Chlor			
Export price FOB Vancouver*		(US$/ton)	96
Freight and Insurance	+	(US$/ton)	50
CIF Price at Port Kelang	=	(US$/ton)	146
Exchange Rate (RM/$)	4.4	(RM/ton)	
Port Handling Charge	+	(RM/ton)	85
Local Transport and Handling	+	(RM/ton)	122
Storage and Distribution Cost	+	(RM/ton)	48
Farm gate price	=	(RM/ton)	400
(Nutrient contents: Potash 55%)	55%	(RM/ton)	727

*: WB Commodity Market and Developing Countries, August 1997

Table VIII-13 Price List of Input and Output

(RM)

	Unit	Financial	Economic
Paddy	(kg)	0.80	0.77
Farm Inputs			
1 Seeds	(kg)	1	1.00
2 Fertilizer			
N	(kg)	1.17	1.06
P	(kg)	1.42	0.91
K	(kg)	1.09	0.73
Lime	(ton)	100.00	100.00
MgO	(kg)	0.02	0.02
3 Agro-chemicals			
- Herbicide			
Thiobencarb	(kg)	2.40	2.40
2.4PA	(kg)	9.00	9.00
- IPBMC	(kg)	6.50	6.50
Buprofezin	(100ml)	10.80	10.80
- IDrat	(lit)	46.00	46.00
Machinery			
1 Land Preparation	(times)	40.00	40.00
2 Spraying (Chemical)	(times)	30.00	30.00
3 Harvesting	(times)	290.00	290.00
4 Transportation		60.00	60.00
Labor	(man-day)	20.0	19.00

Table VIII-14 Economic Crop Budget under "Without-Project Condition"

	Unit per ha	Unit Price	Pulau Pinang Q'ty	Pulau Pinang Price	Kerian (DS) Q'ty	Kerian (DS) Price	Kerian (TP) Q'ty	Kerian (TP) Price	Besut Q'ty	Besut Price
Gross Return										
Production	(kg)	0.77	2,800	2,156.9	2,940	2264.8	2,940	2,264.8	3,180	2,449.7
Production Cost										
Farm Inputs										
1 Seeds	(kg)	1.00	80.0	80.0	80.0	80.0	25.0	25.0	80.0	80.0
2 Fertilizer										
- N	(kg)	1.06	80.0	84.5	80.0	84.5	80.0	84.5	80.0	84.5
- P	(kg)	0.91	30.0	27.2	30.0	27.2	30.0	27.2	30.0	27.2
- K	(kg)	0.73	20.0	14.5	20.0	14.5	20.0	14.5	20.0	14.5
3 Agro-chemicals										
- Insecticide	(kg)	8.00		0.0	0.8	6.0	0.5	4.0	2.5	19.8
	(lit)	20.00		0.0		0.0		0.0		0.0
	(lit)	42.00		0.0	1.0	42.0	0.9	35.7	0.1	5.0
- Fungicide	(kg)	4.20		0.0		0.0		0.0	19.8	83.0
	(lit)	35.00	0.1	3.5		0.0		0.0		0.0
- Herbicide	(kg)	7.80		0.0	0.8	5.9	1.7	12.9	2.5	19.3
	(lit)	12.00	6.0	72.0	8.7	104.4	6.6	79.2	4.9	58.8
- Rat control	(kg)	8.00	1.0	8.0		0.0		0.0		0.0
	(lit)	42.00		0.0		0.0		0.0	0.6	25.2
Sub-total				289.8		364.5		283.0		417.4
Machinery										
1 Land Preparation	(times)	40.00	3.0	120.0	2.0	80.0		0.0	2.0	80.0
2 Harvesting	(times)	290.00	1.0	290.0	1.0	290.0		0.0	1.0	290.0
3 Transportation		60.00	1.0	60.0	1.0	60.0	1.0	60.0	1.0	60.0
Sub-total				470.0		430.0		60.0		430.0
Labor	(man-day)	19.00	13.0	247.0	10.9	207.1	58.0	1,102.0	12.9	245.1
Micellaneous (5% of above)				50.3		50.1		72.3		54.6
Total Production Cost				1,057.1		1,051.7		1,517.3		1,147.1
Net Return per ha				1,099.8		1,213.1		747.5		1,302.6

Table VIII-15 Economic Crop Budget under "Wtih-Project Condition"

	Unit per ha	Unit Price	Besut				Kerian				Pulau Pinang			
			Wet		Dry		Wet		Dry		Wet		Dry	
			Q'ty	Price	Q'ty	Price	Q'ty	Price	Q'ty	Price	Q'ty	Price	Q'ty	Price
Gross Return														
Production	(kg)	0.77	5,500	4,235	5,500	4,235	5,500	4,235	5,500	4,235	5,500	4,235	5,500	4,235
Production Cost														
Farm Inputs														
1 Seeds	(kg)	1.00	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
2 Fertilizer														
- N	(kg)	1.06	100.0	105.7	100.0	105.7	100.0	105.7	100.0	105.7	100.0	105.7	100.0	105.7
- P	(kg)	0.91	30.0	27.2	30.0	27.2	30.0	27.2	30.0	27.2	30.0	27.2	30.0	27.2
- K	(kg)	0.73	30.0	21.8	30.0	21.8	30.0	21.8	30.0	21.8	30.0	21.8	30.0	21.8
- Lime	(ton)	100.00	1.9	187.5	1.9	187.5	0.4	42.5	0.4	42.5	0.0	0.0	0.0	0.0
- MgO	(kg)	0.02	130.0	2.6	130.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 Agro-chemicals														
- Herbicide														
Thiobencarb 1	(kg)	2.40		0.0	6.0	14.4		0.0	6.0	14.4		0.0	6.0	14.4
Thiobencarb 2	(kg)	2.40	30.0	72.0	30.0	72.0	30.0	72.0	30.0	72.0	30.0	72.0	30.0	72.0
2.4PA	(kg)	9.00	30.0	270.0	30.0	270.0	30.0	270.0	30.0	270.0	30.0	270.0	30.0	270.0
- Insecticide														
PBMC	(kg)	6.50	30.0	195.0	30.0	195.0	30.0	195.0	30.0	195.0	30.0	195.0	30.0	195.0
Buprofezin	(100ml)	10.80	6.0	64.8	6.0	64.8	6.0	64.8	6.0	64.8	6.0	64.8	6.0	64.8
- Rat control														
Drat	(lit)	46.00	0.3	11.5	0.3	11.5	0.3	11.5	0.3	11.5	0.3	11.5	0.3	11.5
Sub-total				1,038.1		1,052.5		890.5		904.9		848.0		862.4
Machinery														
1 Land Preparation	(times)	40.00	3.0	120.0	2.0	80.0	3.0	120.0	2.0	80.0	3.0	120.0	2.0	80.0
2 Spraying (Chemical)	(times)	30.00	6.0	180.0	7.0	210.0	6.0	180.0	7.0	210.0	6.0	180.0	7.0	210.0
2 Harvesting	(times)	290.00	1.0	290.0	1.0	290.0	1.0	290.0	1.0	290.0	1.0	290.0	1.0	290.0
3 Transportation		60.00	1.0	60.0	1.0	60.0	1.0	60.0	1.0	60.0	1.0	60.0	1.0	60.0
Sub-total				650.0		640.0		650.0		640.0		650.0		640.0
Labor	(man-day	19.00	3.8	72.2	3.8	72.4	3.8	72.2	3.8	72.4	3.8	72.2	3.8	72.0
Micellaneous (5% of above)				88.0		88.2		80.6		80.9		78.5		78.7
Total Production Cost				1,848.3		1,853.2		1,693.3		1,698.2		1,648.7		1,653.1
Net Return per ha				2,386.7		2,381.8		2,541.7		2,536.8		2,586.3		2,581.9

Table VIII-16 Annual Disbursement Schedule of Economic Project Cost (Kerian)

(RM 10³)

Work Item	Financial Cost	Conv. Factor	Economic Cost	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
I. Improvement of System Infrastructures												
1. Concrete lining of canals	58,803	0.96	56,237	14,059	14,059	14,059	14,059	0	0	0	0	56,237
2. Improvement of drainage facilities	18,905	0.96	18,080	6,027	6,027	6,027	0	0	0	0	0	18,080
3. Improvement of farm road	5,429	0.96	5,192	2,596	2,596	0	0	0	0	0	0	5,192
4. Improvement of related strucures	611	0.96	585	292	292	0	0	0	0	0	0	585
Sub-total	83,749	0.96	80,093	22,974	22,974	20,086	14,059	0	0	0	0	80,093
II. Improvement of In-field Infrastructures												
1. Land leveling	23,108	0.94	21,811	2,726	2,726	2,726	2,726	2,726	2,726	2,726	2,726	21,811
2. In-field structures	1,916	0.94	1,809	226	226	226	226	226	226	226	226	1,809
Sub-total	25,024	0.94	23,620	2,952	2,952	2,952	2,952	2,952	2,952	2,952	2,952	23,620
III. Water Management/Monitoring System												
1. Telemerty and telecontrol system	14,632	0.98	14,359	4,786	4,786	4,786	0	0	0	0	0	14,359
2. Feedback system	869	0.98	853	441	206	154	52	0	0	0	0	853
Sub-total	15,501	0.98	15,211	5,227	4,992	4,940	52	0	0	0	0	15,211
IV. Training of Water Users Group	337	0.94	316	72	72	120	25	26	0	0	0	316

Table VIII-17 Annual Disbursement Schedule of Economic Project Cost (KETARA (Besut))

(RM 10³)

Work Item	Financial Cost	Conv. Factor	Economic Cost	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
I. Improvement of System Infrastructures												
1. Replacement of Besut Barrage Improvement	10,400	0.96	9,946	4,973	4,973	0	0	0	0	0	0	9,946
2. Construction of New Angga Barrage	2,340	0.96	2,238	746	746	746	0	0	0	0	0	2,238
3. Concrete lining of canals	11,062	0.96	10,579	3,526	3,526	3,526	0	0	0	0	0	10,579
4. Improvement of drainage facilities	693	0.96	663	663	0	0	0	0	0	0	0	663
5. Improvement of farm road	1,871	0.96	1,790	895	895	0	0	0	0	0	0	1,790
6. Improvement of related strucures	1,532	0.96	1,465	733	733	0	0	0	0	0	0	1,465
Sub-total	27,899	0.96	26,681	11,536	10,873	4,272	0	0	0	0	0	26,681
II. Improvement of In-field Infrastructures												
1. Land leveling	1,876	0.94	1,771	221	221	221	221	221	221	221	221	1,771
2. In-field structures	560	0.94	529	66	66	66	66	66	66	66	66	529
Sub-total	2,437	0.94	2,300	287	287	287	287	287	287	287	287	2,300
III. Water Management/Monitoring System												
1. Telemerty and telecontrol system	3,525	0.98	3,459	1,729	1,729	0	0	0	0	0	0	3,459
2. Feedback system	923	0.98	906	384	317	205	0	0	0	0	0	906
Sub-total	4,448	0.98	4,365	2,113	2,046	205	0	0	0	0	0	4,365
IV. Training of Water Users Group	102	0.94	96	39	6	39	6	6	0	0	0	96

Table VIII-18 Annual Disbursement Schedule of Economic Project Cost (Pulau Pinang)

(RM 10^3)

Work Item	Financial Cost	Conv. Factor	Economic Cost	1	2	3	4	5	6	7	8	Total
I. Improvement of System Infrastructures												
1. Concrete lining of canals	29,214	0.96	27,939	7,348	7,348	7,348	7,348	0	0	0	0	29,391
2. Improvement of drainage facilities	129	0.95	123	122	0	0	0	0	0	0	0	122
3. Improvement of farm road	2,418	0.96	2,312	1,285	1,285	0	0	0	0	0	0	2,569
4. Improvement of related strucures	299	0.96	286	286	0	0	0	0	0	0	0	286
Sub-total	33,846	0.96	32,368	9,041	8,632	7,348	7,348	0	0	0	0	32,368
II. Improvement of In-field Infrastructures												
1. Land leveling	3,465	0.94	3,270	409	409	409	409	409	409	409	409	3,270
2. In-field structures	853	0.94	805	101	101	101	101	101	101	101	101	805
Sub-total	4,317	0.94	4,075	509	509	509	509	509	509	509	509	4,075
III. Water Management/Monitoring System												
1. Telemerty and telecontrol system	9,387	0.98	9,211	3,070	3,070	3,070	0	0	0	0	0	9,211
2. Feedback system	920	0.98	903	492	206	102	103	0	0	0	0	903
Sub-total	10,307	0.98	10,114	3,562	3,277	3,173	103	0	0	0	0	10,114
IV. Training of Water Users Group	373	0.94	349	94	94	134	14	14	0	0	0	349

Table VIII-19 Benefit and Cost Flow of Kerian Scheme

(RM'000)

Year	Benefit							Cost							B-C
	Without			With			Increm.	System	Infield	Training	Telemetry	O&M	Replace	Total	
	Main	Off	Total	Main	Off	Total	Benefit	Infra.	Infra.	Cost	Feedback	Cost	-ment	Cost	
1	20,555	17,321	37,876	19,645	16,807	36,452	-1,424	22,971	2,952	72	5,227	2,309		33,535	-34,959
2	20,555	17,321	37,876	20,207	17,761	37,968	92	22,971	2,952	72	4,992	4,599		35,590	-35,498
3	20,555	17,321	37,876	22,221	20,166	42,387	4,511	20,086	2,952	120	4,940	6,649		34,747	-30,236
4	20,555	17,321	37,876	25,686	24,023	49,709	11,832	14,059	2,952	25	52	7,804		24,893	-13,061
5	20,555	17,321	37,876	30,602	29,331	59,933	22,056	0	2,952	26	0	7,804		10,783	11,273
6	20,555	17,321	37,876	35,518	34,639	70,157	32,280	0	2,952	0	0	7,804		10,757	21,524
7	20,555	17,321	37,876	40,434	39,947	80,381	42,504	0	2,952	0	0	7,804		10,757	31,748
8	20,555	17,321	37,876	45,350	45,255	90,604	52,728	0	2,952	0	0	7,804		10,757	41,972
9	20,555	17,321	37,876	51,155	51,060	102,215	64,339					7,804		7,804	56,534
10	20,555	17,321	37,876	55,509	55,414	110,923	73,046					7,804	14,664	22,468	50,578
11	20,555	17,321	37,876	58,412	58,316	116,728	78,852					7,804		7,804	71,047
12	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
13	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
14	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
15	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
16	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
17	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
18	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
19	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
20	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804	32,444	40,248	41,506
21	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
22	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
23	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
24	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
25	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
26	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
27	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
28	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
29	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
30	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804	14,664	22,468	59,286
31	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
32	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
33	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
34	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
35	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
36	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
37	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
38	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
39	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
40	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804	32,444	40,248	41,506
41	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
42	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
43	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
44	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
45	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
46	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
47	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
48	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
49	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804		7,804	73,950
50	20,555	17,321	37,876	59,863	59,768	119,630	81,754					7,804	14,664	22,468	59,286
								80,093	23,620	316	15,211				24.1%

IRR	24.1%
B/C	2.59
NPV	277,028

Sensitivity

	Cost		
Benefit	0%	10%	20%
0%	24.1%	22.9%	21.8%
-10%	22.3%	21.1%	20.1%
-20%	20.3%	19.2%	18.3%

Table VIII-20 Benefit and Cost Flow of KETARA (Besut) Scheme

(RM'000)

Year	Benefit							Cost							B-C
	Without			With			Increm.	System	Infield	Training	Telemetry	O&M	Replace	Total	
	Main	Off	Total	Main	Off	Total	Benefit	Infra.	Infra.	Cost	Feedback	Cost	-ment	Cost	
1	5,852	5,179	11,031	5,504	4,818	10,322	-709	11,536	287	39	2,113	684		14,660	-15,369
2	5,852	5,179	11,031	5,449	4,678	10,127	-905	10,873	287	6	2,046	1,332		14,541	-15,449
3	5,852	5,179	11,031	5,682	4,754	10,435	-596	4,272	287	39	205	1,557		6,361	-6,957
4	5,852	5,179	11,031	6,203	5,045	11,249	217	0	287	6	0	1,557		1,850	-1,632
5	5,852	5,179	11,031	7,013	5,554	12,567	1,535	0	287	6	0	1,557		1,850	-314
6	5,852	5,179	11,031	7,823	6,062	13,884	2,853	0	287	0	0	1,557		1,844	1,009
7	5,852	5,179	11,031	8,632	6,570	15,202	4,171	0	287	0	0	1,557		1,844	2,327
8	5,852	5,179	11,031	9,442	7,078	16,520	5,489	0	287	0	0	1,557		1,844	3,645
9	5,852	5,179	11,031	10,595	7,943	18,538	7,507					1,557		1,557	5,950
10	5,852	5,179	11,031	11,460	8,591	20,051	9,020					1,557	3,357	4,914	4,106
11	5,852	5,179	11,031	12,037	9,024	21,060	10,029					1,557		1,557	8,473
12	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
13	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
14	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
15	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
16	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
17	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
18	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
19	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
20	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557	9,153	10,710	-176
21	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
22	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
23	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
24	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
25	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
26	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
27	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
28	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
29	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
30	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557	3,357	4,914	5,620
31	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
32	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
33	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
34	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
35	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
36	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
37	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
38	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
39	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
40	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557	9,153	10,710	-176
41	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
42	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
43	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
44	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
45	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
46	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
47	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
48	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
49	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557		1,557	8,977
50	5,852	5,179	11,031	12,325	9,240	21,565	10,534					1,557	3,357	4,914	5,620
							449,424	26,681	2,300	96	4,365	76,735	28,379	138,555	11.2%

IRR	11.2%
B/C	1.14
NPV	6,178

Sensitivity

	Cost		
Benefit	0%	10%	20%
0%	11.2%	10.6%	10.1%
-10%	10.2%	9.6%	9.1%
-20%	9.1%	8.6%	8.1%

Table VIII-21 Benefit and Cost Flow of Pulau Pinang Scheme

(RM'000)

Year	Benefit						Increm.	Cost							B-C
	Without			With				System	Infield	Training	Telemetry	O&M	Replace	Total	
	Main	Off	Total	Main	Off	Total	Benefit	Infra.	Infra.	Cost	Feedback	Cost	-ment	Cost	
1	10,031	9,926	19,957	9,379	9,287	18,665	-1,292	9,041	509	94	3,562	1,049		14,255	-15,547
2	10,031	9,926	19,957	9,359	9,280	18,638	-1,319	8,632	509	94	3,277	2,041		14,553	-15,872
3	10,031	9,926	19,957	9,962	9,896	19,858	-99	7,348	509	134	3,173	2,917		14,080	-14,179
4	10,031	9,926	19,957	11,189	11,137	22,326	2,369	7,348	509	14	103	3,537		11,511	-9,142
5	10,031	9,926	19,957	13,040	13,001	26,041	6,084	0	509	14	0	3,537		4,061	2,024
6	10,031	9,926	19,957	14,892	14,865	29,757	9,799	0	509	0	0	3,537		4,047	5,753
7	10,031	9,926	19,957	16,743	16,729	33,472	13,515	0	509	0	0	3,537		4,047	9,468
8	10,031	9,926	19,957	18,594	18,594	37,187	17,230	0	509	0	0	3,537		4,047	13,184
9	10,031	9,926	19,957	21,089	21,089	42,177	22,220					3,537		3,537	18,683
10	10,031	9,926	19,957	22,960	22,960	45,920	25,963					3,537	7,780	11,317	14,645
11	10,031	9,926	19,957	24,207	24,207	48,415	28,458					3,537		3,537	24,921
12	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
13	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
14	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
15	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
16	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
17	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
18	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
19	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
20	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537	14,727	18,264	11,441
21	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
22	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
23	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
24	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
25	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
26	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
27	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
28	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
29	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
30	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537	7,780	11,317	18,388
31	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
32	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
33	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
34	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
35	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
36	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
37	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
38	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
39	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
40	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537	14,727	18,264	11,441
41	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
42	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
43	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
44	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
45	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
46	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
47	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
48	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
49	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537		3,537	26,168
50	10,031	9,926	19,957	24,831	24,831	49,663	29,705					3,537	7,780	11,317	18,388
								32,368	4,075	349	10,114				19.5%

IRR	19.5%
B/C	2.08
NPV	80,131

Sensitivity

	Cost		
Benefit	0%	10%	20%
0%	19.5%	18.6%	17.8%
-10%	18.0%	17.1%	16.4%
-20%	16.4%	15.6%	14.9%

Table VIII-22 Repayment of Machinery Loan and Rental Fee

(1) Kerian Scheme

(RM'000)

Year	Loan	Interest	Principal	Repayment	
				Total	per ha (RM)
1	31,927	2,075	6,385	8,461	359
2		1,245	6,385	7,631	324
3		830	6,385	7,216	306
4		415	6,385	6,801	289
5		0	6,385	6,385	271
Total		4,566	31,927	36,493	
Average				7,299	310

(RM)

Rental Fee of Machinery per ha		
	Wet	Dry
Land Preparation	120	80
Spraying	180	210
Cost per season	300	290
Cost / ha / season*	294	
Cropping Intensity	1.8	
Annual Cost	529	

*: Weghted average of Wet and Dry Seeding.

(2) Besut Scheme

(RM'000)

Year	Loan	Interest	Principal	Repayment	
				Total	per ha (RM)
1	10,057	654	2,011	2,665	516
2		392	2,011	2,404	465
3		261	2,011	2,273	440
4		131	2,011	2,142	415
5		0	2,011	2,011	389
Total		1,438	10,057	11,495	
Average				2,299	445

(RM)

Rental Fee of Machinery per ha		
	Wet	Dry
Land Preparation	120	80
Spraying	180	210
Cost per season	300	290
Cost / ha / season*	299	
Cropping Intensity	1.8	
Annual Cost	523	

*: Weghted average of Wet and Dry Seeding.

(3) Pulau Pinang Scheme

(RM'000)

Year	Loan	Interest	Principal	Repayment	
				Total	per ha (RM)
1	18,085	1,176	3,617	4,792	499
2		705	3,617	4,322	450
3		470	3,617	4,087	426
4		235	3,617	3,852	401
5		0	3,617	3,617	377
Total		2,586	18,085	20,671	
Average				4,134	431

(RM)

Rental Fee of Machinery per ha		
	Wet	Dry
Land Preparation	120	80
Spraying	180	210
Cost per season	300	290
Cost / ha / season*	300	
Cropping Intensity	2.0	
Annual Cost	600	

*: Weghted average of Wet and Dry Seeding.

Table VIII-23 Financial Crop Budget under "With-Project Condtion"

	Unit per ha	Unit Price	Besut Wet Q'ty	Besut Wet Price	Besut Dry Q'ty	Besut Dry Price	Besut Average Price*	Kerian Wet Q'ty	Kerian Wet Price	Kerian Dry Q'ty	Kerian Dry Price	Kerian Average Price*	Pinang Wet Q'ty	Pinang Wet Price	Pinang Dry Q'ty	Pinang Dry Price	Pinang Average Price*
Gross Return																	
Production	(kg)	0.80	5,500	4,390	5,500	4,390	4,390	5,500	4,390	5,500	4,390	4,390	5,500	4,390	5,500	4,390	4,390
Production Cost																	
Farm Inputs																	
1 Seeds	(kg)	1.00	80.0	80.0	80.0	80.0	80	80.0	80.0	80.0	80.0	80	80.0	80.0	80.0	80.0	80
2 Fertilizer (Non-subsidized)																	
- N	(kg)	1.17	20.0	23.4	20.0	23.4	23	20.0	23.4	20.0	23.4	23	20.0	23.4	20.0	23.4	23
- P	(kg)	1.42	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0
- K	(kg)	1.09	10.0	10.9	10.0	10.9	11	10.0	10.9	10.0	10.9	11	10.0	10.9	10.0	10.9	11
- Lime	(ton)	100.00	1.9	187.5	1.9	187.5	188	0.4	42.5	0.4	42.5	43	0.0	0.0	0.0	0.0	0
- MgO	(kg)	0.02	130.0	2.6	130.0	2.6	3	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0
3 Agro-chemicals																	
- Herbicide																	
Thiobencarb 1	(kg)	2.40		0.0	6.0	14.4	1		0.0	6.0	14.4	9		0.0	6.0	14.4	0
Thiobencarb 2	(kg)	2.40	30.0	72.0	30.0	72.0	72	30.0	72.0	30.0	72.0	72	30.0	72.0	30.0	72.0	72
2.4PA	(kg)	9.00	30.0	270.0	30.0	270.0	270	30.0	270.0	30.0	270.0	270	30.0	270.0	30.0	270.0	270
- Insecticide																	
PBMC	(kg)	6.50	30.0	195.0	30.0	195.0	195	30.0	195.0	30.0	195.0	195	30.0	195.0	30.0	195.0	195
Buprofezin	(100ml)	10.80	6.0	64.8	6.0	64.8	65	6.0	64.8	6.0	64.8	65	6.0	64.8	6.0	64.8	65
- Rat control																	
Drat	(lit)	46.00	0.3	11.5	0.3	11.5	12	0.3	11.5	0.3	11.5	12	0.3	11.5	0.3	11.5	12
Sub-total				917.7		932.1	919		770.1		784.5	779		727.6		742.0	728
Machinery																	
1 Land Preparation	(times)	40.00	3.0	120.0	2.0	80.0	116	3.0	120.0	2.0	80.0	96	3.0	120.0	2.0	80.0	120
2 Spraying (Chemical)	(times)	30.00	6.0	180.0	7.0	210.0	183	6.0	180.0	7.0	210.0	198	6.0	180.0	7.0	210.0	180
2 Harvesting	(times)	290.00	1.0	290.0	1.0	290.0	290	1.0	290.0	1.0	290.0	290	1.0	290.0	1.0	290.0	290
3 Transportation		60.00	1.0	60.0	1.0	60.0	60	1.0	60.0	1.0	60.0	60	1.0	60.0	1.0	60.0	60
Sub-total				650.0		640.0	649		650.0		640.0	644		650.0		640.0	650
Labor	(man-day	20.00	3.8	76.0	3.8	76.3	76	3.8	76.0	3.8	76.3	76	3.8	76.0	3.8	75.8	76
Micellaneous (5% of above)				82.2		82.4	82		74.8		75.0	75		72.7		72.9	73
Total Production Cost				1,725.9		1,730.8	1,726		1,570.9		1,575.8	1,574		1,526.3		1,530.6	1,526
Net Return per ha				2,663.7		2,658.8	2,663		2,818.6		2,813.8	2,816		2,863.3		2,858.9	2,863

*: Weighted Average of Dry and Wet seeding.

ANNEX-IX

PILOT PROJECT

ANNEX - IX

PILOT PROJECT

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IX. PILOT PROJECT

1. GENERAL

A pilot project has been implemented by the Malaysian Government with technical advice and guidance of the JICA Study Team during the field work period for Phase II, Feasibility Study according to the Minutes of Meeting on Scope of Work for the Study on Modernization of Irrigation Water Management System in the Granary Areas of Peninsular Malaysia agreed between Malaysian Government and JICA on 20 November 1996. The Ketara (Besut) Scheme has been selected as the pilot project through discussion at the meeting on the Progress Report (I) with the Steering Committee at the end of May 1997. Prior to implementation, a meeting had been held to discuss work items and time schedule for implementation of the pilot project at the IADP Ketara (Besut) Office on September 22 and 23, 1997.

2. COMPONENTS OF THE PILOT PROJECT

In implementing the pilot project, the following two systems were proposed :

2.1 Irrigation Water Management System

(1) Purpose

The objectives for introducing the irrigation water management system are as follows :

(a) Effective use of irrigation water, reduction of operation loss (raise of efficiency) and increase of paddy production

(b) Preservation of facilities and prevention of disaster

(c) Saving cost for operation and management

(d) Achievement of a more effective representation and participation of farmers, and attainment of sustainable development in irrigation agriculture

(2) Basic Consideration

For the establishment of irrigation water management system, the following considerations are made :

(a) Timely collection of data and information on water management through measurement and transmission of various data such as rainfall, river runoff, reservoir storage, intake volume, water distribution amount, etc.

(b) Processing of collected data and direction of water control for proper water management by on-site and/or remote control system

(c) Safety control and early action of countermeasures for extraordinary conditions through introduction of warning system for flooding, management system on water shortage in drought year to prevent from drought disaster and protection system of irrigation facilities in emergency cases

(d) Utilization of accumulated data through water management system for the future modification of the project and for the regional development

(3) Proposed System and Facilities

The proposed system consists of :

(a) Observation system

(b) Communication system (telemetry and telecontrol system)

(c) Data management system

(d) Remote control system for gate and pump operations

For the establishment of these systems, the following facilities should be provided :

(a) Observation system

(i) Installation of rainfall stations in the representing areas

(ii) Installation of water level gauges at river, diversion points of irrigation canals and drains, and gate opening gauges at intake and diversion gates

(b) Communication system (telemetry and telecontrol system)

(i) Establishment of telephone line linking among central station, remote stations and other agencies concerned

(ii) Establishment of electric lines for TM/TC equipment

(iii) Installation of TM/TC equipment at both central and remote stations

(iv) Establishment of central and remote stations

(c) Data management system

(i) Establishment of computer system for estimation of water requirement, H-Q calculation of river, canals and drains, and water balance, etc.

(ii) Estimation of optimum water distribution as well as gate opening level and pump operation hour

(iii) Installation of computer equipment for the above system

(d) Remote control system for gate and pump operations

(i) Motorization of gated structures

(ii) Establishment of remote control system for gated structures and pumps

Fig. IX-1 to IX-3 show the schematic diagrams of telemetry and telecontrol system.

(4) Pilot Project Works

In the framework of the above proposed water management system, the following works have been executed as the pilot project in Besut scheme :

(a) Establishment of observation network of 2 rainfall stations and 6 water level stations at Besut river, Besut intake and major diversion points of irrigation canals as shown in Fig. IX-4

(b) Establishment of telephone line linking among central and remote stations, installation of TM/TC equipment at both central and remote stations, and establishment of electric lines for remote stations

(c) Establishment of data management and processing system comprising computer hardware and software

(d) Establishment of central and remote stations

2.2 Irrigation Monitoring and Information Feedback System

(1) Purpose

To monitor irrigation schedule status and progress as well as to provide information feedback to all farmers and managers involved in the granary production system. The same system can be utilized as a communication medium for extension services.

(2) Background

Keeping to irrigation schedule is a critical aspect of double cropping production. It is also a basic assumption in the planning and design of the tertiary system for an optimized resource (water, machinery, manpower, farm input) demand over a season. Past experience show that this assumption is not easily attainable. One management aspect to strengthen is coordination between irrigation managers, agriculture managers, the IADP office and the farmers. From the operation perspective, a common monitoring system is proposed to alert managers and farmers to prepare for all sequential production activities, alert them of any potential delays so that timely corrective measures can be initiated.

(3) Proposed System

The proposed monitoring and feedback system is a computer based system using telephone line communication. This system allows the systems manager to produce, author and schedule and distribute multimedia messages and information for TV output. Since a telephone line is used, the information can be transmitted and displayed at any number of stations from a single central center.

Within a granary, the basic system comprise a master station connected to one or more player stations. The master station is the source of all information presentations and controls the presentation schedules of the player stations. Subsequently the system can be upgraded to one with multi-master stations and interlinked with each other. Ultimately, the system can be extended to an inter-granary network with links to the Ministry of Agriculture and relevant Federal Departments.

Fig. IX-5 to IX-7 show the schematic diagrams of irrigation monitoring and information feedback system.

(4) Pilot Project Works

One master station and one player station have been established as the pilot project in Besut scheme with procurement of hardware and soft ware, and development and testing of information system.

2.3 Integration of the Water Management System and the Monitoring and Feedback System

To ensure that the systems installed functions effectively, they must be managed and operated in an integrated manner. Most important is to appreciate that both systems have their own specific purpose and that the O&M staff work procedure is an integral component.

The Irrigation Water Management System(IWMS) collects data on water resources and irrigation for use of the technical personnel, i.e. the O&M staff of the DID. The data and information presentation are thus technical in nature but easily understood by the systems operators. The basic data are rainfall and water level information, and these data are transformed into decision-making information mainly on water availability status and system allocation levels. On the other hand, the Irrigation Monitoring and Feedback System(IMFS) is targeted to mainly for the farmers and field staffs. This must be less technical in nature and easily understood. Thus data obtained from the WMS must be suitably represented for the IMFS. The water level and rainfall data collected through the WMS can be directly connected to the IMFS via a computer link and programming. Only the display format will differ. The key information necessary for farmers are rainfall, water level and supply conditions.

Apart from the system computer linkage, the planning input and actions of the PMU, the DID, DOA, LPP/PKK and BERNAS components of the IADP are critical. These must be well supported by field staff for activity feedback update and ensuring that information transmission to farmers is executed. A season's planning information must be provided by the PMU and the respective components at the start of every season. Clear targets for each activity are critical and should be input into the IMFS. During a season's operations, monitoring feedback must be provided by the field staff as part of their work program. A feedback format and schedule must be set-up. A weekly reporting and updating must be carried out with allowances for insertion of urgent and important messages at any time necessary.

Overall, farmers' response to the information is the main concern. From the onset, the field staff must encourage leaders of the farmers' groups to constantly refer to the IMFS for updated information and to ensure that the farmers' groups undertake positive action in

response to the information. Gradually, the system should allow for feedback information to be provided by each farmers' group via the manager of the player stations. In the case of Besut, this will be the respective DID Compartment Stations. Farmers' response to the information must be relayed back to central control by the Compartment Stations. This is turn should be indicated in the subsequent information transmission by the Central Control.

3 IMPLEMENTATION OF THE PILOT PROJECT

The following works has been implemented by DID with the technical advice and guidance of the JICA Study Team during the field work period for Phase II :

(1) Establishment of a Central Control Station

A Central Control Station has been established in the IADP Ketara Office based on the discussion held on 23 September 1997 and the following works have been made :

- Installation/supply of wiring, telephone line and electricity
- Supply of office equipment
- Provide office space for DID O & M staff

Fig. IX-9 shows AC outlet design and equipment layout in the Central Control Station.

(2) Procurement and installation of a Master Controller

The Master Controller consists of the following equipment :

- Front end processor c/w SCADA software package and line printer
- PSTN communication equipment c/w 33.6 modem
- UPS and power supply unit
- Data processing unit

(3) Procurement and installation of three(3) Remote Telemetry Units

The Remote Telemetry Unit (RTU) is installed for the long term monitoring of water level and rainfall and to send the data back to the Master Controller through the communication equipment. Three(3) RTUs are installed at Besut intake site and two (2) major diversion points, "G" and "O".

(4) Procurement and installation of two(2) rainfall gauges

Two(2) tipping bucket rainfall sensors are installed at Besut intake site and diversion point "O".

(5) Procurement and installation of six(6) water level gauges

Six(6) analog/digital water level sensors are installed at upstream and downstream sites of Besut intake and two(2) major diversion points, "G" and "O".

(6) Establishment of remote control system for a off-take gate

A off-take gate at the diversion point "G" is motorized and equipped with the actuators for remote control.

(7) Procurement of hardware and software for irrigation water management system

The following is the system specification for irrigation water management system :

Hardware	CPU	MMX 200MHz
	Motherboard	512K Pipeline Cache
	RAM	64MB
	Network interface	Ethernet / 10BASE-T
	Interface	RS232C
	Hard disk interface	SCSI-II
	Storage	4GB(8GB)
	CD ROM	16X
	Monitor	17 inch
	Others	KB+FD+Mouse
		DAT drive
OS	Window 95	
Software	Microsoft Office 95	Professional Edition
	Visual Basic 5.0	Professional Edition
Printer	Network Color Printer	IEEE802.3 10BASE-T
Network	Hub	IEEE802.3
	10BASE-T	8port

(8) Procurement of hardware and software for irrigation monitoring and information feedback system

The following is the system specification for irrigation monitoring and information feedback system :

Items	Master Station	Play Station
- Hardware	(Desktop)	(Notebook)
CPU	MMX 200MHz	MMX 166MHz
Motherboard	512K Pipeline Cache	512K Pipeline Cache
RAM	64MB	32MB
Network interface	Ethernet / 10BASE-T	—
Interface	RS232C	RS232C
Hard disk interface	SCSI-II	IDE

Storage	4.0 GB	2.0 GB
Graphic card + TV encoder	Ati 3D Turbo 4MB	portable
CD ROM(inner)	16X	8X
Video Card	Broadway	—
Sound Card	SBAWE64BIT	SBAWE64BIT
Monitor / TV	VIEWSONIC20"	—
Digital Camera	Casio / Sony	—
Modem	33600bps	33600bps
Others	KB+FD+Mouse	KB+FD+Mouse
- OS	Window 95	Window 95
- Software		
Scala Information	IC Master software	IC Player software
Non-linear	Adobe Premier 4.2	—
Multimedia	Scala MM200	—
Imaging	Photoshop LE3.05	—
Business Soft	Microsoft Office Pro.	Microsoft Office Pro.
WWW Brower/e-mail	Internet Explorer	Internet Explorer
Utilities	Norton Utilities	Norton Utilities
	Anti virus	Anti virus
- Printer	Laser Printer	—
	Inkjet Printer	—

(9) Design for irrigation water management system

The irrigation water management system has various functions such as data calculation, guidance for proper decision making for daily operation and project monitoring. From the viewpoint of computer system, the water management system is developed under the following concept :

(a) Easy operation

The operator of the existing irrigation system in the Besut scheme will be the user for the water management system and user oriented concept should be adopted. The system shall have user friendly interface and minimum routine work so that the user can operate the system easily.

(b) Easy maintenance

The system should be maintained in good condition and project information shall be updated with the latest one. Even if there are some changes in various project information, the user shall not have to change program itself. The user can easily change the project information in screen, excel file or text file as shown below.

- Irrigation schedule data can be updated in screen.
- Kumpulan Petani data can be updated in excel file.
- Project data except for calculation of ETo can be updated in excel file.
- Project data for calculation of ETo can be updated in text file.

(c) Easy extension

The number of rainfall stations and water level stations shall be installed in future. The system has many blank spaces for these additional stations. Therefore, the user can install new stations without changing program.

The irrigation water management system will be used for decision making for daily irrigation system operation and project monitoring. On the other hand, Supervisory Control and Data Acquisition (SCADA) system which be included in the master controller, will be used for data collecting, primary data calculation and telecontrol. The water management system and the SCADA system will be connected by using Ethernet as shown in Fig.VI-10 and data exchange will be done based on the Comma Separated Variable (CSV) format.

Visual Basic(VB) version 5 is the latest and the most popular programming language for Windows 95. Consequently, VB is selected for developing the water management system.

Irrigation water management system is developed to assist irrigation system operator in proper decision making. Basically, the system has two functions, one is daily operation function and the other is project monitoring function.

(i) Daily Operation Function

The objective of this function is to guide irrigation system operator to proper daily operation. To achieve proper operation, the following information will be useful for the operator.

i) Water demand at major diversion points

ii) Actual water supply at major diversion points

iii) Proper distribution simulation

iv) Required gate opening level

To get such kind of information, functions shown below are established in the water management system. In the system, the required information is displayed in graphic so that the user can understand them easily.

<u>i) Water demand at major diversion points</u>

- Rainfall Data Reading Function

  This function is used for reading rainfall data in SCADA System.

- Water Requirement Calculation Function

  This function is established to calculate water requirement in each Kumpulan Petani.

- Diversion Discharge Function

  This function is used for estimating requested discharges at major diversion points for conveying water necessary for Kumpulan Petani.

- Kumpulan Petani Data Input Function

  From this function, user can enter and change required project data to calculate water requirement of each Kumpulan Petani.

ii) Actual water supply at major diversion points

- Water Level Data Reading Function

  This function is used for reading water level data in SCADA System.

- H-Q Calculation Function

  This function is developed to convert collected water level data to present discharge in the canal.

- Canal Data Input Function

  From this function, user can enter and change canal information at discharge measurement point.

iii) Proper water distribution

- Intake Operation Function

  This function will be used to determine maximum available water for the scheme.

- Water Balance Simulation Function

  From this function, the user can simulate and decide proper water distribution of the scheme.

iv) Required gate opening level

- Gate Opening Level Data Reading Function

  This function is used for reading gate opening level data in SCADA System.

- Gate Operation Guidance Function

  This function can decide gate opening level to supply target discharge.

- Target Gate Opening Level Data Sending Function to SCADA System

  This function can send target gate opening level from Water Management System to SCADA System.

- Gate Data Input Function

  From this function, user can enter and change required project data on each gate to be controlled remotely.

(ii) Project Monitoring

The objective of this function is monitoring the irrigation system.

- Rainfall Trend Monitoring Function

  This function will be used for checking rainfall trend in the scheme.

- Water Level Monitoring Function

  This function can tell operator whether major diversion points have enough water level or nor.

By using the irrigation water management system, operation factor in present condition will be upgraded and modernized as shown below without burden.

Operation Factor	Present Operation		Modernized Operation System	
Data Collection	On Sight	->	In Central Office	SCADA
Data Collection Frequency	Daily	->	Hourly	SCADA
Calculation Frequency	Seasonally	->	Daily	WMS
Water Distribution	Experience	->	Simulation	WMS

Note : WMS = Water Management System
SCADA = Supervisory Control and Data Acquisition

The operation manual, flow chart and design sheet of irrigation water management system are shown in Attachment-1 to 3..

(10) Development of programs for irrigation monitoring and feedback system

The proposed irrigation monitoring and feedback system is to encourage farmers to adhere to planting schedules and adopt recommended farm practices. It is also as a medium to explain to the farmers on the objectives of the modernization program and to obtain their full support. The main criteria is that the system is easily updated, display simple message and carries good visual impact. The recommended software for the system is the SCALA Infochannel. For the pilot project, the SCALA MM200 software is recommended for initial development and as a demonstration.

The content of the demonstration package is divided into the following three(3) segments :

(a) Irrigation and farm activities

In this segment, the contents are

(i) irrigation schedule,

(ii) alert messages on dates of field activities,

(iii) farmers preparatory works necessary,

(iv) status of field activities, and

(v) water management information which includes rainfall and water supply and water level status at the Besut and Angga Barrage, and current information on operations and maintenance.

(b) Agronomic

This segment comprise messages pertaining to

(i) recommended farm and crop husbandry practices,

(ii) alert messages on DRIP, and

(iii) current issues and problems such as pest and disease outbreaks and recommended management.

(c) Administrative

The administrative segment comprise

(i) administrative and motivational message from IADP PMU and component heads, DID O&M section and Compartment Task Forces (Pasukan Petugas Komparttmen),

(ii) paddy production statistics (yield and production) and targets, and

(iii) news on current issues.

The sample display of Irrigation Monitoring and Feedback System are shown in Attachment-4.

FIGURES

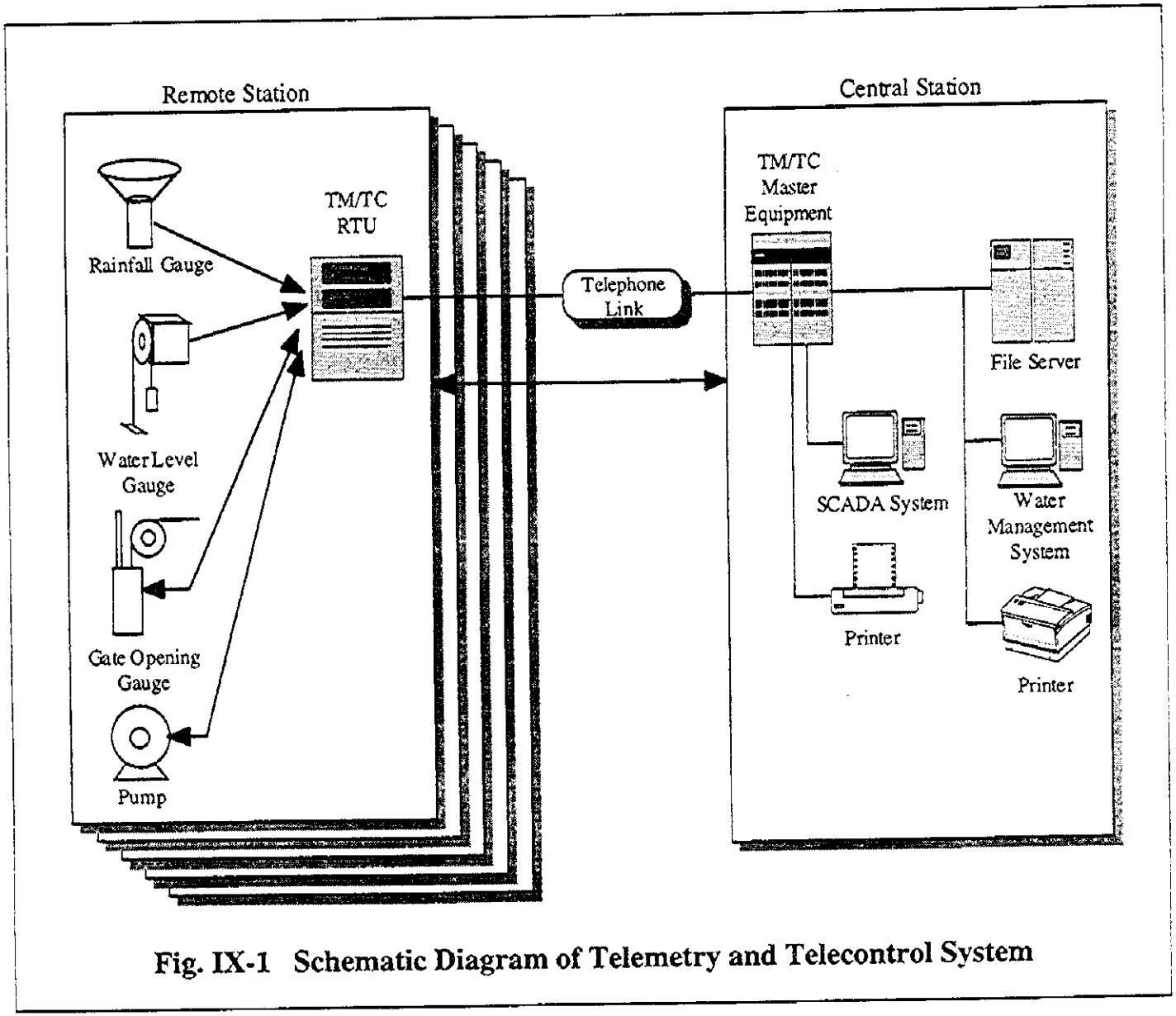


Fig. IX-1 Schematic Diagram of Telemetry and Telecontrol System

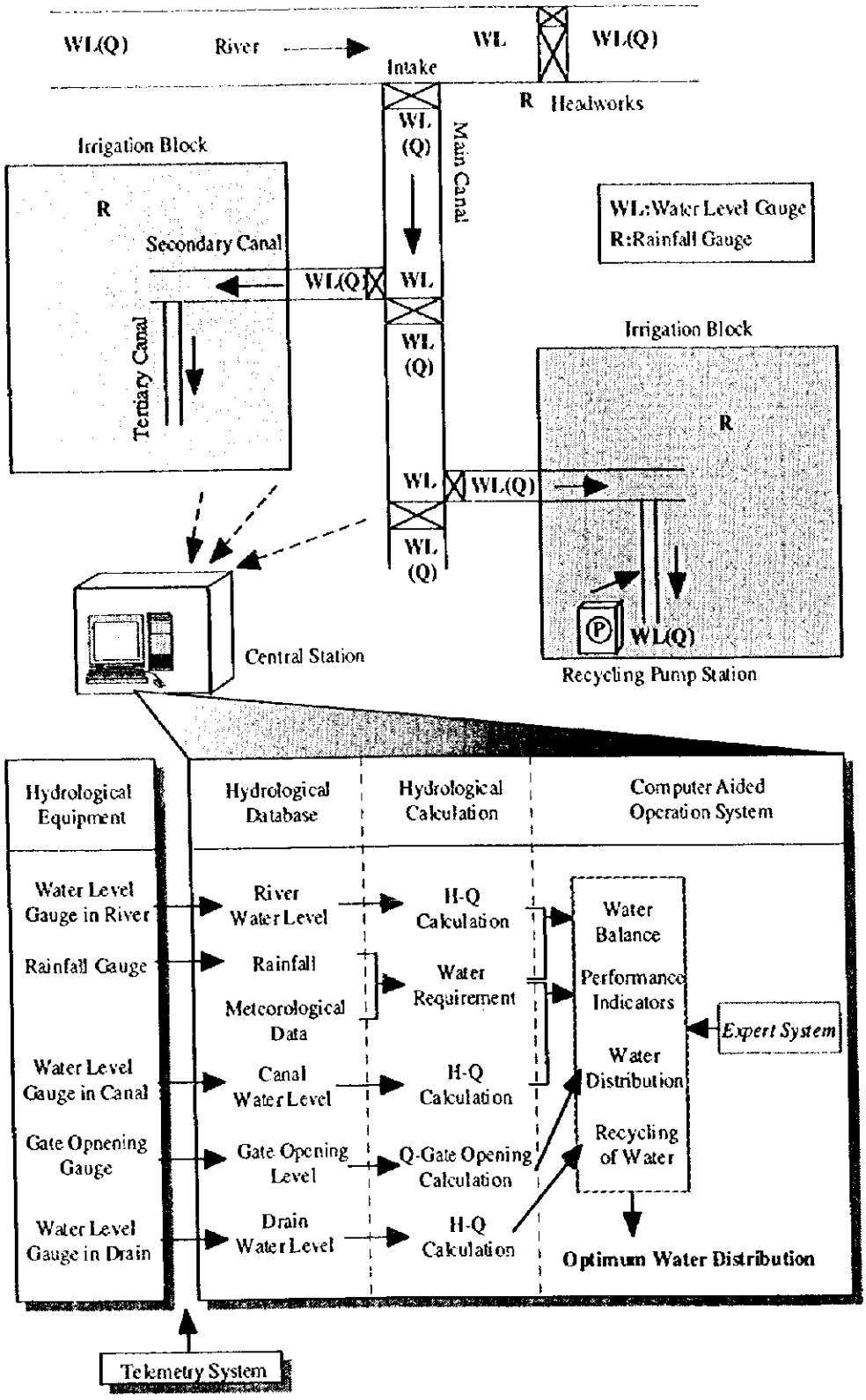


Fig. IX-2 Schematic Diagram of Telemetry System

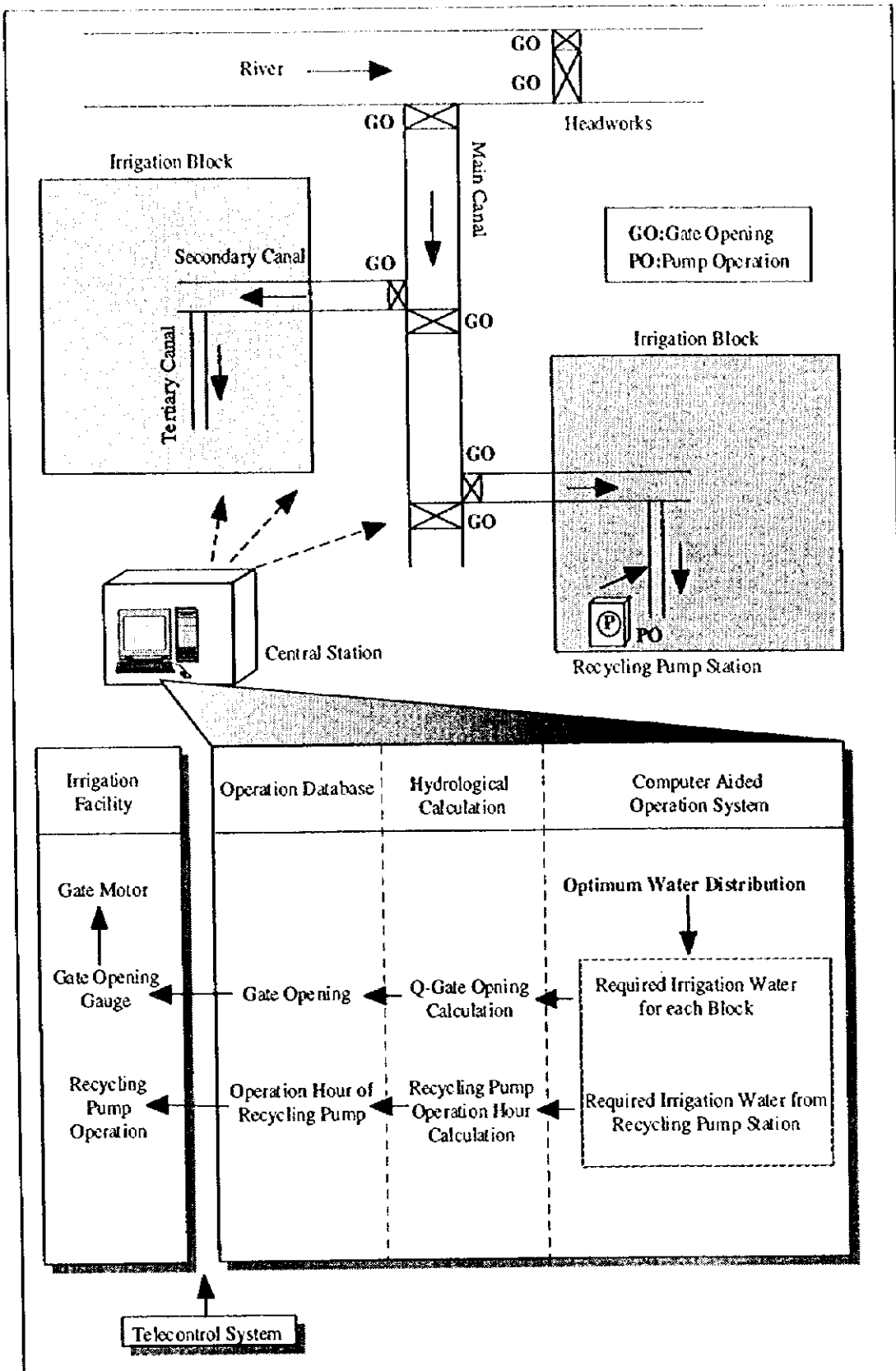


Fig. IX-3 Schematic Diagram of Telecontrol System

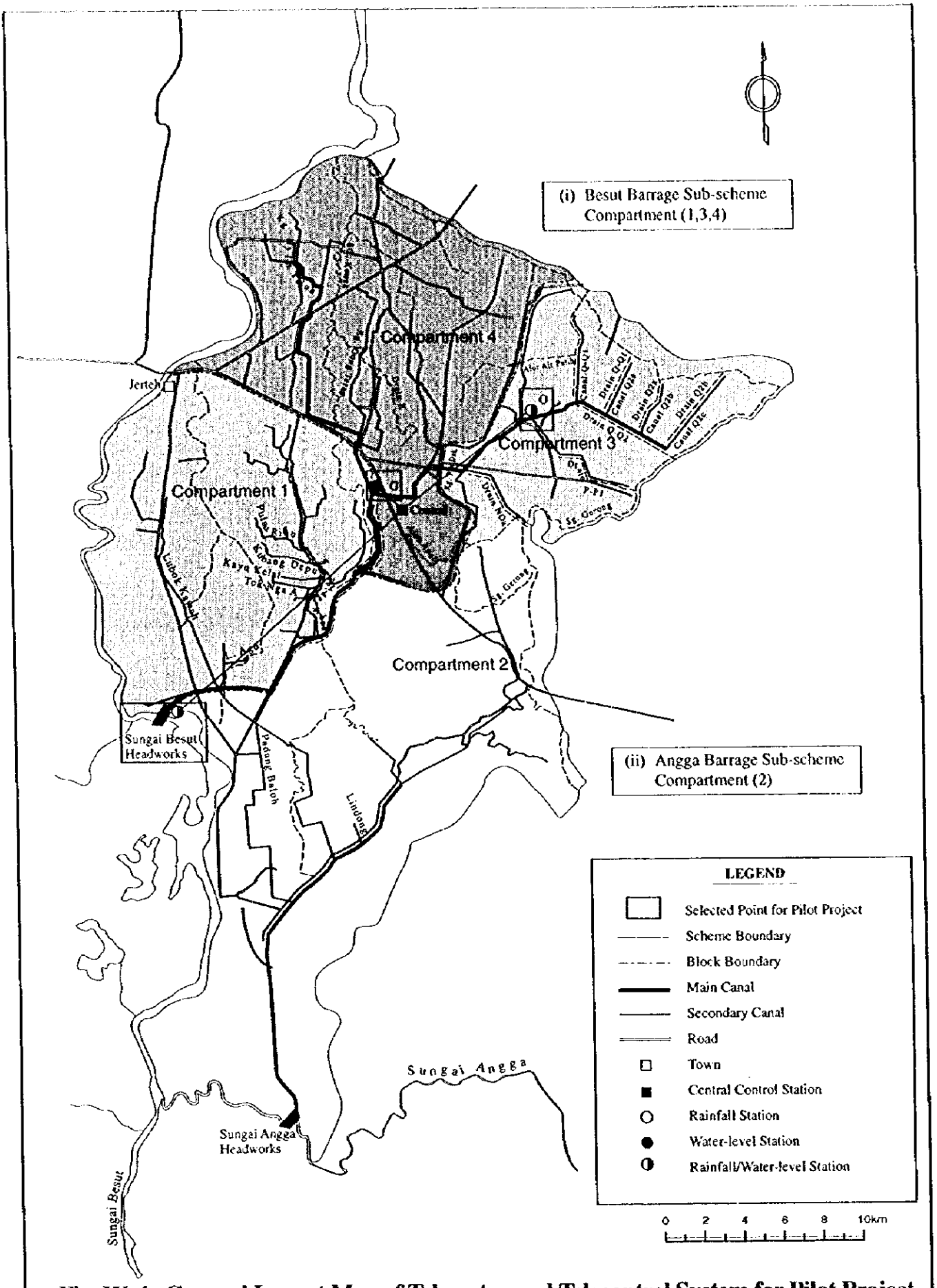


Fig. IX-4 General Layout Map of Telemetry and Telecontrol System for Pilot Project

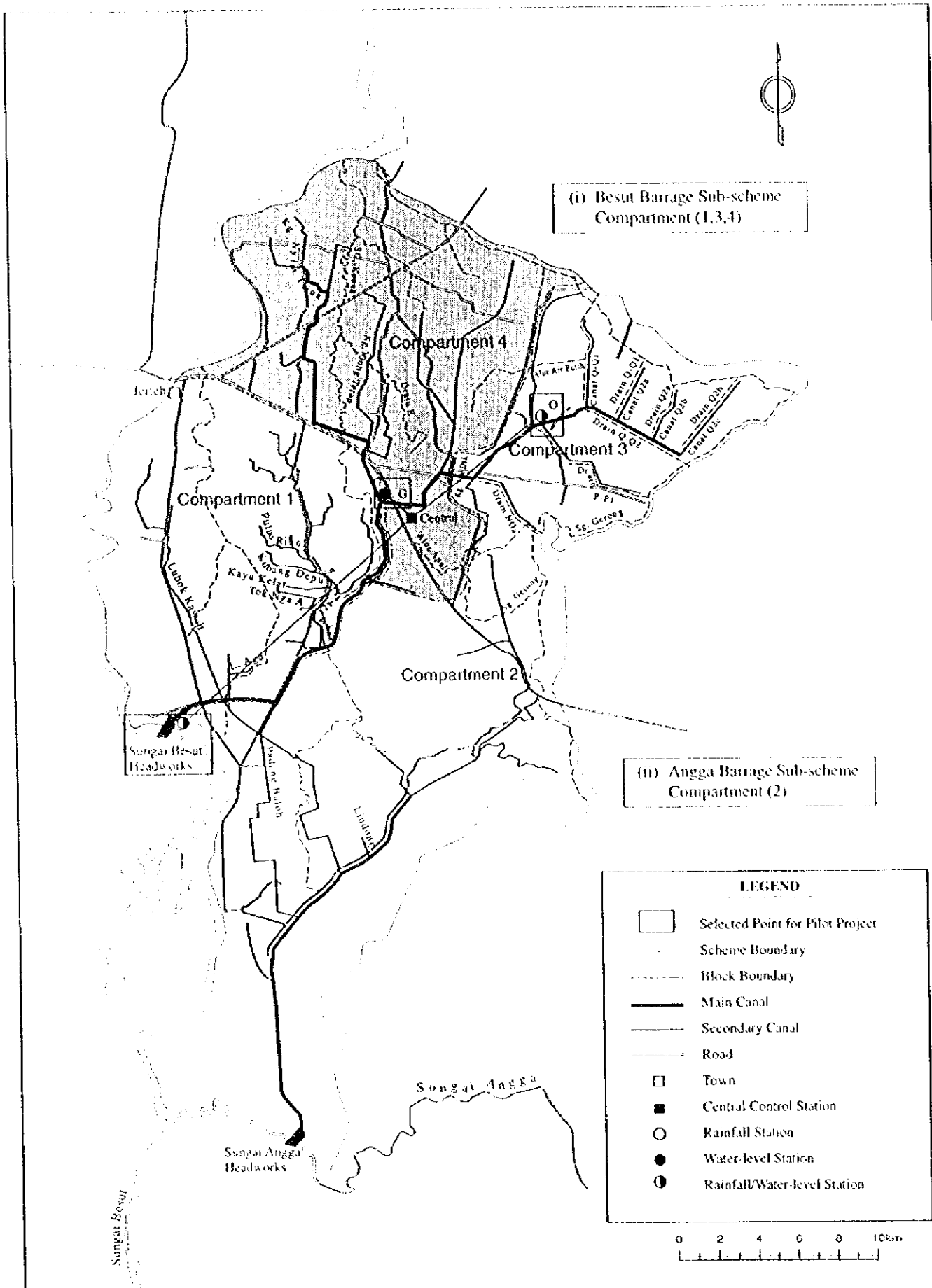


Fig. IX-4 General Layout Map of Telemetry and Telecontrol System for Pilot Project

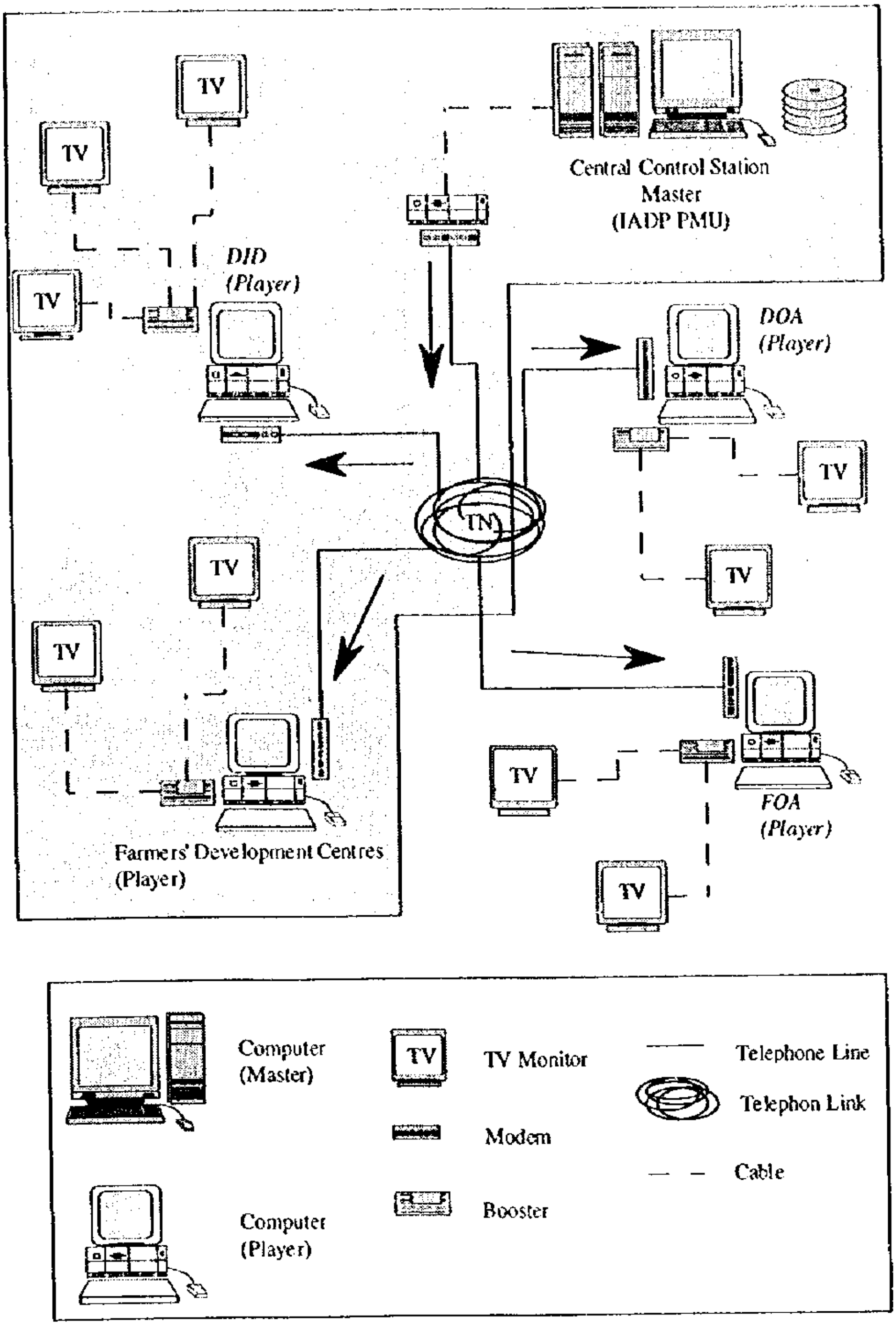


Fig. IX-5 Schematic Diagram of Irrigation Monitoring and Information Feedback System (1st Step)

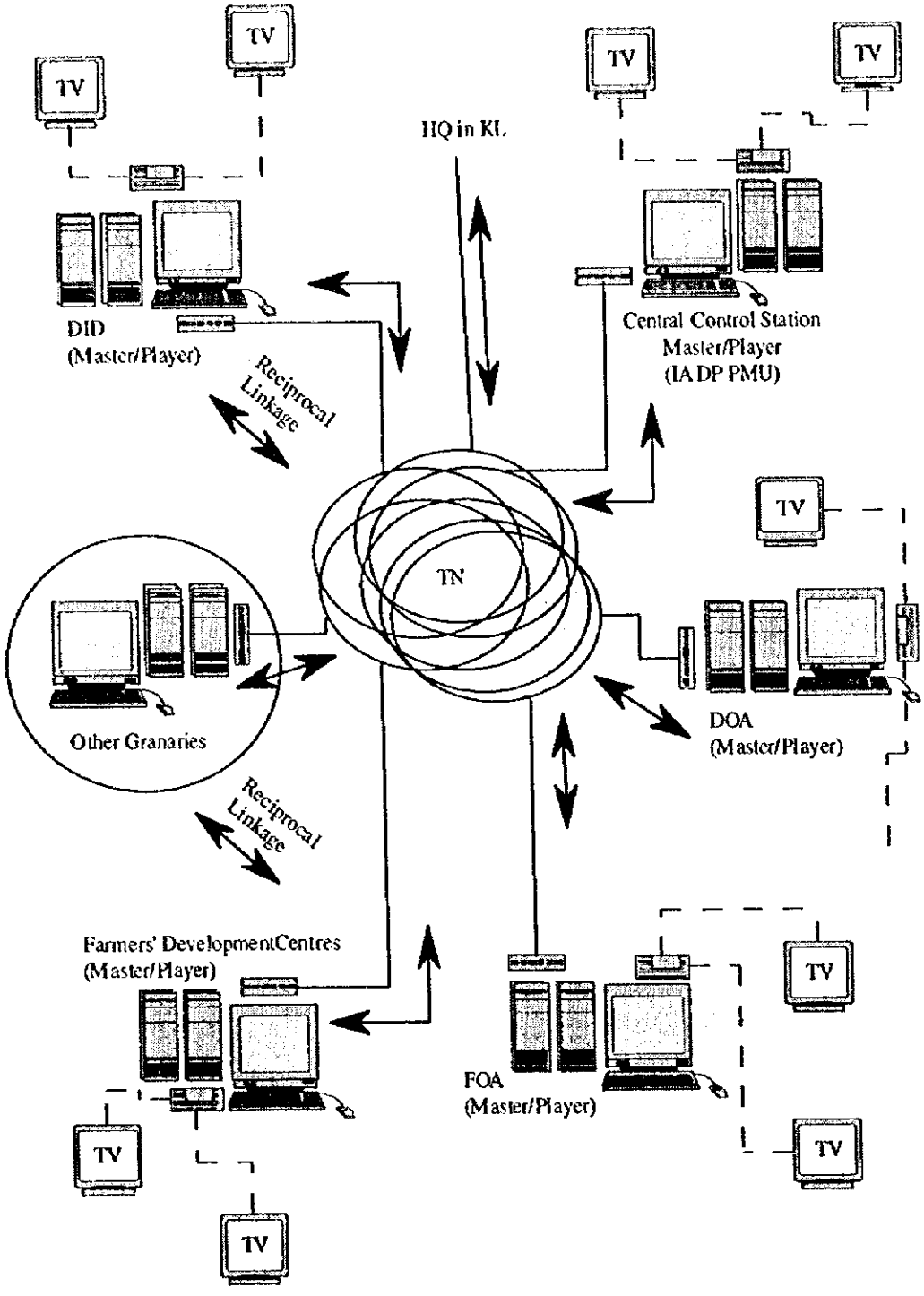


Fig. IX-6 Schematic Diagram of Irrigation Monitoring and Information Feedback System (Option in the Future)

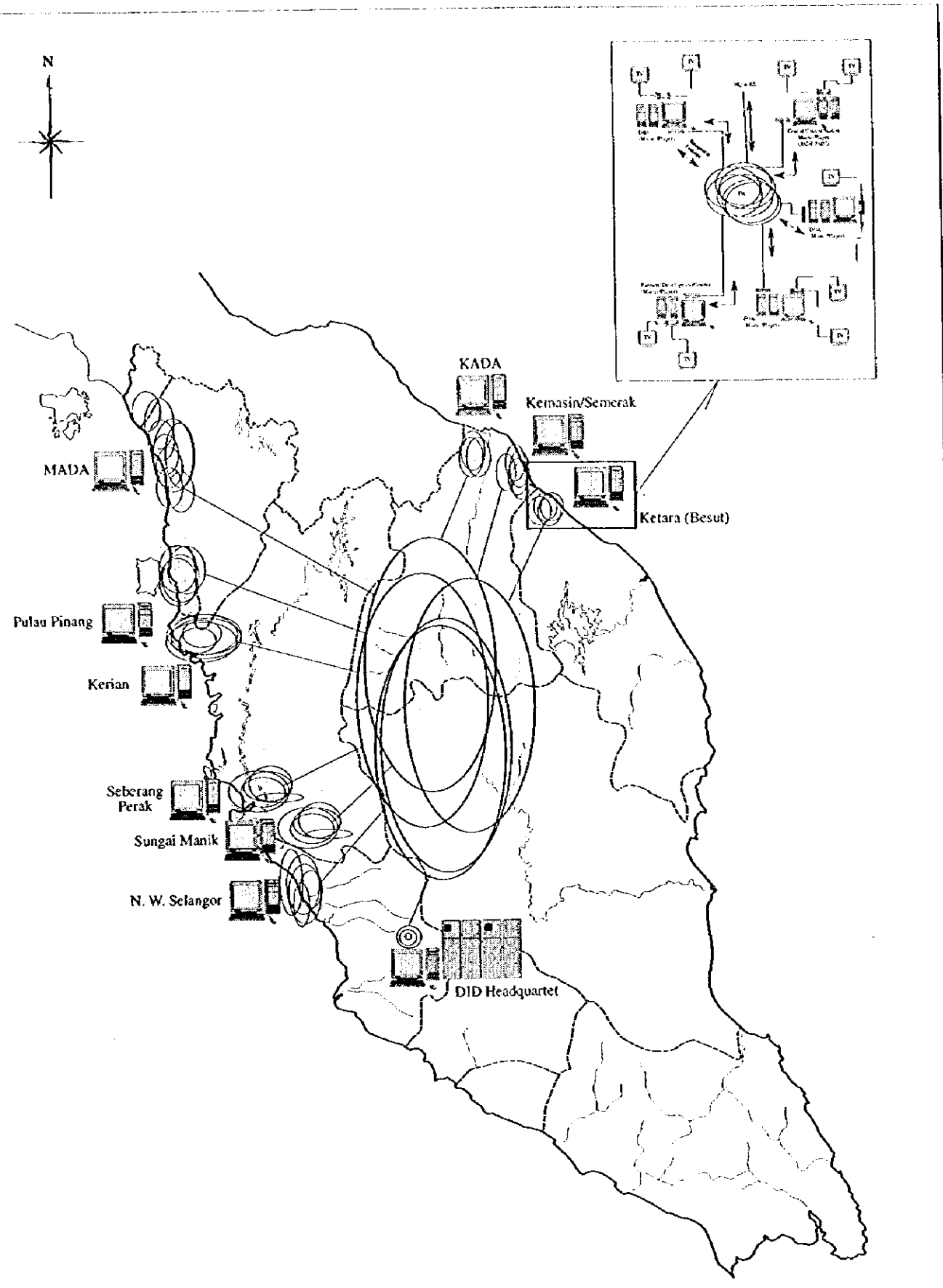


Fig. IX-7 Inter-Granary Information Linkage

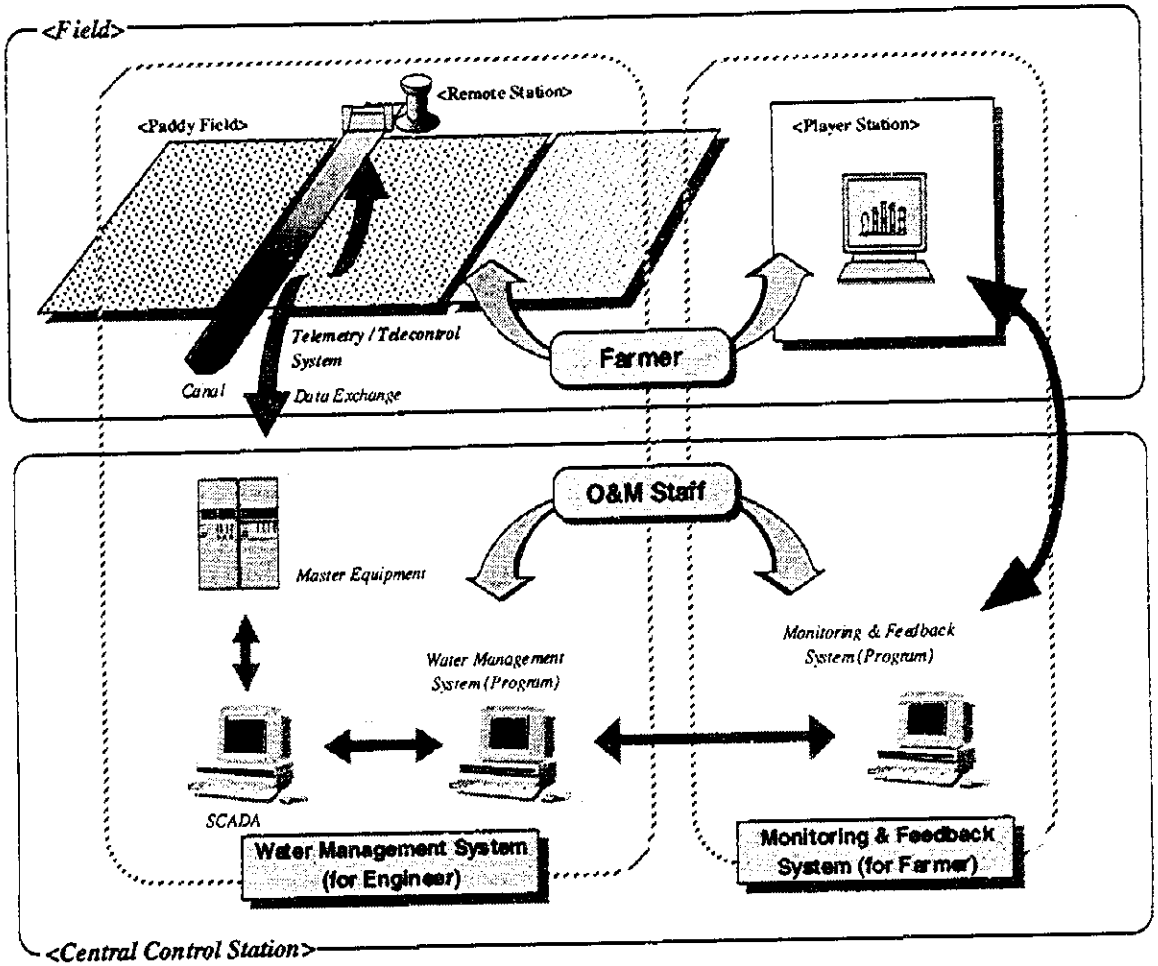


Fig. IX-8 Integration of the Water Management System and the Monitoring and Feedback System

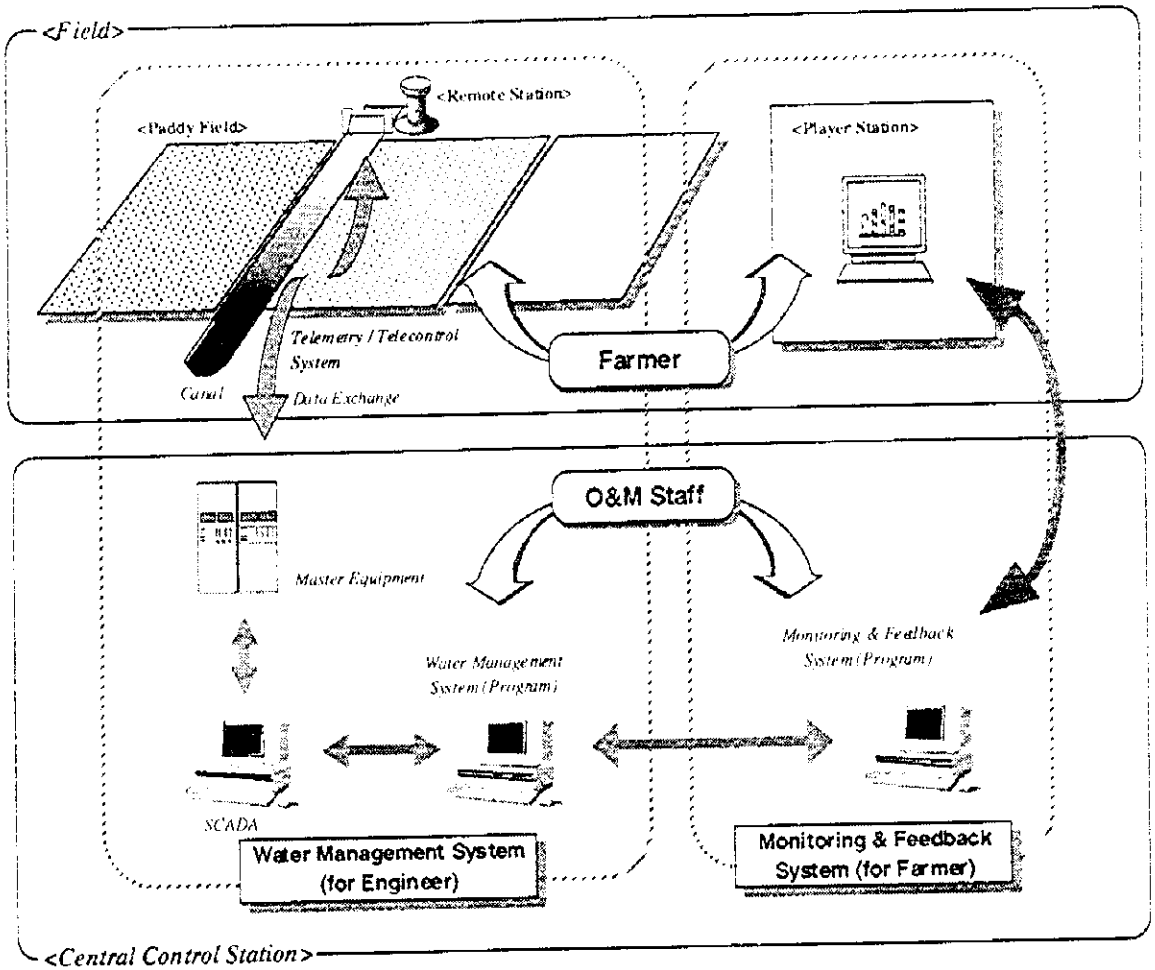
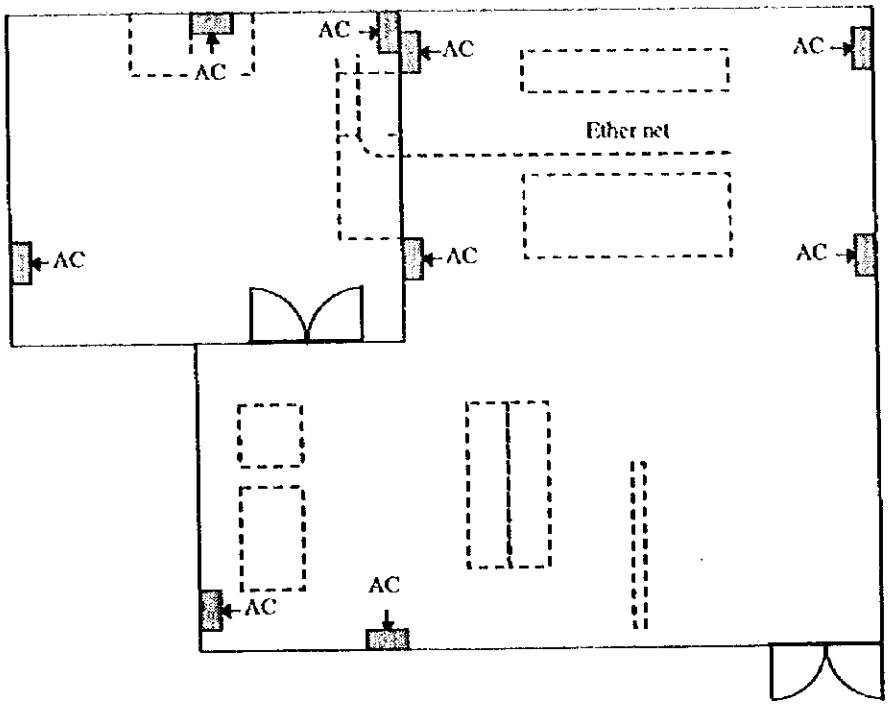


Fig. IX-8 Integration of the Water Management System and the Monitoring and Feedback System

1. AC Outlet Design



2. Equipment Layout

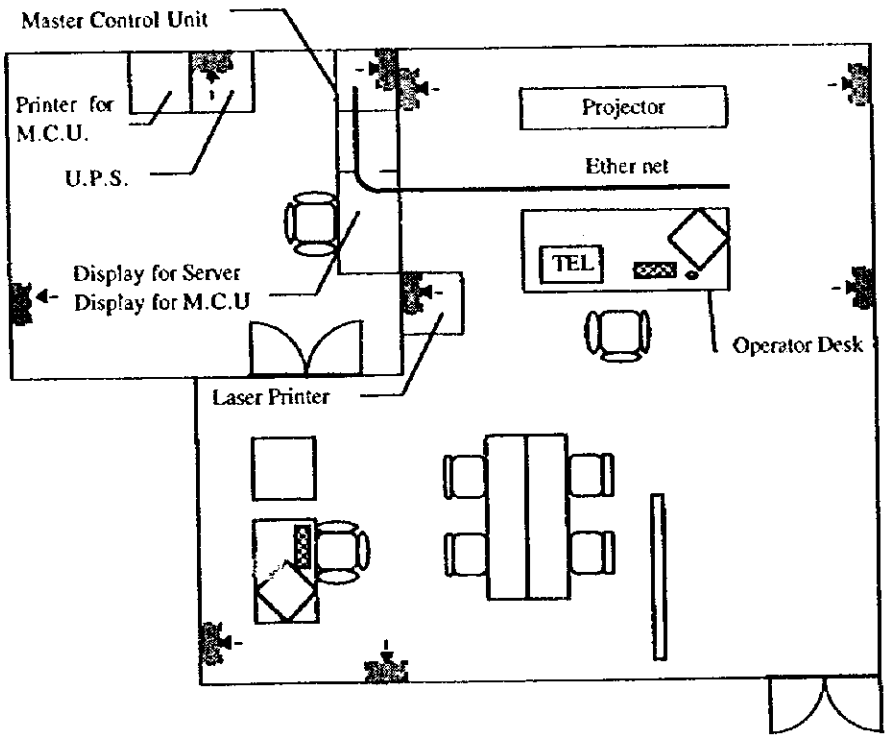


Fig. IX-9 AC Outlet Design and Equipment Layout of Central Control Station