Table III-50: In-field channel construction targets

IADP/ Scheme	Scheme/Block/ Compartment	Total in-field channel (km)	Av. annual target (km)	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	Notes
Pulau Pinang	Sg Muda	985	123		123	123	123	123	123	123	123	123					
	Pinang Tunggal	105	13		13	13	13	13	13	13	13	13					
	Sg. Jarak	42	5		5	5	5	5	5	5	5	5					
	Sg Kulim	158	20		20	20	20	20	20	20	20	20					
	Total	1,290	161		161	161	161	161	161	161	161	161					
Ketara (Besut)	Compartment 1	167	21		21	21	21	21	21	21	21	21					
	Compartment 2	153	19		19	19	19	19	19	19	19	19					
	Compartment 3	176	22		22	22	22	22	22	22	22	22					
	Compartment 4	203	25		25	25	25	25	25	25	25	25					
	Total	699	87		87	87	87	87	87	87	87	87					
Kerian	A	360	45		45	45	45	45	45	45	45	45					
	B	573	115		0	0	0	115	115	115	115	115					infield improvement for B&C after polder drainage project
	C	536	107		0	0	0	107	107	107	107	107					
	D	315	39		39	39	39	39	39	39	39	39					
	E	255	32		32	32	32	32	32	32	32	32					
	F	308	39		39	39	39	39	39	39	39	39					
	G	101	13		13	13	13	13	13	13	13	13					
	H	309	39		39	39	39	39	39	39	39	39					
	Total	2,757	345		206	206	206	428	428	428	428	428					
Sg Manik		876	110		110	110	110	110	110	110	110	110					
Sbg Perak		541	68		68	68	68	68	68	68	68	68					
Kemasin-Semerak		247	31		31	31	31	31	31	31	31	31					
	Overall total	6,410	801		663	663	663	884	884	884	884	884					

Table III-51: In-field channel estimated construction cost

IADP/ Scheme	Scheme/Block/ Compartment Scheme	Total in-field channel (km)	Total Cost (RM)	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	Notes
Pulau Pinang	Sg Muda	985	344,750		43,094	43,094	43,094	43,094	43,094	43,094	43,094	43,094					Cost @ RM0.35/m
	Pinang Tunggal	105	36,750		4,594	4,594	4,594	4,594	4,594	4,594	4,594	4,594					
	Sg. Jarak	42	14,700		1,838	1,838	1,838	1,838	1,838	1,838	1,838	1,838					
	Sg Kulim	158	55,300		6,913	6,913	6,913	6,913	6,913	6,913	6,913	6,913					
	Total	1,290	451,500		56,438	56,438	56,438	56,438	56,438	56,438	56,438	56,438					
Ketara (Besut)	Compartment 1	167	58,450		7,306	7,306	7,306	7,306	7,306	7,306	7,306	7,306					
	Compartment 2	153	53,550		6,694	6,694	6,694	6,694	6,694	6,694	6,694	6,694					
	Compartment 3	176	61,600		7,700	7,700	7,700	7,700	7,700	7,700	7,700	7,700					
	Compartment 4	203	71,050		8,881	8,881	8,881	8,881	8,881	8,881	8,881	8,881					
	Total	699	244,650		30,581	30,581	30,581	30,581	30,581	30,581	30,581	30,581					
Kenan	A	360	126,000		15,750	15,750	15,750	15,750	15,750	15,750	15,750	15,750					
	B	573	200,550		0	0	0	40,110	40,110	40,110	40,110	40,110					infield improvement for B&C after polder drainage project
	C	536	187,600		0	0	0	37,520	37,520	37,520	37,520	37,520					
	D	315	110,250		13,781	13,781	13,781	13,781	13,781	13,781	13,781	13,781					
	E	255	89,250		11,156	11,156	11,156	11,156	11,156	11,156	11,156	11,156					
	F	308	107,800		13,475	13,475	13,475	13,475	13,475	13,475	13,475	13,475					
	G	101	35,350		4,419	4,419	4,419	4,419	4,419	4,419	4,419	4,419					
	H	309	108,150		13,519	13,519	13,519	13,519	13,519	13,519	13,519	13,519					
	Total	2,757	964,950		72,100	72,100	72,100	149,730	149,730	149,730	149,730	149,730					
Sg Manik		876	306,600		38,325	38,325	38,325	38,325	38,325	38,325	38,325	38,325					
Sbg Perak		541	189,350		23,669	23,669	23,669	23,669	23,669	23,669	23,669	23,669					
Kemasin-Semerak		247	86,450		10,806	10,806	10,806	10,806	10,806	10,806	10,806	10,806					
	Total	6,410	2,243,500		231,919	231,919	231,919	309,549	309,549	309,549	309,549	309,549					

Table III-52: In-field control boxes construction targets

IADP/ Scheme	Scheme/Block/ Compartment	Total Nos Control Box (No)	Av. annual target (No)	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	Notes
Pulau Pinang	Sg Muda	2,626	328		328	328	328	328	328	328	328	328					
	Pinang Tunggal	279	35		35	35	35	35	35	35	35	35					
	Sg. Jarak	113	14		14	14	14	14	14	14	14	14					
	Sg Kulim	421	53		53	53	53	53	53	53	53	53					
	Total	3,439	430		430	430	430	430	430	430	430	430					
Ketara (Besut)	Compartment 1	741	93		93	93	93	93	93	93	93	93					
	Compartment 2	678	85		85	85	85	85	85	85	85	85					
	Compartment 3	783	98		98	98	98	98	98	98	98	98					
	Compartment 4	903	113		113	113	113	113	113	113	113	113					
	Total	3,105	388		388	388	388	388	388	388	388	388					
Kenan	A	961	120		120	120	120	120	120	120	120	120					
	B	1529	306		0	0	0	306	306	306	306	306					infield improvement for B&C after polder drainage project
	C	1430	286		0	0	0	286	286	286	286	286					
	D	841	105		105	105	105	105	105	105	105	105					
	E	680	85		85	85	85	85	85	85	85	85					
	F	820	103		103	103	103	103	103	103	103	103					
	G	270	34		34	34	34	34	34	34	34	34					
	H	825	103		103	103	103	103	103	103	103	103					
	Total	7,356	920		550	550	550	1,141	1,141	1,141	1,141	1,141					
Sg Manik		2,313	289		289	289	289	289	289	289	289	289					
Sbg Perak		1,442	180		180	180	180	180	180	180	180	180					
Kemasin-Semerak		1,097	137		137	137	137	137	137	137	137	137					
	Total	18,752	2,344		1,974	1,974	1,974	2,566	2,566	2,566	2,566	2,566					

Table III-53: In-field control boxes construction cost

IADP/ Scheme	Scheme/Block/ Compartment	Total Nos Control Box (No)	Total cost (RM)	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	Notes
Pulau Pinang	Sg Muda	2,626	157,560		19,695	19,695	19,695	19,695	19,695	19,695	19,695	19,695					Control box @ RM 60 each
	Pinang Tunggal	279	16,740		2,093	2,093	2,093	2,093	2,093	2,093	2,093	2,093					
	Sg. Jarak	113	6,780		846	846	846	846	846	846	846	846					
	Sg Kulim	421	25,260		3,158	3,158	3,158	3,158	3,158	3,158	3,158	3,158					
	Total	3,439	204,180		25,793	25,793	25,793	25,793	25,793	25,793	25,793	25,793					
Ketara (Besut)	Compartment 1	741	44,460		5,558	5,558	5,558	5,558	5,558	5,558	5,558	5,558					
	Compartment 2	678	40,680		5,085	5,085	5,085	5,085	5,085	5,085	5,085	5,085					
	Compartment 3	783	46,980		5,873	5,873	5,873	5,873	5,873	5,873	5,873	5,873					
	Compartment 4	903	54,180		6,773	6,773	6,773	6,773	6,773	6,773	6,773	6,773					
	Total	3,105	186,300		23,288	23,288	23,288	23,288	23,288	23,288	23,288	23,288					
Kerian	A	961	57,660		7,208	7,208	7,208	7,208	7,208	7,208	7,208	7,208					
	B	1529	91,740		0	0	0	18,348	18,348	18,348	18,348	18,348					infield improvement for B&C after polder drainage project
	C	1430	85,800		0	0	0	17,160	17,160	17,160	17,160	17,160					
	D	841	50,460		6,308	6,308	6,308	6,308	6,308	6,308	6,308	6,308					
	E	680	40,800		5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100					
	F	820	49,200		6,150	6,150	6,150	6,150	6,150	6,150	6,150	6,150					
	G	270	16,200		2,025	2,025	2,025	2,025	2,025	2,025	2,025	2,025					
	H	825	49,500		6,188	6,188	6,188	6,188	6,188	6,188	6,188	6,188					
	Total	7,356	508,920		32,978	32,978	32,978	68,486	68,486	68,486	68,486	68,486					
Sg Manik		2,313	138,780		17,348	17,348	17,348	17,348	17,348	17,348	17,348	17,348					
Sbg Perak		1,442	86,520		10,815	10,815	10,815	10,815	10,815	10,815	10,815	10,815					
Kemasin-Semerak		1,097	65,820		8,228	8,228	8,228	8,228	8,228	8,228	8,228	8,228					
	Total	18,752	1,190,520		118,448	118,448	118,448	153,956	153,956	153,956	153,956	153,956					

Table III-54 Cost Summary for In-field Infrastructure Improvement Works

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	961,950
	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
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 III-55: Target formation of consolidated farms

IADP/ Scheme	Scheme/Block/ Compartment	No of Consolidated farms	Av. annual target (No)	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	Notes
Pulau Pinang	Sg Muda	1,377	172		172	172	172	172	172	172	172	172					
	Pinang Tunggal	188	24		24	24	24	24	24	24	24	24					
	Sg. Jarak	78	10		10	10	10	10	10	10	10	10					
	Sg Kulim	277	35		35	35	35	35	35	35	35	35					
	Total	1,920	240		240	240	240	240	240	240	240	240					
Ketara (Besut)	Compartment 1	411	51		51	51	51	51	51	51	51	51					
	Compartment 2	383	48		48	48	48	48	48	48	48	48					
	Compartment 3	435	54		54	54	54	54	54	54	54	54					
	Compartment 4	492	62		62	62	62	62	62	62	62	62					
	Total	1,721	215		215	215	215	215	215	215	215	215					
Kerian	A	480	60		60	60	60	60	60	60	60	60					
	B	800	160		0	0	0	160	160	160	160	160					program for B&C after polder drainage project
	C	792	158		0	0	0	158	158	158	158	158					
	D	672	84		84	84	84	84	84	84	84	84					
	E	469	59		59	59	59	59	59	59	59	59					
	F	540	68		68	68	68	68	68	68	68	68					
	G	366	46		46	46	46	46	46	46	46	46					
	H	593	74		74	74	74	74	74	74	74	74					
	Total	4,712	589		390	390	390	708	708	708	708	708					
Sg Manik		1,264	158		158	158	158	158	158	158	158	158					
Sbg Perak		801	100		100	100	100	100	100	100	100	100					
Kemasin-Semerak		2,298	287		287	287	287	287	287	287	287	287					
	Total	12,716	1,590		1,391	1,391	1,391	1,709	1,709	1,709	1,709	1,709					

Table III-56: Software and Hardware Cost Estimate for Irrigation Monitoring and Feedback System (1997)

	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 III-57 Irrigation Monitoring and Feedback System Set-up and Cost Estimate

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	58,800	646,800
2. Ketara (Besut)	PMU			1								
	DID Component			1								
	DOA Component			1								
	DID O&M Central Control	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	668,050
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	685,850
4. Sungai Manik	PMU Sub-Office		1	1								
	DID O&M Tk Intan	1	1									
	Farmers Development Centres		3									
		1	5	1	227,000	35,500	2,000	227,000	177,500	2,000	40,650	447,150
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	58,800	642,800
6. Kemasin-Semerak	PMU			1								
	DID Component			1								
	DOA Component			1								
	DID O&M Central Control	1	1	1								
	DID Pasir Putih		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 III-58: Irrigation Monitoring and Feedback System Set-up program

IADP/Scheme	Location	(A) Master (Set)	(B) Player & TV (Set)	(C) Additional display (Set)	Year 0 A	0 B	0 C	1 A	1 B	1 C	2 A	2 B	2 C	3 A	3 B	3 C	4 A	4 B	4 C	5 A	5 B	5 C	6 A	6 B	6 C	7 A	7 B	7 C	8 A	8 B	8 C	9 A	9 B	9 C	10 A	10 B	10 C	11 A	11 B	11 C	12 A	12 B	12 C	Notes
IADP PP	PMU			1						1																																		
	DID Component			1						1																																		
	DOA Bumbung Lima		1									1																																
	DID O&M Central Control	1	1	1				1	1	1																																		
	DID Field Office		2						1			1																																
	Farmers Development Centres		4						1			1			1			1																										
	PPK		3									1			1			1																										
		1	11	3	0	0	0	1	3	3	0	4	0	0	2	0	0	2	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	
KETARA (Besut)	PMU			1						1																																		Yr 0 for pilot project
	DID Component			1								1																																
	DOA Component			1								1																																
	DID O&M Central Control	1	1	1				1				1	1																															
	DID District Office		1									1																																
	Besut Barrage		1												1																												
	DID Compartment Stations		4						1			2			1																												
	Farmers Centres		4									2			2																												
		1	11	4	0	0	0	1	1	1	0	6	1	0	4	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	0	
Kenan	PMU			1						1																																		
	DID Component			1						1																																		
	DOA Component (Spg Tiga)		1									1																																
	DID O&M Central Control	1	1	1				1	1	1																																		
	Farmers Development Centres		6						1			3			2																												
	PPK		2												1			1																										
		1	10	3	0	0	0	1	2	3	0	4	0	0	3	0	0	1	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	
Sg. Manik	PMU Sub-Office		1										1																														
	DID O&M Tk Intan	1	1	1							1	1	1																															
	Farmers Development Centres		3									1			2																												
		1	5	1	0	0	0	0	0	0	1	2	2	0	2	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	0	
Sbg Perak	DID O&M Central Control	1	1	1							1	1	1																														
	Telok Sena Intake		1												1																												
	DOA		1												1																												
	FELCRA		1												1																												
	Farmers Development Centres		5									1			2			3																								
		1	10	1	0	0	0	0	0	0	1	2	1	0	5	0	0	3	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	
Kemasin-Semerak	PMU			1																		1																				
	DID Component			1																		1																				
	DOA Component			1																		1																				
	DID O&M Central Control	1	1	1																	1	1	1																				
	DID Pasir Putih		1																			1																				
	Farmers Development Centres		7																			1		3			3															
		1	9	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	4	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Min. of Agriculture	Strategic Planning Unit		1	2								1	2																													
DID HQ	Irrigation Division		1	2					1	2																																
DOA HQ	Paddy Division		1	2					1	2																																
	Grand Total	6	59	22	0	0	0	3	8	11	2	19	8	0	16	0	0	6	0	1	3	4	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Table III-59: Irrigation Monitoring and Feedback System estimated set-up cost

IADP/Scheme	Location	Total Cost (RM)	Year 0	1	2	3	4	5	6	7	8	9	10	11	12
IADP PP	PMU			2,200											
	DID Component			2,200											
	DOA Bumbung Lima				39,050										
	DID O&M Central Control			290,950											
	DID Field Office			39,050	39,050										
	Farmers Development Centres			39,050	39,050	39,050	39,050								
	PPK				39,050	39,050	39,050								
	Total	685,850	0	373,450	156,200	78,100	78,100	0	0	0	0	0	0	0	0
KETARA (Besut)	PMU		2,200												
	DID Component			2,200											
	DOA Component			2,200											
	DID O&M Central Control		249,700	41,250											
	DID District Office			39,050											
	Besut Barrage				39,050										
	DID Compartment Stations		39,050	78,100	39,050										
	Farmers Centres			78,100	78,100										
		688,050	290,950	240,900	156,200	0	0	0	0	0	0	0	0	0	0
Kenan	PMU			2,200											
	DID Component			2,200											
	DOA Component (Spg Tiga)				39,050										
	DID O&M Central Control			290,950											
	Farmers Development Centres			39,050	117,150	78,100									
	PPK					39,050	39,050								
		646,600	0	334,400	156,200	117,150	39,050	0	0	0	0	0	0	0	0
Sg. Manik	PMU Sub-Office					2,200									
	DID O&M Tk Intan					290,950									
	Farmers Development Centres					39,050	78,100								
		410,300	0	0	0	332,200	78,100	0	0	0	0	0	0	0	0
Sbg Perak	DID O&M Central Control						290,950								
	Telok Sena Intake							39,050							
	DOA							39,050							
	FELCRA							39,050							
	Farmers Development Centres						39,050	78,100	117,150						
		642,400	0	0	0	0	330,000	195,250	117,150	0	0	0	0	0	0
Kemasin-Semerak	PMU							2,200							
	DID Component							2,200							
	DOA Component							2,200							
	DID O&M Central Control							290,950							
	DID Pasir Putih							39,050							
	Farmers Development Centres							39,050	117,150	117,150					
		609,950	0	0	0	0	0	375,650	117,150	117,150	0	0	0	0	0
Min. of Agriculture	Strategic Planning Unit	43,450			43,450										
DID HQ	Irrigation Division	43,450		43,450											
DOA HQ	Paddy Division	43,450		43,450											
	Grand Total	3,813,700	290,950	1,035,650	512,050	527,450	525,250	570,900	234,300	117,150	0	0	0	0	0

Unit Cost	(RM)
Master	249,700
Player	39,050
Add. Display	2,200
(Cost incl.10% for internal wiring)	

Table III-60: WUG Formation targets and training cost estimates for Kerian Scheme

IADP/Scheme	Area (ha)	Farmers (Nos)	WUGs (Nos)	Area/WUG (ha/WUG)	Farmers/WUG (No/WUG)	On-site training cost (RM)	Off-site training cost (RM)	Total Cost (RM)	Cost/ha (RM/ha)	Notes
Compartment A&B	6,403		20	320						1. Area is net area 2. Nos of farmers are estimated figures and based on nos. of farm households 3. On site training is 2 times 1 day duration each at RM 5/person/day 4. Off-site training is at NWMTC 3 days duration +2 days travel for WUG leaders (2 per WUG) at RM 400/person/day
Compartment C	3,960		4	990						
Compartment D	3,362		17	198						
Compartment E&F	5,041		22	229						
Compartment G&H	4,794		21	228						
Total	23,560	13,485	84	280	161	134,850	201,600	336,450	14	

Table III-61: In-field infrastructure improvement works and cost estimates for Kerian Scheme (Paddy parcel lots and area source: Paddy Production Statistics Secretariat, DOA)

IADP	Nos of lots*	Area* (ha)	Av. Area (ha/lot)	Lots for intra.improv (Nos.)	Area for infra. improv. (ha.)	Levelling by DOA (ha.)	Levelling by DOA (RM)	Levelling by Private Sect. (ha.)	Levelling by Private Sect. (RM inc.)	Total Cost of levelling (RM)	In-field channel constr. (km)	Cost of In-field channel constr. (RM)	In-field control boxes (Nos.)	In-field control boxes (RM)	Total on-farm infra improv. (RM)	Notes
(a) Compartment A	1,955	2,402	1	1,955	2,402	961	240,250	1,441	504,350	744,600	360	126,000	961	57,660	928,260	Assumptions: a) 90% of lots & area need infra improvement. b) 40% of land levelling by DOA @ RM 250/ha. c) 60% of land levelling by Private Sector @ RM 350/ha. d) In-field channel density @ 150m/ha, cost @ RM0.35/m e) Two control boxes for every lot @ RM 60/box
(b) Compartment B	2,939	4,001	1	2,803	3,822	1,529	382,250	2,293	802,550	1,184,800	573	200,550	1,529	91,740	1,477,090	
(c) Compartment C	2,285	3,960	2	2,039	3,575	1,430	357,500	2,145	750,750	1,108,250	536	187,600	1,430	85,800	1,381,650	
(d) Compartment D	2,624	3,362	1	1,665	2,103	841	210,250	1,262	441,700	651,950	315	110,250	841	50,460	812,660	
(e) Compartment E	1,538	2,344	2	1,082	1,700	680	170,000	1,020	357,000	527,000	255	89,250	680	40,800	657,050	
(f) Compartment F	1,773	2,697	2	1,246	2,050	820	205,000	1,230	430,500	635,500	308	107,800	820	49,200	792,500	
(g) Compartment G	1,385	1,830	1	411	675	270	67,500	405	141,750	209,250	101	35,350	270	16,200	260,800	
(h) Compartment H	2,142	2,964	1	1,450	2,062	825	206,250	1,237	432,950	639,200	309	108,150	825	49,500	796,850	
Total	16,641	23,560	1	12,651	18,389	7,356	1,839,000	11,033	3,861,550	5,700,550	2,757	964,950	7,356	508,920	7,174,420	Av. cost of on-farm infra improv. = RM/ha. 390

* Lot and Area are paddy parcels

Table III-62: Land consolidation estimates for Kerian Scheme

Scheme/Subscheme	Blocks/Compartment	Nos of Farmers	Nos of lots*	Area* (ha)	Av. Area (ha/lot)	Av. no. of lots per consolidation	Estmd no of consolidated farms	Notes
Kerian	A		1,955	2,402	1.23	4	480	Per consolidated farm is 5ha.
	B		2,939	4,001	1.36	4	800	
	C		2,285	3,960	1.73	3	792	
	D		2,624	3,362	1.28	4	672	
	E		1,538	2,344	1.52	3	469	
	F		1,773	2,697	1.52	3	540	
	G		1,385	1,830	1.32	4	366	
	H		2,142	2,964	1.38	4	593	
	Total	13,485	16,641	23,560	1.42	4	4,712	

Table III-63: WUG Formation targets and training cost estimates for Besut Scheme

Compartment	Area (ha)	Farmers (Nos)	WUGs (Nos)	Area/WUG (ha/WUG)	Farmers/WUG (Nos/WUG)	On-site training cost (RM)	Off-site training cost (RM)	Total Cost (RM)	Cost/ha (RM/ha)	Notes
Compartment 1	1,235	659	8	154	82	6,590	6,400	12,990	11	1 Area is net area
Compartment 2	1,148	509	5	230	102	5,090	4,000	9,090	8	2 Nos of farmers are estimated figures and based on nos. of farm households 3 On site training is 2 times 1 day duration each at RM 5/person/day
Compartment 3	1,306	858	8	163	107	8,580	6,400	14,980	11	4 Off-site training is at NWMTC 3 days duration +2 days travel for WUG leaders (2 per WUG) at RM 400/person/day
Compartment 4	1,475	1,028	9	164	114	10,280	7,200	17,480	12	
Total	5,164	3,054	30	172	102	30,540	72,000	102,540	20	

Table III-64: In-field improvement works and cost estimates for Besut Scheme (Paddy parcel lots and area source: Paddy Production Statistics Secretariat, DOA)

Compartment	Nos of lots*	Area* (ha)	Av. Area (ha/lot)	Lots for infra.improv. (Nos.)	Area for infra. improv. (ha.)	Leveling by DOA (ha.)	Leveling by DOA (RM)	Leveling by Private Sect. (ha.)	Leveling by Private Sect. (RM only)	Total Cost of leveling (RM)	In-field channel constr. (km)	Cost of In-field channel constr. (RM)	In-field control boxes (Nos.)	In-field control boxes (RM)	Total on-farm infra improv. (RM)	Notes
(a) Compartment 1	1,302	1,235	0.95	1,172	1,111	444	111,000	667	233,450	344,450	167	58,450	741	44,460	447,360	Assumptions: a) 90% of lots & area need infra improvement b) 40% of land leveling by DOA @ RM 250/ha c) 60% of land leveling by Private Sector @ RM 350/ha d) In-field channel density @ 150m/ha cost @ RM1.35/m e) 12 control boxes for every lot @ RM 60/box Av. cost of on-farm infra improv. = RM/ha 403
(b) Compartment 2	1,069	1,148	1.07	962	1,017	407	101,750	610	213,500	315,250	153	53,550	678	40,680	409,480	
(c) Compartment 3	1,715	1,306	0.76	1,544	1,175	470	117,500	705	246,750	364,250	176	61,600	783	46,980	472,830	
(d) Compartment 4	1,704	1,475	0.87	1,534	1,353	542	135,500	811	283,850	419,350	203	71,050	903	54,180	544,580	
Total	5,790	5,164	0.89	5,212	4,656	1,863	465,750	2,793	977,550	1,443,300	699	244,650	3,105	186,300	1,874,250	

* Lot and Area are paddy parcels

Table III-65: Land consolidation estimates for Besut Scheme

Scheme/Sub-scheme	Blocks/Compartment	Nos of farmers	Nos of lots*	Area* (ha)	Av. Area (ha/lot)	Av. no. of lots per consolidation	Estimated no of consolidated farms	Notes
Besut	1	659	1,302	1,235	0.95	3	411	Per consolidated farm is 3ha.
	2	509	1,069	1,148	1.07	3	383	
	3	858	1,715	1,306	0.76	4	435	
	4	1,028	1,704	1,475	0.87	3	492	
	Total	3,054	5,790	5,164	0.89	3	1,721	

Table III-66: WUG Formation targets and training cost estimates for IADP Pulau Pinang

Blocks	Area (ha)	Farmers (Nos)	WUGs (Nos)	Area/WUG (ha/WUG)	Farmers/WUG (No/WUG)	On-site training cost (RM)	Off-site training cost (RM)	Total Cost (RM)	Cost/ha (RM/ha)	Notes
Sungai Muda	6,888		105	66						1 Area is net area 2 Nos of farmers are estimated figures and based on nos. of farm households 3 On-site training is 2 times 1 day duration each at RM 5/person/day 4 Off-site training is at NWMTC 3 days duration +2 days travel for WUG leaders (2 per WUG) at RM 400/person/day 5 IADP Pulau Pinang exclude Sg. Burong scheme
Sungai Kulim	1,387		10	139						
Pinang Tunggal	938		7	134						
Padang Menora & Pokok Tampang	388		3	129						
Total	9,601	7,301	125	77	58	25,000	300,000	323,000	34	

Table III-67: In-field infrastructure improvement works and cost estimates for IADP Pulau Pinang
(Paddy parcel lots and area source: Paddy Production Statistics Secretariat, DOA)

Scheme	Nos of lots*	Area* (ha)	Av. Area (ha/lot)	Lots for infra.improv. (Nos.)	Area for infra. improv. (ha.)	Leveling by DOA (ha.)	Leveling by DOA (RM)	Leveling by Private Sect. (ha.)	Leveling by Private Sect. (RM mil.)	Total Cost of leveling (RM)	In-field channel constr. (km)	Cost of in-field channel constr. (RM)	In-field control bunds (Nos.)	In-field control bunds (RM)	Total on-farm infra.improv. (RM)	Notes
(a) Sg Muda	11,129	6,888	0.62	10,129	6,564	2,626	656,500	3,938	1,378,300	2,034,800	985	344,750	2,626	157,560	2,537,110	Assumptions: a) 90% of lots & area need infra improvement.
(b) Pasung Tunggal	1,248	938	0.75	1,123	697	279	69,750	418	146,300	216,050	105	36,750	279	16,740	269,540	b) 40% of land leveling by DOA @ RM 250/ha. c) 60% of land leveling by Private Sector @ RM 350/ha.
(c) Sg. Jarak	427	388	0.91	384	283	113	28,250	170	59,500	87,750	42	14,700	113	6,780	109,230	d) In-field channel density @ 150m/ha cost @ RM0.35/m e) Two control bunds for every lot @ RM 60/bnd.
(d) Sg Kulim	1,427	1,387	0.97	1,284	1,053	421	105,250	632	221,200	326,450	158	55,300	421	25,260	402,010	Av. cost/ha. improvement (RM):
Total	14,231	9,601		12,920	8,597	3,439	859,750	5,158	1,805,300	2,665,050	1,290	451,500	3,439	206,340	3,320,730	386

Table III-68: Land consolidation estimates for IADP Pulau Pinang

Scheme/Subscheme	Blocks/Compartmental	Nos of farmers	Nos of lots*	Area* (ha)	Av. Area (ha/lot)	Av. no. of lots per consolidation	Estimated no of consolidated farms	Notes
Muda sub-scheme	M1		2,186					Per consolidated farm is 5ha.
	M2		911					
	M3		2,590					
	M4		666					
	M5		3,281					
	M6		1,495					
			11,129	6,888	0.62	8	1,437	
Kulim sub-scheme	K1b&K2a		462					
	K3		553					
	K4		407					
			1,427	1,387	0.97	5	272	
Pasung Tunggal	P1A		332					
sub-scheme	P2		911					
			1,248	938	0.75	7	180	
Sg Jarak sub-scheme	Pokok Tampang		193					
	Padang Mensira		234					
			427	388	0.91	6	78	
	Total IADP Pasung	7,301	14,231	9,601	0.67	7	1920	

FIGURES

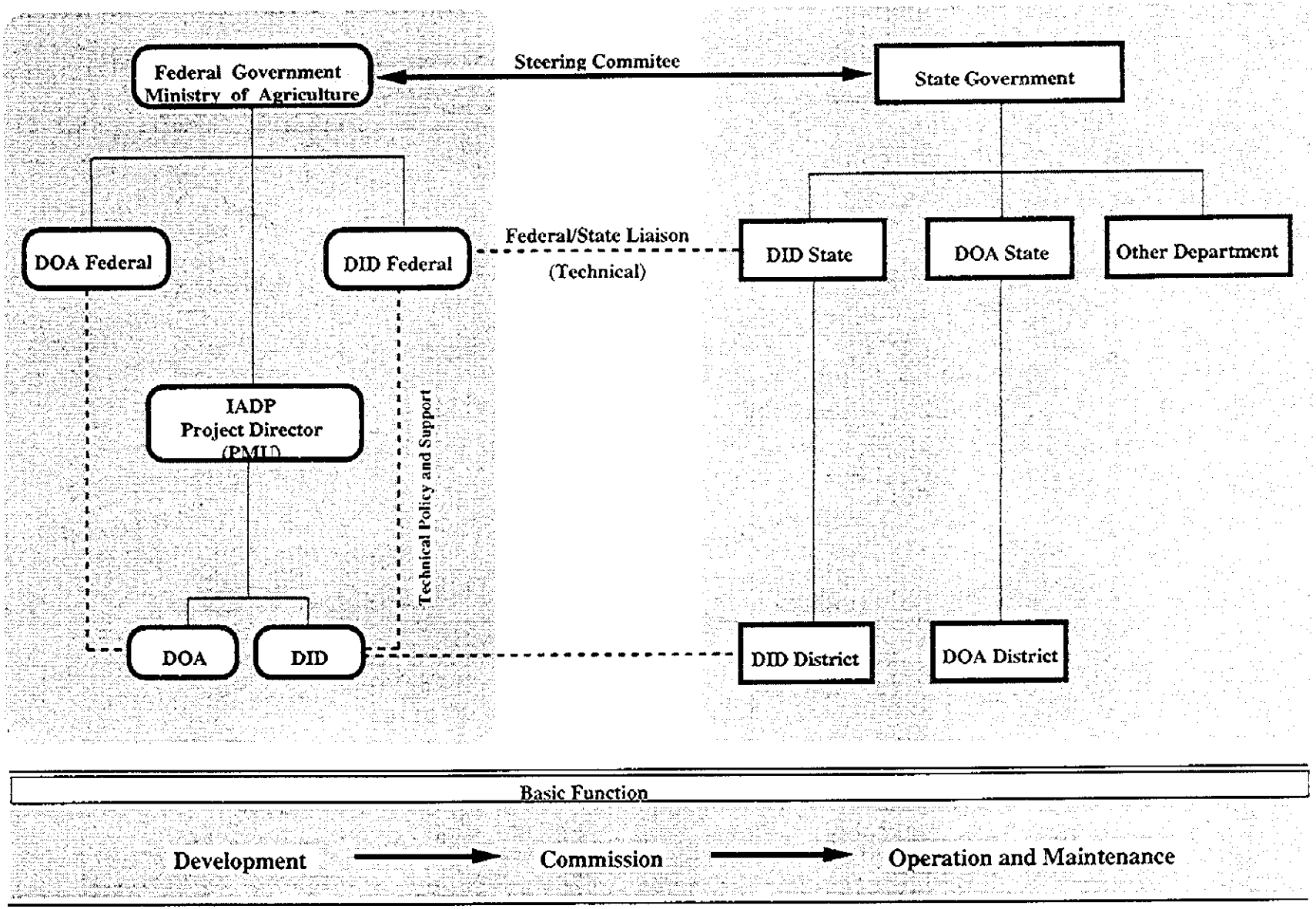


Fig. III-1 General Organization Chart of IADP

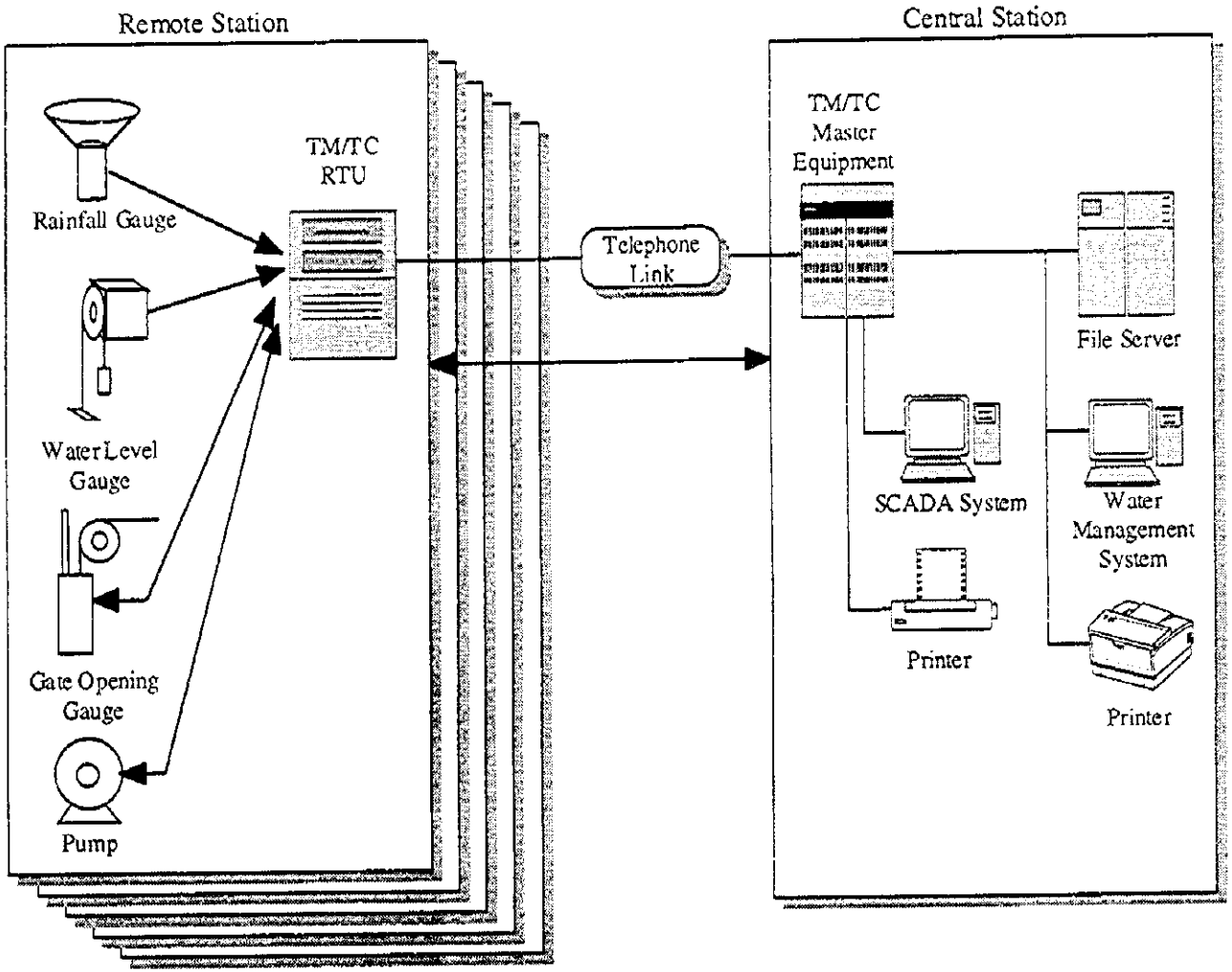


Fig. III-2 Schematic Diagram of Telemetry and Telecontrol System

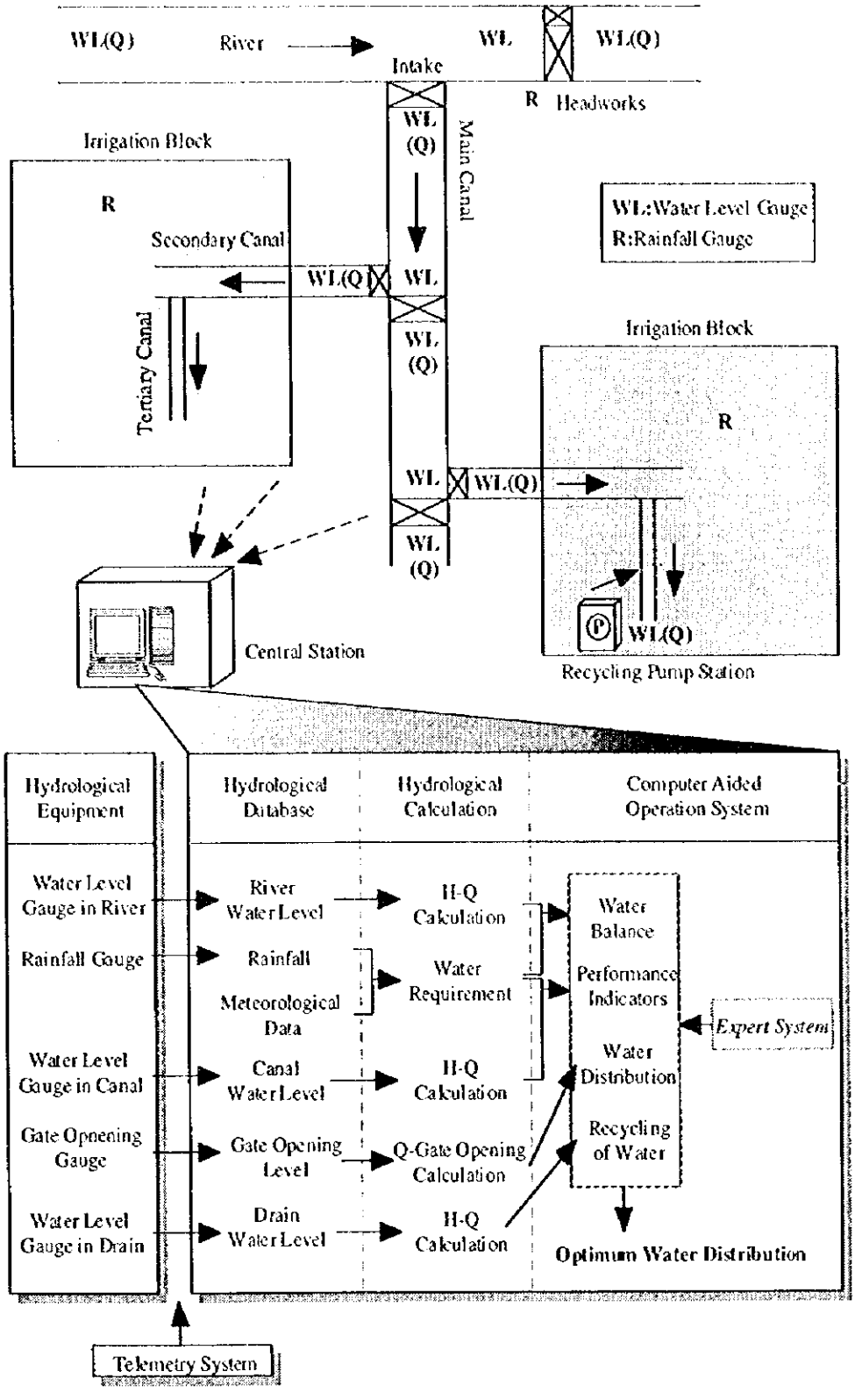


Fig. III-3 Schematic Diagram of Telemetry System

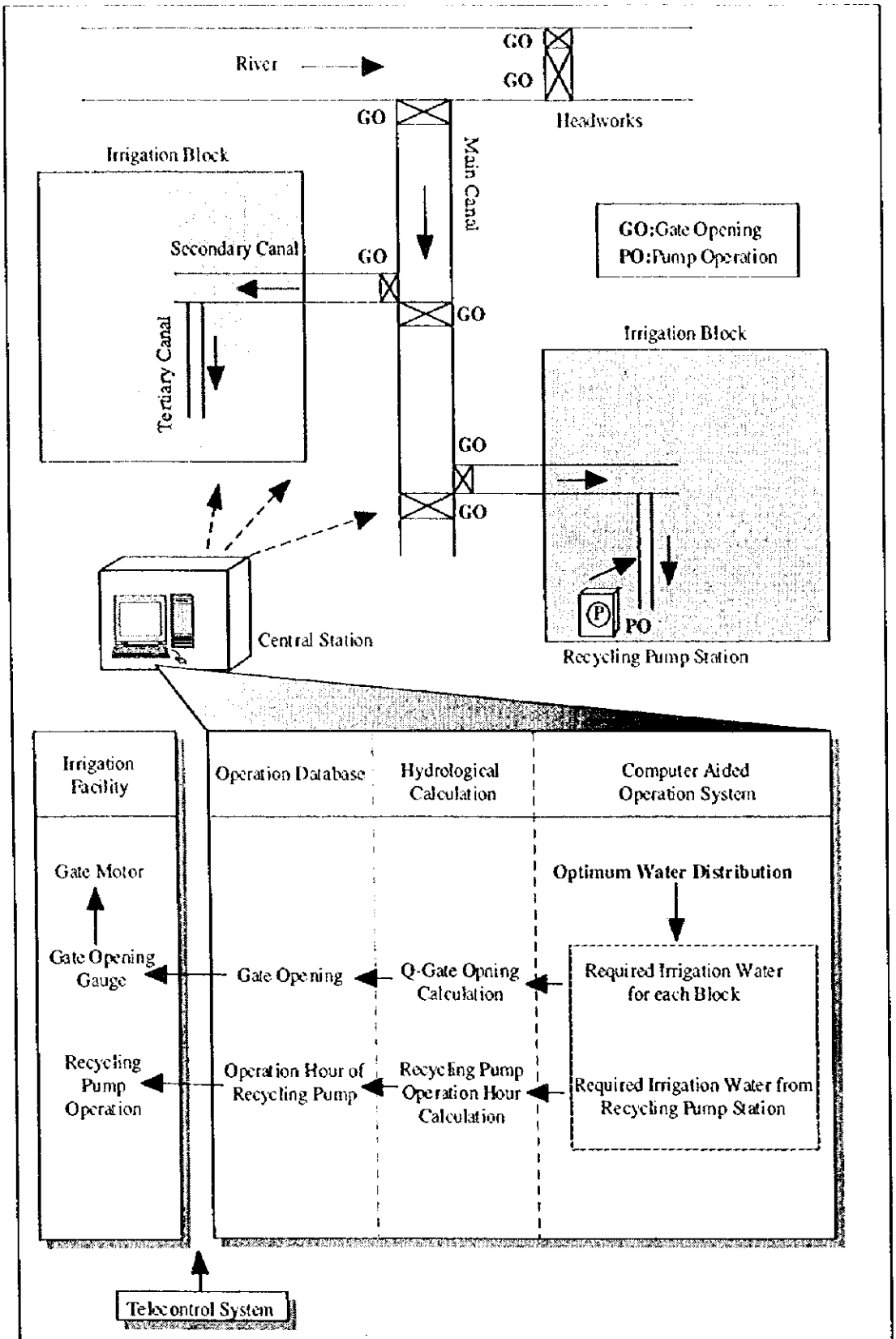


Fig. III-4 Schematic Diagram of Telecontrol System

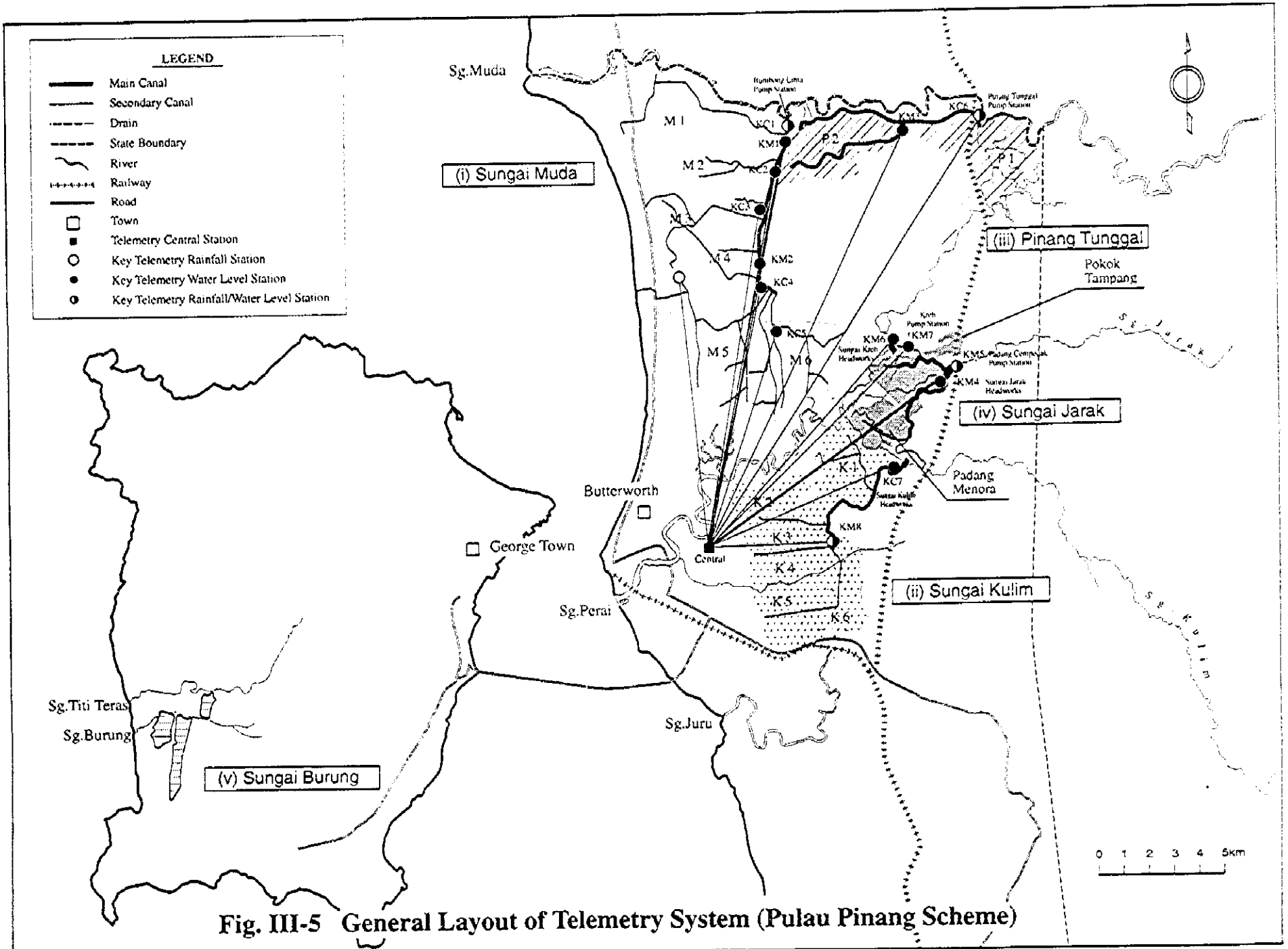


Fig. III-5 General Layout of Telemetry System (Pulau Pinang Scheme)

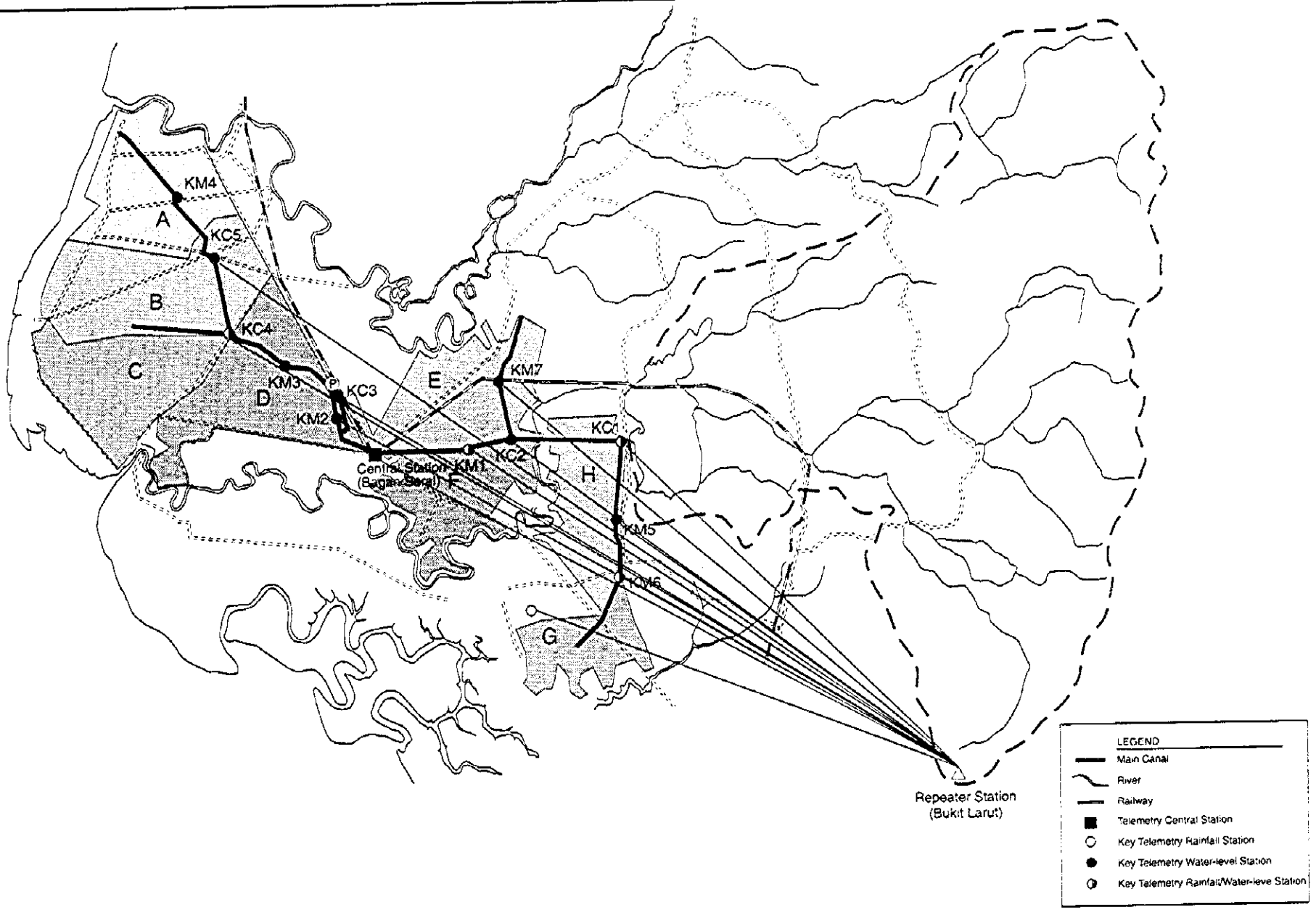


Fig. III-6 General Layout of Telemetry System (Kerian Scheme)

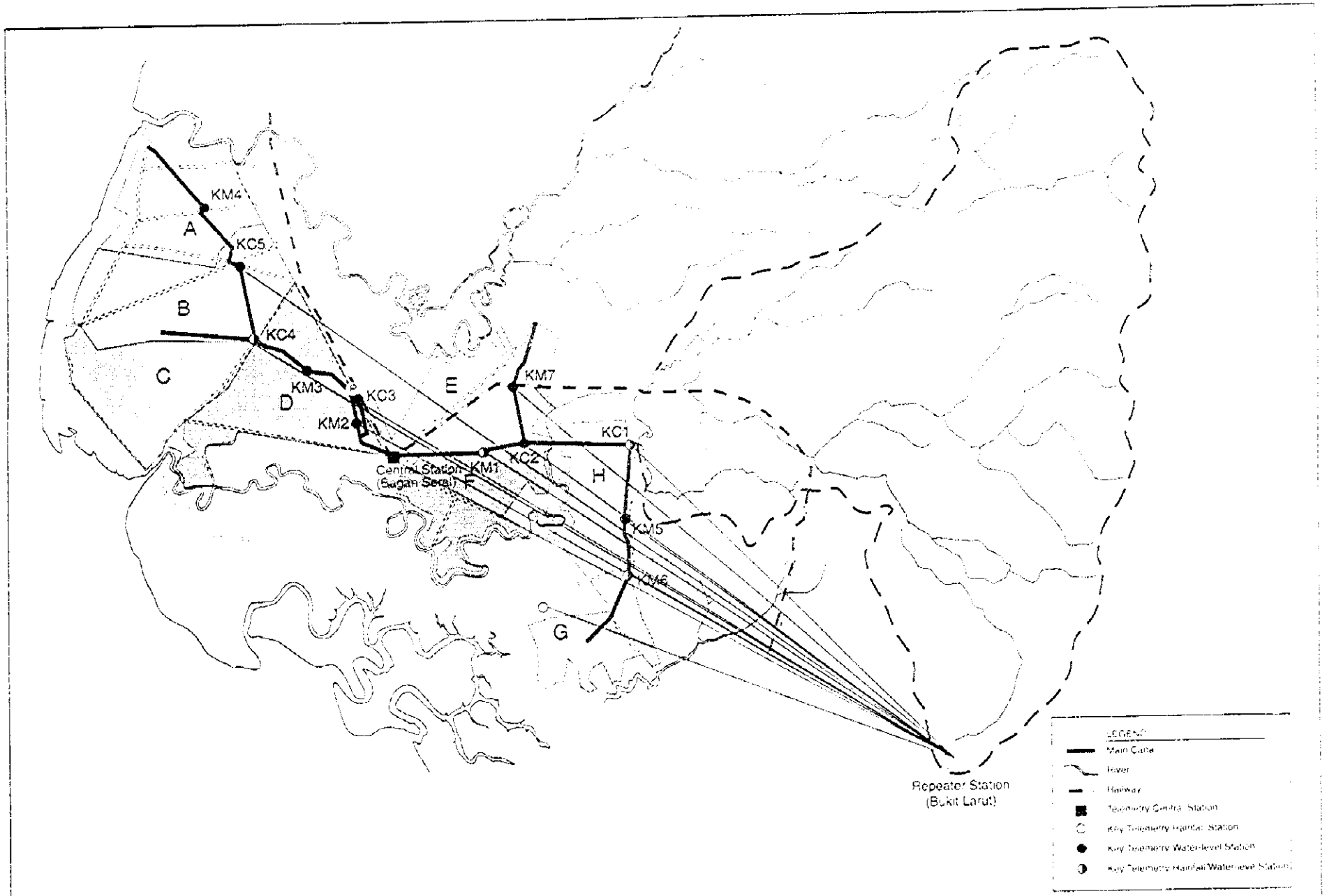


Fig. III-6 General Layout of Telemetry System (Kerian Scheme)

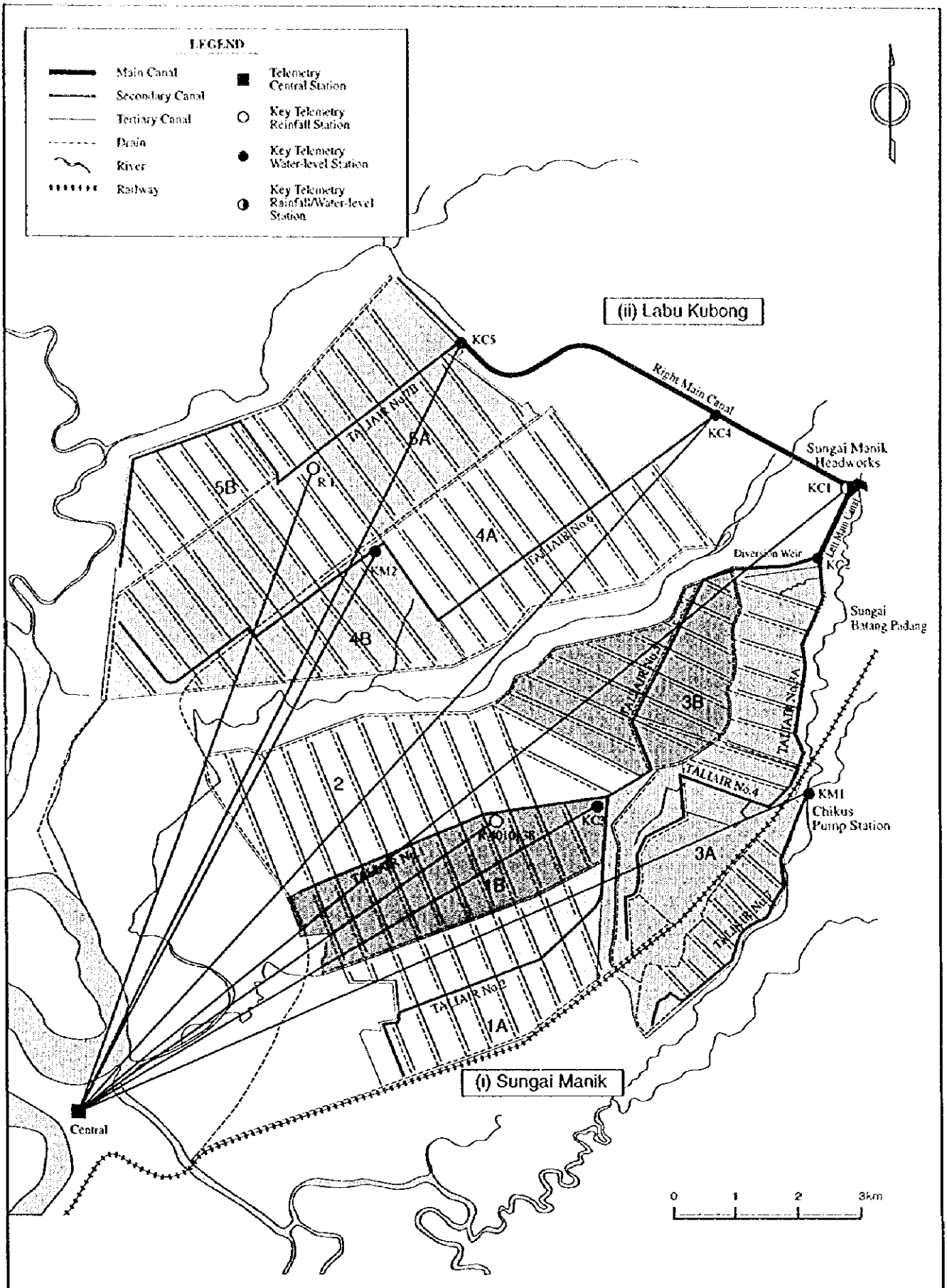


Fig. III-7 General Layout of Telemetry System (Sungai Manik Scheme)

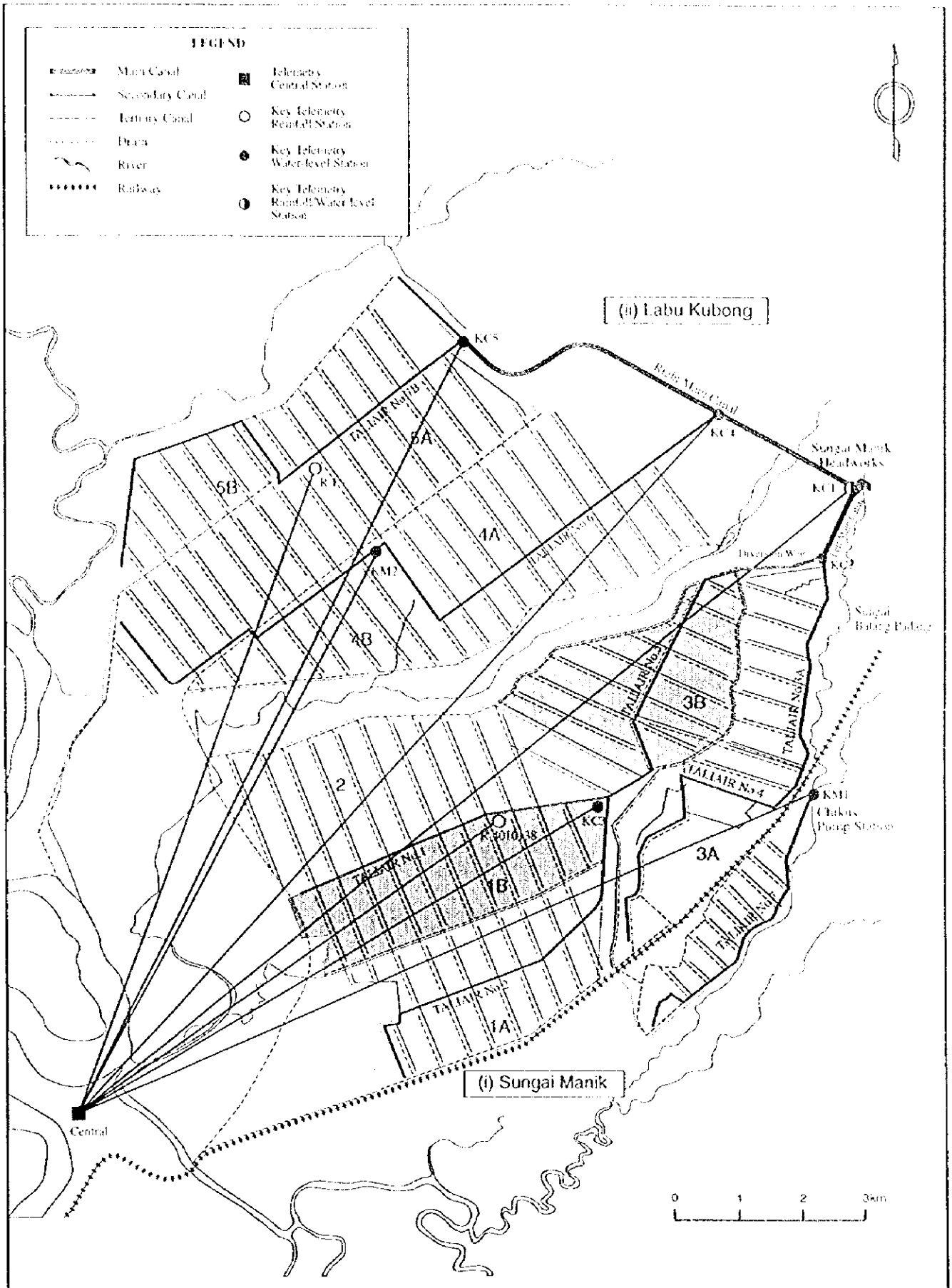


Fig. III-7 General Layout of Telemetry System (Sungai Manik Scheme)

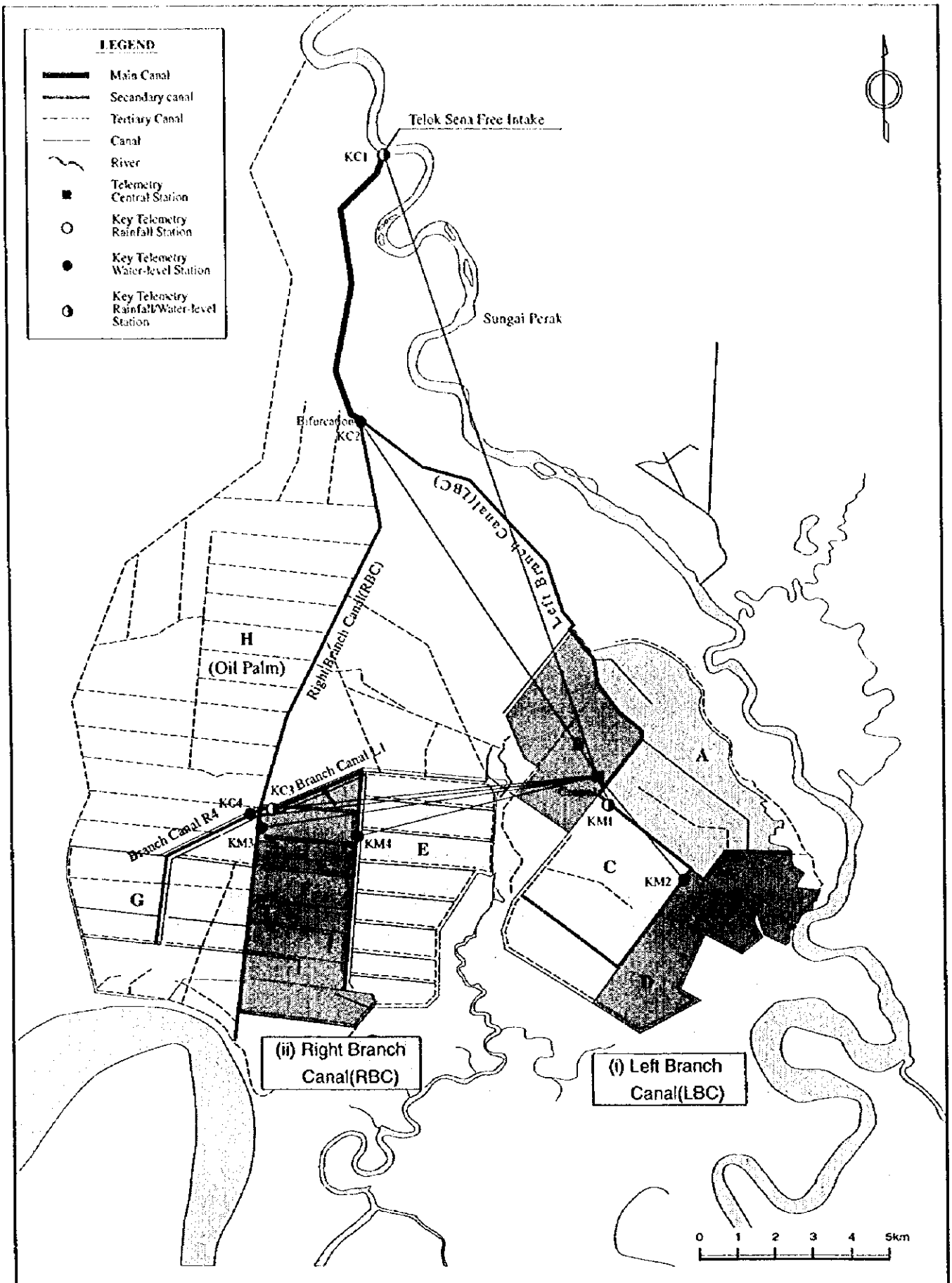


Fig. III-8 General Layout of Telemetry System (Seberang Perak Scheme)

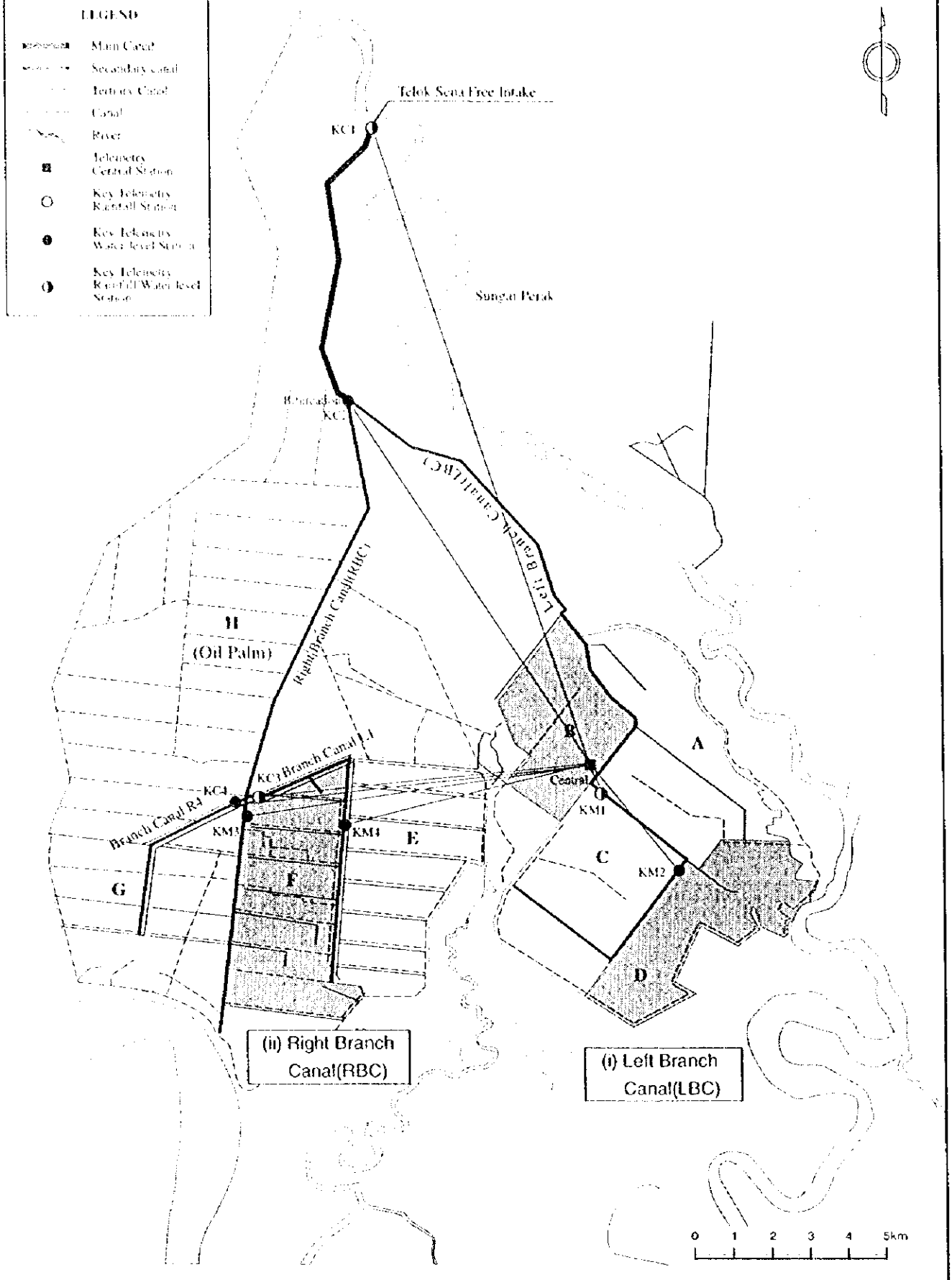


Fig. III-8 General Layout of Telemetry System (Seberang Perak Scheme)

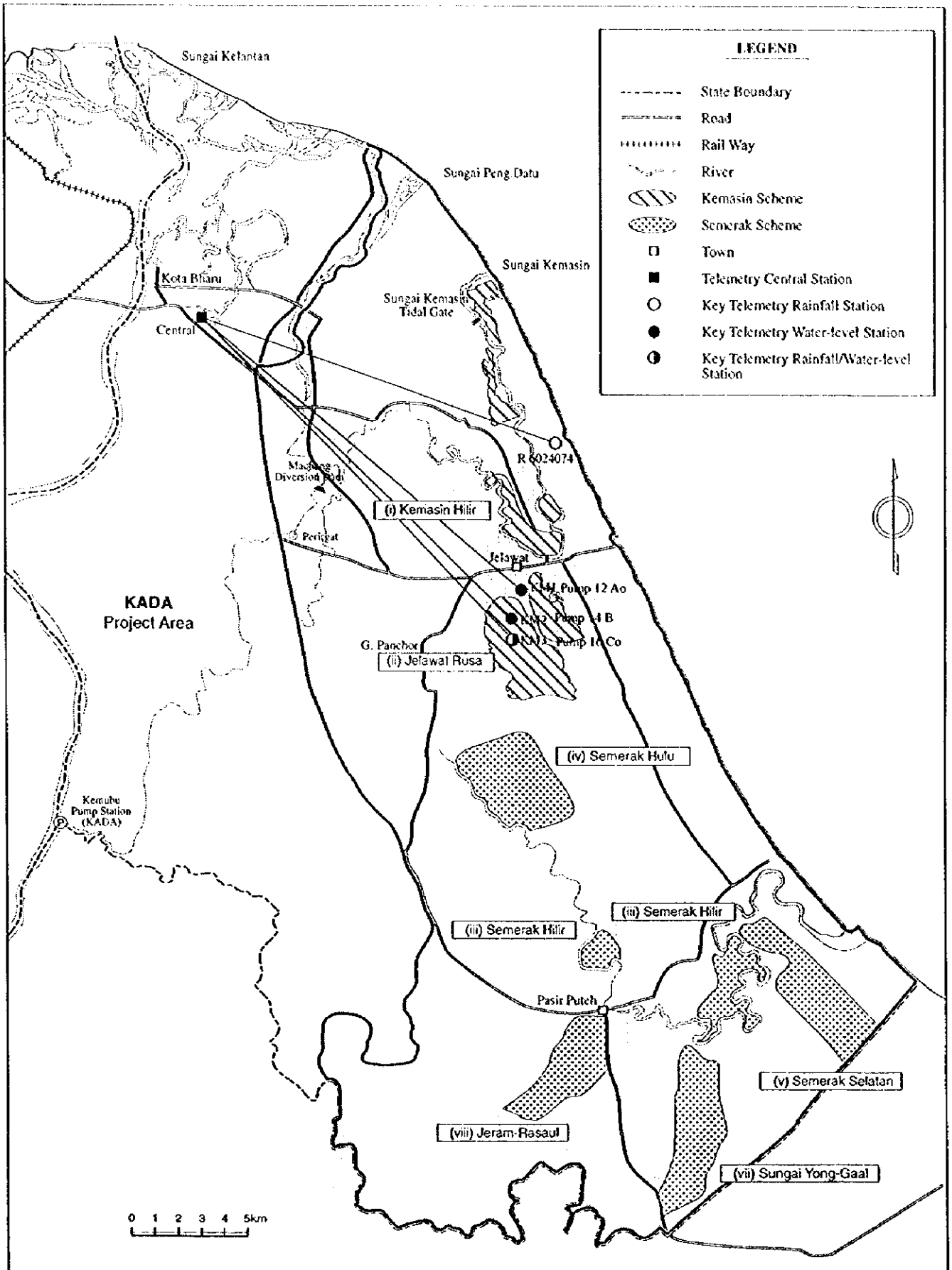


Fig. III-9 General Layout of Telemetry System (Kemasin / Semerak Scheme)

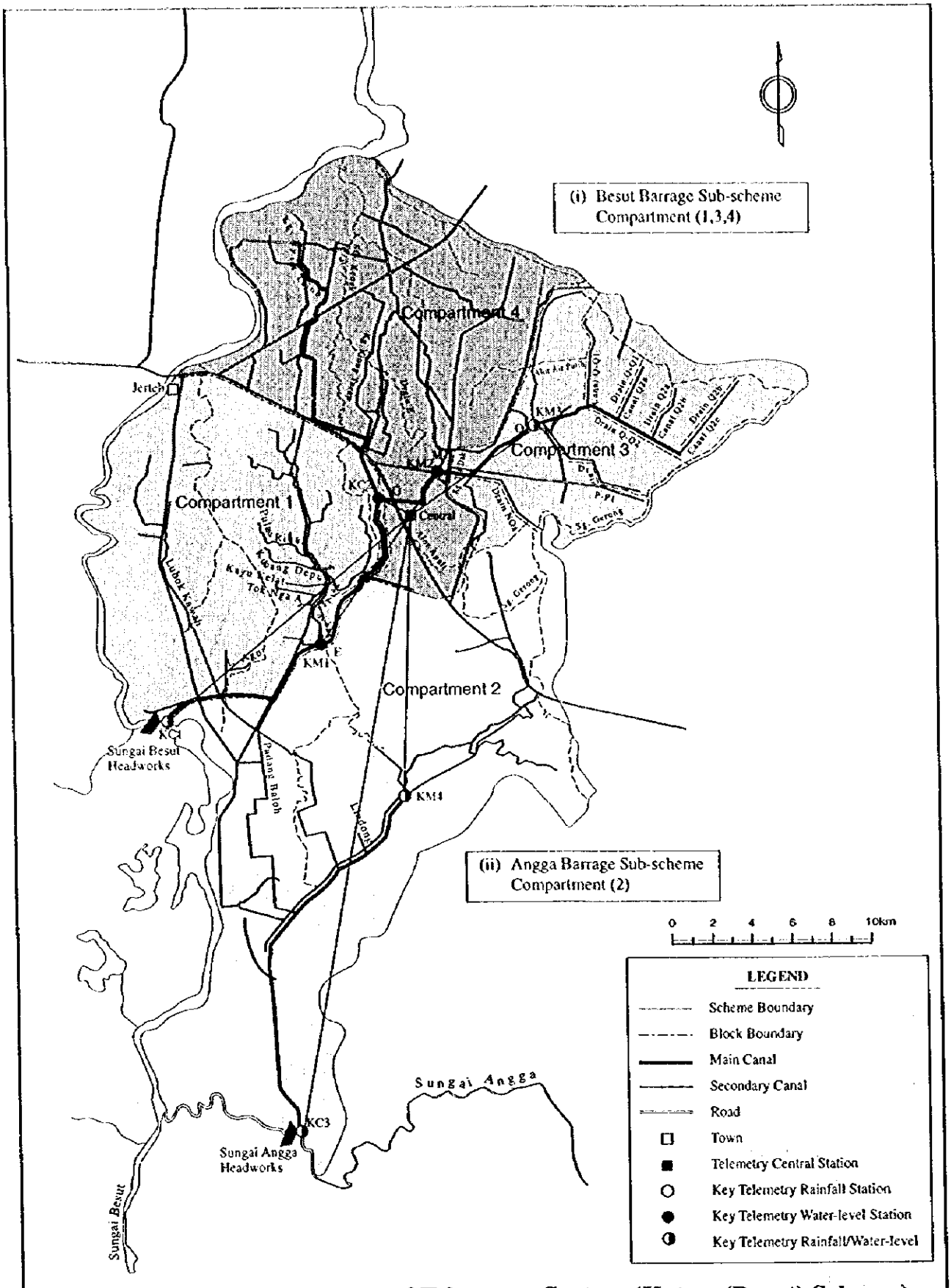


Fig. III-10 General Layout of Telemetry System (Ketara(Besut) Scheme)

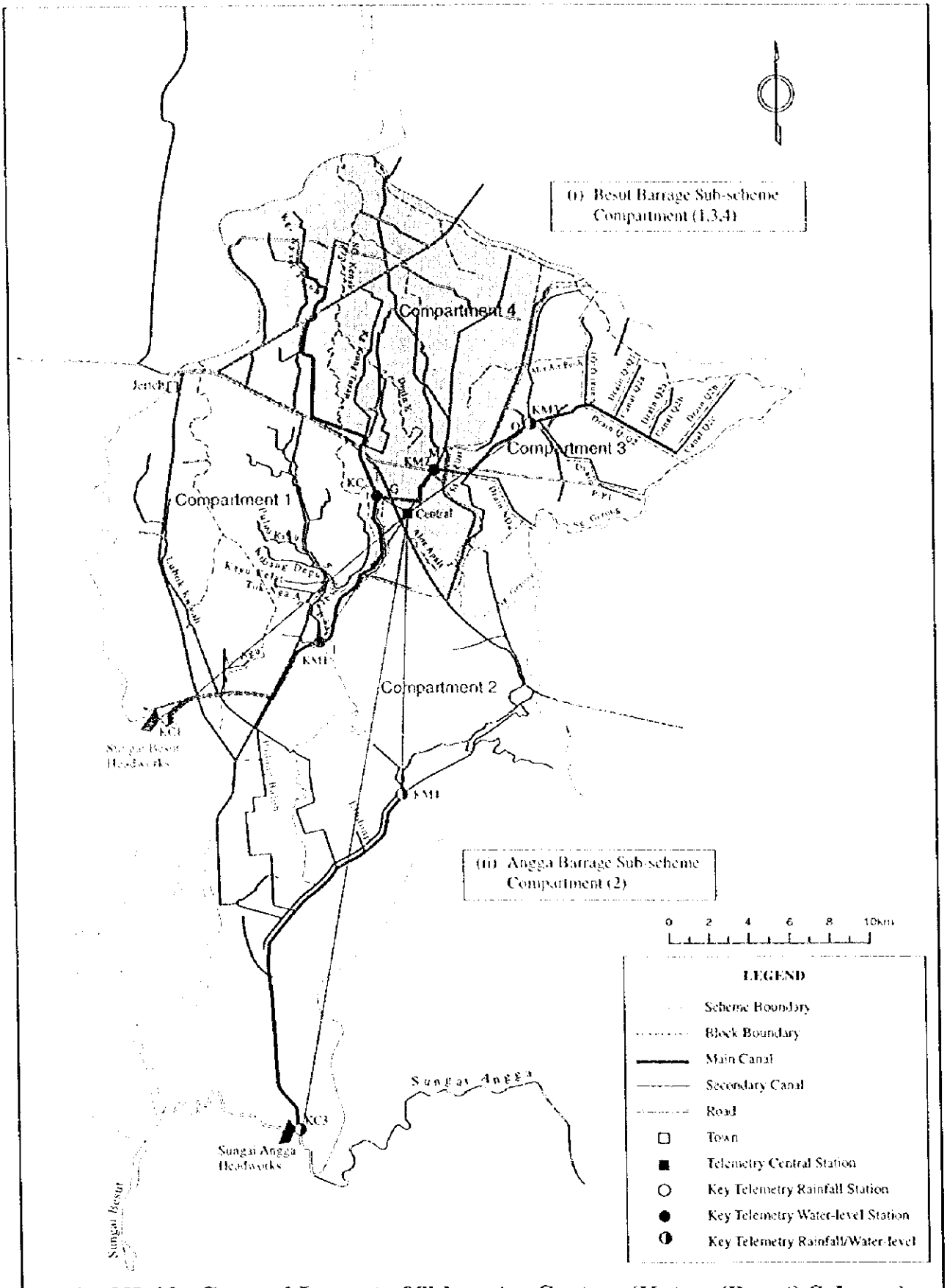


Fig. III-10 General Layout of Telemetry System (Ketara(Besut) Scheme)

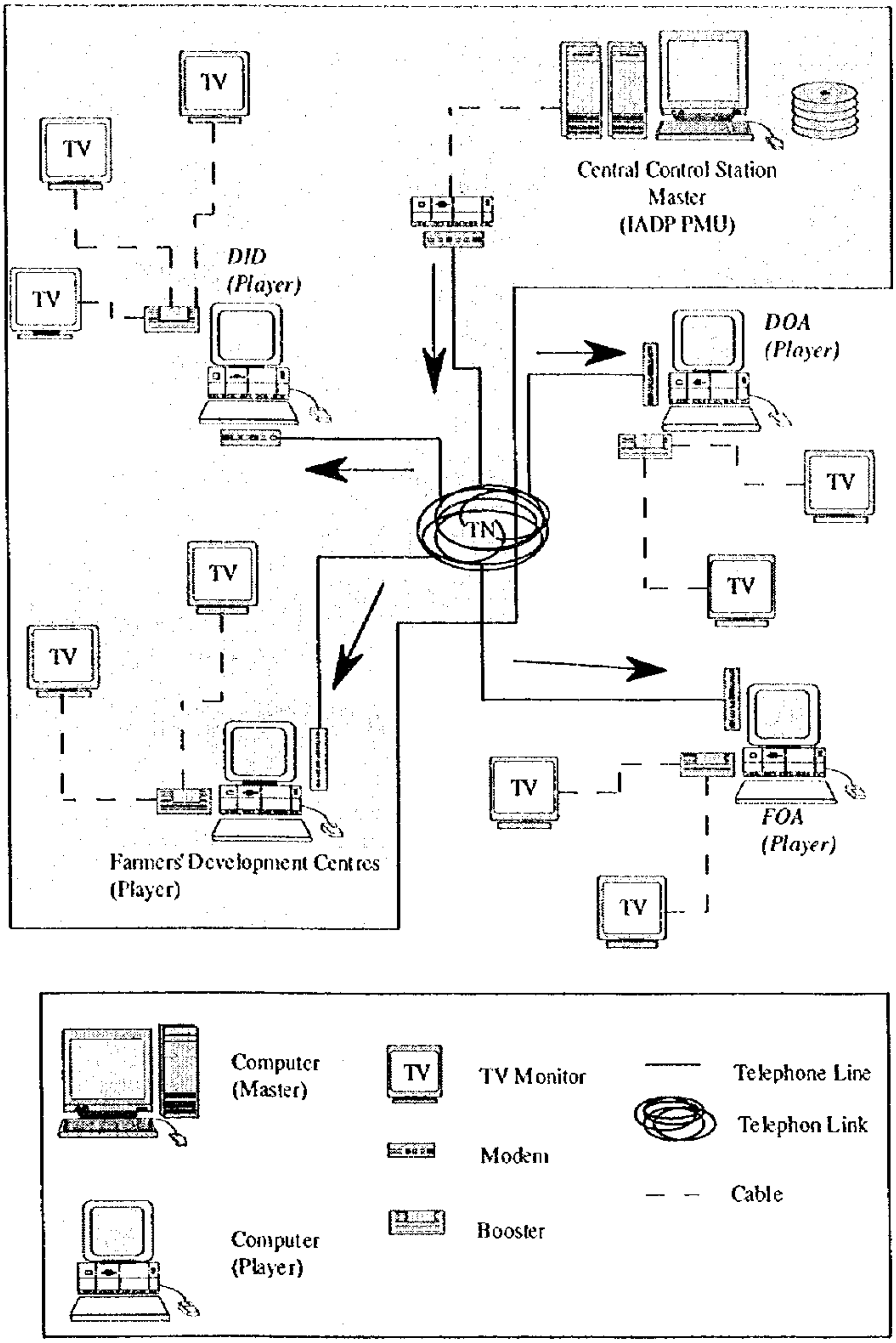


Fig. III-11 Schematic Diagram of Irrigation Monitoring and Information Feedback System (1st Step)

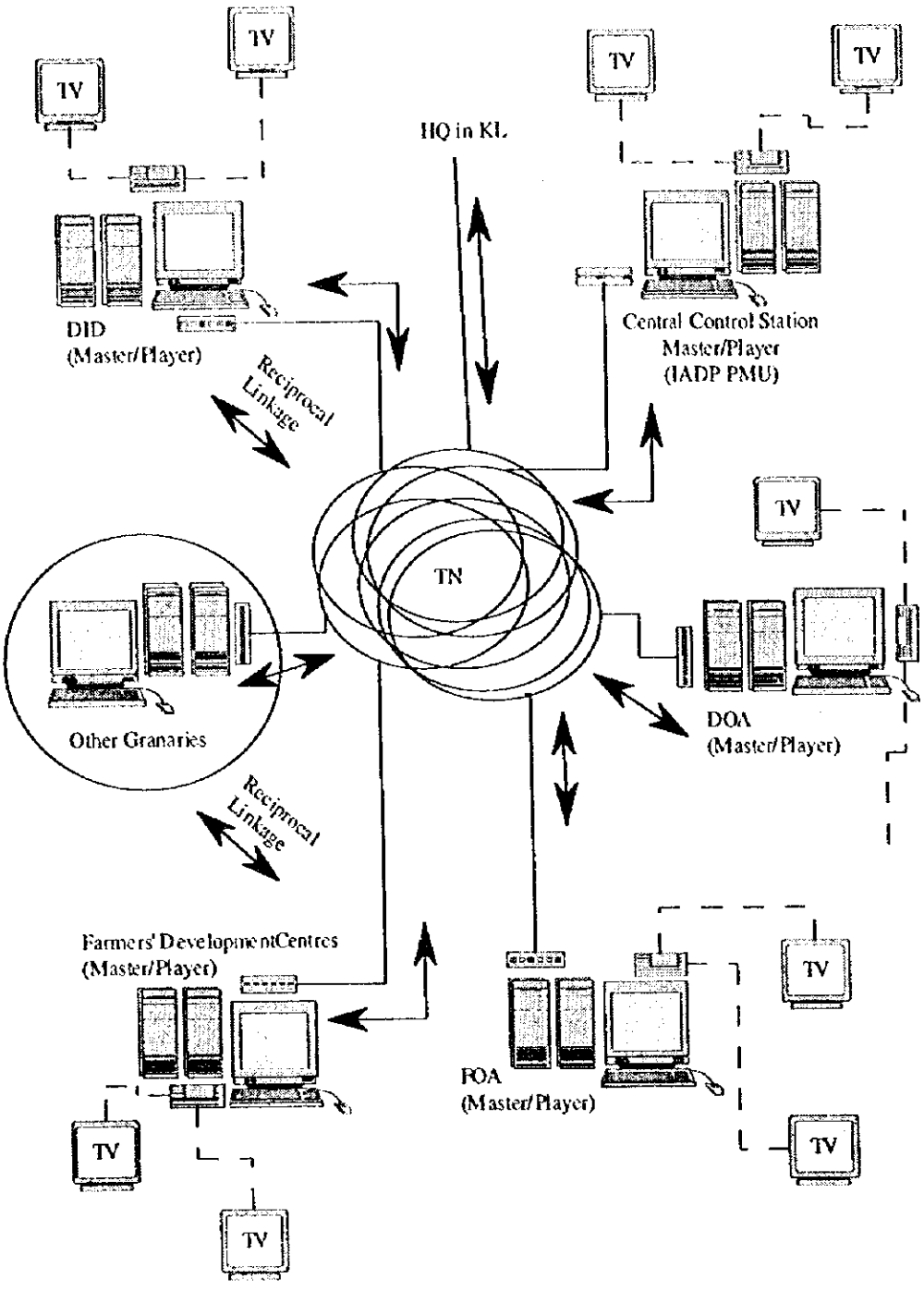


Fig. III-12 Schematic Diagram of Irrigation Monitoring and Information Feedback System (Option in the Futrue)

ANNEX-IV

AGRICULTURE AND AGRO-ECONOMY

ANNEX - IV

AGRICULTURE AND AGRO-ECONOMY

Contents

List of Tables

List of Figures

List of Attachment

1. SOCIO-ECONOMIC BACKGROUND

1.1 Population and Labor Force

The estimated population, number of household and average family size of the five granary areas are summarized as below.

IADP	Number of House-hold*1	Average Family Size*2	Estimated Population*3 ('000 pers.)	Literacy Rate*4 (%)
Pulau Pinang	7,301	5.0	36,500	91.4
Kerian / Sungai Manik				
- Kerian	13,485	4.9	66,100	91.5
- Sungai Manik	4,030	4.7	18,900	91.5
Seberang Perak	2,333	5.1	11,900	81.2
Kemasin/Semerak	11,889	5.2	61,800	78.8
Besut	3,054	5.2	15,900	81.2

*1: Subsidy Registration, LPP, 1997, Number of registered farmers are used as the estimation of number of households.
*2: Population Census '91, Assumed that family size hasn't changed since '91.
*3: Estimated by number of household multiplied by family size.
*4: Farm Survey, JICA Study Team, 1997. For Kerian/Sg.Manik, data show overall average for both areas.

According to the Population Census 1991, average family size for five granary areas are about 5.1 persons and there are no significant difference among five granary areas.

Based on the Farm Survey conducted by the JICA Study Team, the literacy rate for five granary areas is about 86%. Among five granary areas, Kemasin Semerak area shows lowest literacy rate. On the other hand, the area locates near the urban area such as Pulau Pinang and Kerian, shows higher literacy rate. Considering the national average of 89.3%, there are still needs for the enhancement of education opportunity in Seberang Perak, Kemasin Semerak and Besut.

According to the Population Census 1991, the structure of population by ethnic group shows high degree of mixture in the Pulau Pinang scheme and Kerian / Sungai Manik scheme. On the other hand, more than 96% of people are Malay in Kemasin/Semerak and Besut. However, it is also observed that there are some Thai-origin farmers called "Siamese" in the Kemasin/Semerak scheme. The population structure by ethnic group is summarized as below and the detail are shown in Table IV-1.

(%)

Ethnic Group	Pulau Pinang	Kerian	Sungai Manik	Seberang Perak	Kemasin/ Semerak	Besut
Malay	75.0	62.5	50.1	98.7	97.6	96.5
Chinese	19.4	22.3	23.2	0.1	1.3	1.8
Indian	4.9	9.9	8.2	0.0	0.0	0.1
Others	0.6	5.3	18.5	1.2	1.1	1.6

Note: Figure is calculated based on the Mukim-wise data.
Source: Population Census, 1991, Department of Statistics

Regarding occupational structure of the population between 15 and 64 years old, in Pulau Pinang, the share for agriculture and related works are only 11% and most popular occupation is production, transport, etc. This implies that labor force is shifting to industrial sector from agricultural sector and, hence, labor scarcity in agricultural sector. On the other hand, Seberang Perak shows highest share for agricultural sector which accounts for about 70%. In other three areas, the share of agriculture ranges from 44 to 48 % and agriculture is still a major source of labor absorption. Occupational structure is summarized as below. (See Table IV-2)

(%)

	Professio -nal, Technical	Administ- ration Service	Agriculture and related works	Production transport, etc.	Others
IADP Pulau Pinang	8.2	22.5	10.8	52.5	6.0
Kerian	6.1	17.8	45.6	29.7	0.7
Sungai Manik	5.2	15.9	56.5	22.2	0.2
Seberang Perak	7.2	12.3	70.4	9.9	0.2
Kemasin Semerak	8.7	21.7	44.5	24.4	0.6
Besut	9.8	21.3	44.9	22.7	1.3

Source: Population Census, 1991, Department of Statistics

1.2 Social Infrastructure

The state-wise social indicators of the concerning 4 states and national average are summarized as below.

State	Telephones per 1,000 population	Provided with Piped Water (%)	Electricity Provision (%)	Infant Mortality per 1,000	No.of Doctors per 10,000	Length of Paved Road (km/10km^2)
Pulau Pinang	232.0	99.6	100.0	8.8	7.4	30.2
Perak	164.4	92.9	100.0	11.5	4.7	2.8
Kelantan	180.5	65.7	100.0	9.3	4.0	1.7
Terengganu	181.4	80.2	100.0	12.7	3.0	2.4
Malaysia	164.3	89.1	95.8	9.9	5.3	1.5

Source: 7th Malaysian Plan. The figure is for the year 1995.

(1) Transportation & Communication

All the five schemes are in the good location in terms of connection to the neighboring cities. Pulau Pinang scheme and Kerian scheme are located near the motorway which accesses to Ipoh, the capital city of Perak state, and Kuala Lumpur to the south. Besides, both schemes are also close to Geroge Town and are accessible to other major cities by air. Kemasin/Semerak scheme and Besut scheme are connected by the national highway (Route 3) with Kota Bharu to the north and with Kuala Terengganu to the south. Sungai Manik scheme and Seberang Perak scheme are locating near Telok Intan which is the capital town of Hilir Perak District and accessible to Kuala Lumpur and Ipoh through the motorway which locates about 30km to the east. Regarding the road density of each state, based on the length of paved road, all 4 states are above the national average (1.5 km/10 km^2). Especially, Pulau Pinang district performs second highest density (30.2 km/10 km^2) in Malaysia, while that of Kelantan state is low as 1.7 km/10 km^2, which is slightly above the national average.

As to communication facility, about 54.6% of households are facilitated with a telephone according to the result of farm survey, while the state-wise statistics shows 189.5 units per 1,000 population in average of 4 states. Holding rate of television and radio are more than 90% in 5 granary areas, which indicates good accessibility to mas-media.

(2) Water Supply and Energy for Domestic Use

The result of the farm survey shows that the source of drinking water are different between west and east coast. In the west coast, 90 to 100% of households are using tap water as the source, while less than 50% can access to tap water in the east coast. In the east coast, the main source of drinking water is tube well, on which 50 to 70% of households relies. As to the electricity for lightning, almost all respondents (98.6%) are using electricity and very few are using kerosene. Regarding the energy for cooking, mainly LP gas are used (91.2%), and charcoal are also used especially in Kemasin Semerak (17.9%), Besut (16.9%) and Kerian Sungai Manik (7.8%).

(3) Health and Education

Almost all districts in the 5 granary areas have at least 1 government hospital except Bachok District in Kelantan (Kemasin/Semerak scheme). However, the number of doctors per 10,000 persons are below the national average in all the states except Pulau Pinang. Accordingly, infant mortality rate per 1,000 persons are showing relatively high value especially in Perak and Kelantan, which implies that there is the room for improvement. It should be noted, however, the results of the farm survey indicate that hospitals are available within 5km in average in all areas.

Schools are well facilitated in all schemes. According to the District-wise data, there are more than 30 primary schools and 10 secondary schools in each district. The average number of students per teacher is approximately 20.3 persons in primary school and 17.1 persons in secondary school according to the State-wise data. It is consistent with the result of the farm survey which indicates primary school is available within 2.3km and secondary school is available within 5km in average .

2. PRESENT CONDITION

2.1 Soil

(1) IADP Pulau Pinang

Muda and Kulim sub-schemes are covered with coastal alluvial soils called Kranji and Linau series, and acid sulfate soil called Chengi series. In Burung River sub-scheme on Pinang Island, most of the area is covered with Kranji series. The Kranji series soil has a thin brown to dark yellowish brown A horizon with clayey textures. The soil types and the suitability classes for paddy cultivation are shown in Table IV-3 and the distribution of the soil types is shown in Fig. IV-1

(2) IADP Kerian / Sungai Manik Scheme

The soils in the Kerian paddy area are developed basically on three types of sediments, namely marine alluvium, brackish water deposits and organic rich deposits. The coastal portion of the scheme consists mainly of alluvial soils of marine origin; a thin brown sticky clay surface layer subsoil which is mainly structureless greenish-gray clay. The inland area consists of mainly alluvial soils of riverine origin. Almost 5,000ha of land along the Bagan Serai-Parit Buntar road is overlain by slightly acid organic clay muck soils. All soils in Kerian scheme area are suitable for rice growing as shown Table IV-4. However, the muck soils are distinctly less productive and requires suitable water management and crop husbandry techniques in order to grow paddy effectively. The distribution of the soil types in Kerian scheme is shown in Fig. IV-2

Sungai Manik scheme is covered with alluvial soil called Sogomana-Sitiawan-Manik Series which are characterized by light grey to white clays showing strong to moderate prismatic to coarse angular blocky structures an sticky consistence. Clay skins are well developed in these soils.

(3) IADP Seberang Perak Scheme

Most of the scheme area is covered with local alluvium soils of riverine origin. The major soil series is Akob Series. The soil is found on the flood plains of the Sungai Perak. The fertility of the series varies on the nature of the deposits and hence their productivity. Rubber can be grown on this soil when sufficiently drained. Paddy is a more suitable crop to grow especially when irrigation can be practiced.

(4) IADP Kemasin/Semerak Scheme

Alluvial deposits generally characterize the scheme area and are composed of sand, silt and clayey soil. However, past littoral currents have developed raised sand dunes in parallel to the coast line and are now referred to as the Bris Soils Zone. The flat alluvial plains are characterized by deposits which can be classified as marine and fluvial deposits, although it is not always possible to demarcate between the two variations. Marine deposits predominate along the Bris Soils areas and are composed of coarse sand containing shell fragments. The

low lying swamps formed behind the raised sand dunes are composed of clayey soils with significant quantities of organic matter. Fluvial deposits are generally composed of number of materials including gravel, sand, silt and clay, clayey soils generally predominate.

(5) IADP Ketara (Besut) Scheme

Generally, the soils utilized for rice cultivation in this area are of all alluvial origin. These surface formations were deposited in different periods, bringing into existence a series of alluvial sedimentation levels or terraces. The Tok Yong series, which is the most widespread soil series on the area, are characterized by a uniform yellowish brown, clay to silty clay loam with friable consistence and strongly to moderately well developed structure. On the eastern and northern edges of the riverine alluvial formation are marine deposits of a coarse sandy nature forming beach ridges. Organic soils have accumulated in some of the depressions and old river channels adjacent to these beach ridges. The soils in Krtara (Besut) scheme are classified as marginal soil for paddy cultivation as shown in Table IV-5. The distribution of the soil types in Ketara (Besut) scheme is shown in Fig. IV-3

2.2 Land Use and Irrigation Area

(1) IADP Pulau Pinang Scheme

Based on the Pulau Pinang Land Use Map presented as Fig. IV-4, the area of the Pulau Pinang is estimated at about 104,781ha. The below table indicate the land use pattern.

(Unit : ha)

Land Use	Area
1. Urban areas	15,170
2. Agriculture	67,095
(Paddy)	15,356
(Rubber)	13,487
(Oil Palm)	16,444
(Others)	17,071
3. Forest and Swamp	14,696
4. Others	7,820

Source: DOA

The IADP Pulau Pinang scheme has 9,832 ha of the total net irrigation area with five (5) sub-schemes. Out of five (5) sub-schemes, one sub-scheme of Sungai Burung is located in the Pinang Island and the other four (4) sub-schemes are situated at the north western part of the State of Pulau Pinang in the Peninsular. The sub-scheme wise net irrigation areas are as followings.

Sub-scheme	Net Irrigation Area (ha)	Location
(1) Sungai Muda	6,888	Peninsular
(2) Sungai Kulim	1,387	- do -
(3) Pinang Tunggal	938	- do -
(4) Sungai Jarak	388	- do -
(5) Sungai Burung	231	Pinang Island
Total	9,832	

(2) IADP Kerian / Sungai Manik Scheme

The main vegetation in the area is paddy. Around the house lots, the mixed horticulture with coconuts and mangoes being most common crops. Other crops such as bananas, maize, yam and vegetables are also observed. Large patches of rubber are found in the outskirts of the paddy growing areas. Along the coastal mud flats which are subjected to tidal influence mangrove swamp forest occur. The Land Use Map of Kerian is shown in Fig. IV-5.

The net irrigation areas of the Kerian and Sungai Manik schemes are 23,671 ha and 6,318 ha, respectively as shown below.

Scheme	Block	N.I.A (ha)	Scheme	Block	N.I.A (ha)
Kerian	Kerian Laut	13,857	Sungai Manik	Sungai Manik	3,602
	Kerian Darat	9,814		Labu Kubong	2,716
Total		23,671	Total		6,318

(3) IADP Seberang Perak Scheme

The net irrigation area is 8,708 ha consisting the following seven (7) blocks :

Block		N.I.A (ha)	Block		N.I.A (ha)
Left Bank Canal	Block A	881	Right Bank Canal	Block E	1,528
	Block B	634		Block F	1,384
	Block C	1,692		Block G	1,431
	Block D	1,158			
Total		4,365	Total		4,343

(4) IADP Kemasin Semerak Scheme

The total irrigable area is 6,895 ha consisting of eight (8) relatively smaller sub-areas as shown below.

Sub-area	Irrigable area (ha)	Sub-area	Irrigable area (ha)
(1) Kemasin Hilir	261	(5) Semerak Selatan	1,100
(2) Jelawat Rusa	1,384	(6) Semerak Barat	115
(3) Semerak Hilir	1,000	(7) Sungai Yong-Caal	2,260
(4) Semerak Hulu	174	(8) Jeram-Rasan	601
		Total	6,895

At present, the construction works of Kemasin Hilir and Jelawat Rusa were completed.

(5) IADP Ketara (Besut)

Agricultural development is extensive and most of the arable soils are cultivated. The agricultural pattern is complex, with paddy and horticulture crops as the main crops. Mixed horticulture is common along the roads and rivers. The variety of crops cultivated include

rubber, coconuts and some kinds of fruits. The Land Use Map of Kerian is shown in Fig. IV-6.

The Besut scheme is located at the north-western corner of the State of Terenganu immediately adjacent to the State of Kelantan. The total net irrigation area is 5,164 ha, of which about 4,182 ha is covered with the Besut barrage and about 982 ha with the Angga barrage.

2.3 Agriculture

2.3.1 Paddy Cultivated Area and Cropping Intensity

Land use of the study area is already defined by farmers and settlers living in the area and, dependent on the availability of irrigation water. Irrigated fields are being used for paddy cultivation. The areas planted with paddy and cropping intensity per season are shown in Table IV-6. The average annual paddy cultivated area in the study area for 5 years from 1991 to 1995 is estimated at 102,950 ha comprising 55,370 ha in the main season and 47 ,580 ha in the off season respectively, which is about 15 % of the total paddy cultivated area in Malaysia.

The average cropping intensities of five (5) years from 1991 to 1995 in the five (5) schemes is summarized below. The detailed data on the paddy planted area in Kerian and Ketara (Besut) is shown Table Table IV-7 and 8.

(Unit : %)

Name of Scheme	Annual	Main Season	Off Season
Pulau Pinang*1	189	95	94
Kerian	164	89	75
Sungai Manik	191	95	96
Seberang Perak	191	94	98
Kemasin Semerak	57	50	6
Ketara (Besut)	164	87	77

Source : Paddy Statistics of Malaysia, 1995, IADP Kerian

Irrigation system of the Kemasin Semerak scheme is incomplete. Only 7% of command area is used for paddy growing in the off season, while paddy is grown in the about 50 % during the main season. The detailed cropping intensity in Kemasin Hilir and Jelawat Rusa is shown in Table IV-9. The average cropping intensity during the last five (5) years from 1991 to 1995 in the study area except Kemasin Semerak was in the range of 160 to 190 %. Mechanized land preparation and direct seeding method have contributed to the increase of the cropping intensity. Cropping intensity of Kerian and Besut schemes remains lower level compared with others because of the lower cropping intensity in the off season owing to poor-drainage of Kerian, and floods and shortage of irrigation water of Besut.

2.3.2 Land Ownership and Tenure System

Based on land tenure, the paddy farmers in the study area are classified into three (3) types, namely owner operator, owner/tenant operator and the tenant operator. Landlords who do not cultivate but instead hire out land to cultivators is called lessors. The majority of farmers in the study area are owner operators and owner/tenant operators. The estimated average

holding size of farm land in the study area ranges from 1.04 to 1.82 ha as shown in the following table :

(Unit : ha)

Name of Scheme	Average Holding Size
Pulau Pinang	1.32
Kerian	1.54
Sungai Manik	1.73
Seberang Perak	1.82
Kemasin Semerak	1.04
Besut	1.29

Source: DOA and PPK in the Study Area, 1995

Direct seeding technology and mechanized farming have helped in the revitalization of paddy land that were left idle because of absentee landlord and labor shortage. There are now groups of enterprising young farmers looking for paddy land to cultivate as direct seeding makes the effort cost effective. The average operated farm size is gradually increasing year by year as shown below.

(Unit : ha)

Year	Average Farm Size
1972	1.61
1981	1.39
1986	1.91
1988	1.81
1991	2.11
Pulau Pinang	2.87

Source: DOA

2.3.3 Cropping Schedule and Agricultural Production

(1) Cropping Schedule

The net irrigation area of the study area is 60,477 ha, of which the major part is double cropped area. The cropping calendar in the study area is characterized by two seasons, the first season from around February / March to July / August called off season and the other season from August / September to January / February called main season. The ideal cropping schedules in five(5) granary areas are developed by the respective IADP offices as shown in Fig. IV-7.

Majority of the farmers in the study areas can adhere to the cropping schedule, however some farmers do no follow the schedule, as a result the progress of the actual farming in all the study area is generally behind the schedule. Especially, in compartments A, B and C of the Kerian scheme, several crop seasons have been missed during the last decade due to prolonged staggering of cropping schedule.

(2) Yield and Production

Average unit yields and annual production of paddy are given in the Table IV-10. The average yields and annual production of paddy of five years from 1991 to 1995 in the study area are summarized below.

Study Area		Production (ton)	Average Yield (ton/ha)
Pulau Pinang	Total	58,674	2.80
	Main Season	29,757	2.90
	Off Season	28,915	2.71
Kerian	Total	112,668	2.94
	Main Season	59,419	2.86
	Off Season	53,249	3.05
Sungai Manik	Total	36,808	3.05
	Main Season	19,006	3.16
	Off Season	17,802	2.94
Seberang Perak	Total	58,853	3.53
	Main Season	29,150	3.57
	Off Season	29,703	3.50
Kemasin Semerak	Total	19,098	2.82
	Main Season	17,120	2.91
	Off Season	1,978	2.22
Ketara (Besut)	Total	27,787	3.18
	Main Season	15,429	3.34
	Off Season	12,358	3.00

Source: Paddy Statistics of Malaysia, 1995 and IADP Kerian

The paddy yields from 1986 to 1995 in the study area is graphically illustrated Fig. IV-8. The average unit yields in five (5) schemes are beyond national average, however they are unstable and various season by season. The range of the average yield of each scheme from 1991 to 1995 was between 2.22 to 3.57 ton/ha. The average unit yields of paddy in the study area have not reached sufficient levels and are lower than the NAP target yield. The paddy production fluctuated according to the planted area and yield. The average production from 1991 to 1995 of the study area was about 314,000 tons or about 15 % of national production. The data of the paddy production survey in Kerian, Ketara (Besut) and Pulau Pinang is given in the Table IV-11, 12 and 13.

2.3.4 Farming Practices

Paddy cultivation in the study area has been modernized with the introduction and promotion of mechanization for the labor intensive works of the paddy cultivation practices except a part of Kerian scheme. These include land preparation and harvesting, which in the traditional method have been highly time consuming and costly. Furthermore, the acute shortage of labor force arising from the Malaysian rapid and strong industrialization which leads to urban migration of young farm labor, has put a tremendous pressure on the need for farm mechanization. The typical farming practices of paddy in the study area as follows :

(1) Planting Method

Generally, there are two different kinds of paddy planting methods in the study area. One is the traditional transplanting method which is practiced in some compartments of Kerian scheme, and another is direct seeding method. Direct seeding has shown significant impact of paddy cultivation since its introduction in 1970's. The present dominance of direct seeding has come as a result of the shortage of labor for transplanting. In IADP Pulau Pinang, direct seeding was adopted as one of the strategy to rehabilitate abandoned or idle paddy land in 1980's.

Two types of direct seeding methods are practiced, namely dry direct seeding and wet direct seeding based on soil moisture condition during land preparation and irrigation water availability. In wet direct seeding, the first half of farm operations generally proceeds in the following order :

Tillage → Initial Irrigation → Puddling → Drainage → Sowing → Seedling establishment → Irrigation

Under wet direct seeding, the field water should be drained after puddling. The soaked seeds are sown under wet soil condition.

On the other hand, under dry seeding, the farm operations normally proceed as shown below. The dry direct seeding is divided into two (2) types according to the irrigation water supply pattern for germination. One is the rainfall induced germination method which uses rainfall seedling establishment and the other is the irrigation induced germination which uses irrigation water for seedling establishment. The latter is safe and stable method.

Tillage → Sowing → Germination → Seedling establishment → Irrigation

The wet direct seeding method with pre-germinated seeds is more commonly practiced in the study area. The dry direct seeding is adopted in Kerian and Sungai Manik scheme during the Off Season. In the east coast granary schemes, sowing of seed is done manually, while both manual and mechanical broadcasting of seeds using mortorblowers are done in the west coast schemes.

(2) Land Preparation

Land preparation has already been mechanized in the large part of the study area on a contract basis. In the study area, 4 wheel tractors and rotovators are used for land preparation. However, pedestrian tractors (2 wheel tractors) are also used in Pulau Pinang, Kerian and Besut. Generally, the pedestrian tractors are owned by farmers and used for 2nd and 3rd tillages after first tillage done by 4 wheel tractors. The areas with a cone index of less than 1.5 kg/cm^2 in Kerian scheme cannot be mechanized and only manual land preparation is permitted.

Two to three times of tillage are done in most cases. The duration between times of tillage ranges from 2 weeks to 30 days before sowing (DBS) for the first round, 5-10 DBS for the second round and 1-3 DBS for the third round for areas with three rounds. For areas practicing two rounds of tillage, the first round is done 7-30 DBS and the second 2-3 DBS.

The tractor arrangement for land preparation especially at the peak period is very important in order to avoid delay from planting schedule. An inadequate arrangement is one of main reasons for the un-adherence to cropping schedule.

(3) Varieties Used

The major recommended varieties of paddy are MR10, MR77, MR84, MR159 and MR167. All these varieties are classed as the short maturation and high yielding types. However, only MR84 is widely used and use of other varieties are very limited because of the suitability for direct seeding. The paddy varieties used in the study area are summarized below.

(Unit: %)

Study Area	MR84	Semerak	MR10	Others
Pulau Pinang	98.3	-	-	1.7
Kerian	21.6	29.7	12.6	36.1
Sungai Manik	100.0		-	-
Seberang Perak	100.0	-	-	-
Kemasin Semerak	85.0	-	-	15.0
Ketara (Besut)	100.0	-	-	-

Source: Paddy Statistics of Malaysia, 1995 and IADP Kerian

The seed rates adopted for direct seeding varies from 40 to 150 kg per ha depending on the area and direct seeding method. The summarized seed rates in the study area are shown as below.

(Unit: kg/ha)

Study Area	Direct Seeding (Wet)	Direct Seeding (Dry)	Trans Planting
Pulau Pinang	75 - 100	-	-
Kerian/Sungai Manik	40 - 100	60 - 150	20 - 25
Seberang Perak	80 - 100	-	-
Kemasin Semerak	40 - 60	-	-
Ketara (Besut)	50	-	-

Source: Paddy Statistics of Malaysia, 1995 and IADP Kerian, Direct Seeding-Impact and Implications on Rice Cultivation Practices in Peninsular Malaysia

(4) Fertilizer Application

Fertilizer are subsidized by the Government. Urea 100 kg/ha and compound fertilizer (17.5:15.5:10) of 200 kg/ha based on an agronomic recommendation of 80 kg of Nitrogen, 30 kg of P_2O_5 and 20 kg of K_2O are subsidized in each crop season. In general, farmers apply only subsidized fertilizer and some advanced farmers apply additional fertilizers on their own expenses. Compound fertilizers are commonly used as additional fertilizers. Fertilizer application amounts in the study area are as follows :

(Unit: kg/ha)

Study Area	Urea	Compound	Others	Nitrogen contents
Pulau Pinang	94.1	156.5	48.9	78.0
Kerian/Sungai Manik	94.2	187.2	79.3	88.0
Seberang Perak	105.1	206.8	50.0	92.0
Kemasin Semerak	93.9	190.6	-	76.6
Ketara (Besut)	98.9	197.6	-	80.0

Source: Paddy Statistics of Malaysia, 1995

Applications of fertilizers by farmers who practice direct seeding are made between 14 to 75 days after seeding. Manual broadcast of fertilizers is the common practice except Seberang Perak where farmers use motorblowers. The comparative table of dosage amount of seed and fertilizer inputs is shown in Table IV-14.

(5) Pest Management

The shift to direct seeded rice in the country has aggravated pest problems, especially weeds and insects. Apart from the impact on pest species, direct seeding has also affected the pest surveillance and forecasting techniques as the techniques were previously based on a transplanting. Operation to control and certain outbreaks have become more difficult to implement effectively, especially if the crop is at the maximum tillering stage onwards. Among the insects that had been reported to come into prominence with direct seeding in the study area are the brown planthopper and the leaf rollers.

The weed management is critical to ensure a good yield with direct seeding method. Hence with the introduction and establishment of direct seeding, emphasis was and is being given to weed control. Farmers in the study area are advised to prepare land well, practice good water management together with appropriate herbicide technology. All IADPs stressed that water management is very important to keep weed population down in paddy fields.

Integrated Pest Management (IPM) has been introduced in some area in the study area and is followed by farmers.

(6) Harvesting

The mechanized harvesting through the use of combine harvesters is commonly done in the study area, and to much smaller extent, reapers and threshers. No manual harvesting is observed except Kerian scheme. Manual harvesting is done in some extent of Kerian scheme because of the low soil bearing capacity under ill-drainage soil condition.

The combine harvesters used are of the larger type with cutting size ranging from 12 to 16 feet. Generally after the crop is harvested, the harvested crop is loaded directly onto lorries or tractors in bulk. The rice crop is harvested at varying degrees of grain ripeness, ranging from 65 to 100 % ripeness. The exact stage of ripeness harvested depends largely on the availability and logistics of the combine harvesters. The harvesting and loading work are done by contract.

To facilitate harvesting by combine harvesters, farmers drain their fields as early as 4 weeks or as late as 7 days before the harvesting date. The general tendency is 2 weeks which is also the recommended interval. Earlier drainage than recommended is often because of soil conditions, weather and sometimes for pest control.

The typical farm inputs in the study area is summarized in Table IV-15. Some samples of actual and recommendable farming practices in the study areas are shown in the Attachment IV-1.

2.4 Agricultural Extension

(1) Agricultural Research

The Malaysian Agricultural Research and Development Institute (MARDI) was established under MARDI ACT in 1969 as a central, integrated organization to undertake agricultural research geared towards the development of locally adapted technology for serving the farming community and agro-based industries. MARDI maintains several station in the study area carrying out agronomic and breeding research. The overall supervision and direction for rice research is the responsibility of the Rice Research Stations.

Research programme is envisaged to concentrate on developing high yielding disease resistant varieties. Farm machinery modification tests and research into ways of reducing post-harvest losses are the other major areas of concern of MARDI. Apart from research carried out by MARDI, field demonstrations by DOA in direct seeding, fertilizer trials, water management and so on are encouraging.

(2) Agricultural Extension

Agricultural extension service is provided by the State Department of Agriculture staff. The agricultural extension services in the each project area are supervised one Agriculture Officer assisted by Assistant Agricultural Officer and Agricultural Assistants. The agricultural extension services covers almost all technical aspect.

The objectives of agricultural extension services are to guide and train farmers, and to introduce more systematic crop production technique and practices. The training and visit system is adopted. The Agricultural Assistants Officers are also responsible for regulator duties, statistical work and administration of subsidies. The duty and works of the state officers as below:

(a) Assistant Agriculture officer
   i) to supervise the extension work
   ii) to supervise the Agriculture Assistant
   iii) to plan, control and evaluate the extension works

(b) Agricultural Assistant
   i) to give the extension service to farmers in the area
   ii) to manage the agriculture extension from planning stage

iii) to collect and keep the information about the agricultural activities in the area
iv) to distribute the agriculture inputs to farmers
v) to prepare the reports

Besides formal training courses and field visits to successful farms or progressive farmers, all the IADPs in the study area support their extension services with printed materials such as pamphlets, papers on irrigation schedule and farming technologies. The broad cast on specific direct seeding activities are regulary aired with the assistence of the local radio stations.

(3) Seed Supply

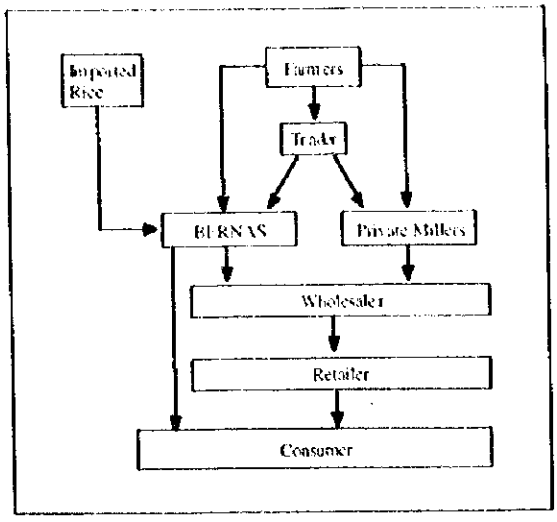
Breeder seeds are obtained from MARDI and planted in Commodity Development Centre in Kedah, Pulau Pinang, Perak, Selangor, Trengganu and Kerantan States for the production and processing of registered seeds. Registered seeds are then distributed and planted in the seed production areas in each Commodity Development Centre as well as through contract farmers in adjacent areas. In the production of certified seeds, these farmers are supplied free registered seeds but the production, harvesting and transport costs have to be borne by the farmers themselves. The seeds produced are brought and processed at the Commodity Development Centres. A standard for the certified seed is prescribed in mixing under 2% of the other paddy varieties, more than 80% of the germination rates and under 14% of the water content. The processed seeds are then distributed to local farmers, local agriculture agencies and agriculture agencies in other states.

2.5 Agricultural Economy

2.5.1 Processing and Marketing

(1) Marketing Channel

There are no significant difference in marketing channel among five granary areas. During the harvesting, farmers load harvested paddy direct onto a lorry (bulk handling) or pack into sacks called *Guni*. Presently, major mode for harvesting is bulk handling, although *Guni* suck handling is still dominant in Kerian scheme because of infrastructure constraints and, in some cases, conservativeness of farmers. After the harvesting, farmers bring their products to rice mills either directly or through traders, and in some cases, through PPK. The paddy brought into the mills are graded and the deduction rate is decided according to their moisture contents, dirt, unripe grains and germinated grains. According to the information obtained from the BERNAS and DOA, the average deduction rate is about 15 ~ 20 %, although it varies for each mill and condition of paddy. After the milling, rice are sold to the wholesaler or retailers and finally reach consumers. The marketing flow of paddy is simply summarized as follows.



The selection of marketing destination among farmers is made according to the several condition such as availability of transportation, accessibility, deduction rate, location of mills, commission rate and so on. According to the result of Farm Survey, about 50.2% of total respondents sell to the BERNAS and 28.5% sell to non-BERNAS private millers. However, this tendency is different from one area to another because of the above-mentioned reasons. Following table shows the farmers' selection of marketing destination for each granary area.

(%)

	Bernas	Non-Bernas	Trader	Middlemen	Others	Total
Pulau Pinang	45.0	47.5	0.0	3.8	3.8	100
Kerian/ Sg.Manik	26.9	30.1	2.6	32.7	7.7	100
Seberang Perak	88.9	2.5	0.0	2.5	6.2	100
Kemasin Semerak	51.5	41.2	1.5	1.5	4.4	100
Besut	81.5	11.1	0.0	3.7	3.7	100
Overall	50.2	28.5	1.2	14.0	6.0	100

Source: JICA Farm Survey, 1997

In Pulau Pinang and Kemasin Semerak, the farmers' choice is almost even between BERNAS and private millers, which indicates well competitiveness between millers. On the other hand, marketing destination is highly biased to BERNAS in Besut and Seberang Perak. The existence of middlemen and trader is not so significant except in Kerian/Sungai Manik area. In case of Kerian/Sungai Manik, about 32.7% of respondents sell their products to middlemen. Among the all respondents in Kerian/Sungai Manik, about 80% sells their products individually and the rest of 20% sells in group. For those who sell individually, about 39% of them are relying on middlemen as the marketing destination, while it is only 9.4 % in case of the group sellers.

(2) Rice Mill

There are two types of rice mills, namely BERNAS mills and non-BERNAS mills. BERNAS (Padiberas Nasional Berhad), which had been a governmental agency named LPN (Lembaga Padi dan Beras Negara), was privatized in 1996 and presently it is the biggest agency dealing with paddy and rice all over the country. Non-BERNAS private mills also

exists as another destination of marketing. Number of rice mills and their capacity in each granaries are summarized below and details are shown in Table IV-16.

Scheme	No. of Mills		Annual Capacity*1	Paddy Prod'n in Scheme*2
	Bernas	Non-Bernas	(mt/year)	(mt)
Pulau Pinang	1	13	294,000	58,674
Kerian	1	9	220,000	112,668
Sungai Manik	1	0	20,000	36,808
Seberang Perak	1	0	40,000	58,853
Kemasin Semerak	1	0	20,000	19,098
Besut	1	2	29,000	27,787
Total	6	24	623,000	313,888

*1: Annual capacity is calculated by assuming working hour is 16 hrs/day and working days are 250 days/year.
*2: Average annual production for 4 years from 1991 to 1994.
Source: MOA, BERNAS, 1997

According to the data shown above, the milling capacity is enough to cover for the present production in Pulau Pinang, Kerian, Kemasin/Semerak and Besut. Although the capacities of rice mills within the project area are not enough in Sungai Manik and Seberang Perak, some portion of products are sold to the private millers from outside of the schemes such as Pulau Pinang and Kerian. Accordingly, in total of five granaries, balance of milling capacity is large enough to cover present production level.

(3) Price

The Malaysian Government set a floor price for paddy and provides price subsidy in order to stabilize farmers' income . The floor price, usually referred as Government Minimum Price (GMP), has been recently raised by RM5.39/100kg. As of January, 1998, GMP for Grade 1 paddy (long grain) are RM 55.0 per 100kg and for Grade 2 paddy (medium grain) it is RM51.7 per 100kg. In addition to GMP, RM24.81 per 100 kg of price subsidy is also provided irrespective to the paddy grade. Accordingly, the actual value that farmers obtain is estimated to be, at least, RM76.51 to RM79.81 per 100kg.

Because of this price system, purchase price of paddy at milling factory is generally fixed. In case of non-BERNAS mills, however, there are cases that milling factory offers incentives for selling paddy such as provision of transportation and/or higher purchasing price.

(4) Farm Input

As to the farm input marketing, the channel is broadly divided into 3 streams. One is through PPK, the other is through DOA and through retailers. In case of seeds, DOA sells certified seeds to farmers with about RM1.0/kg, but it is often mentioned that supply is not enough or supply timing is not adequate. Presently, MARDI recommend that seeds should be replaced after 3 seasons. Based on this recommendation, DOA supplies 30% of total amount of seeds required for one season. Therefore, the supply does not match with demand of farmers and results in relative excess demand.

In case of subsidized fertilizer, it is distributed through PPK based on the registration at PPK. Farmers who operates less than 6 acres (2.43 ha) are entitled for this fertilizer subsidy. Subsidized amount is approximately equivalent to 300kg/ha based on an agronomic recommended 'optimum' of 80N:30P:20K kg/ha in nutrient terms. Agro-chemicals are marketed with similar flow as fertilizer.

Based on the result of farm survey, the purchase of farm inputs are mostly done individually (70~87% of respondents) and group purchase is not significant (13~30% of respondents). The results of Farm Survey on purchasing mode (either by group or individually) by input item are as follows.

(%)

	Seed		Insecticides		fertilizer	
	Indiv.	Group	Indiv.	Group	Indiv.	Group
Kemasin Semerak	96.8	3.2	92.8	7.2	92.7	7.3
Besut	86.7	13.3	83.1	16.9	87.0	13.0
Pulau Pinang	13.3	86.7	72.4	27.6	63.0	37.0
Seberang Perak	68.3	31.7	79.5	20.5	68.3	31.7
Kerian Sungai Manik	79.0	21.0	95.7	4.3	64.4	35.6
Total	68.9	31.1	86.9	13.1	70.2	29.8

Source: JICA Farm Survey, 1997

Farmers insisted that the major problems for the farm-input marketing is 1) high price, which gives a high pressure on their farm economy, and 2) untimely supply of farm inputs although it is not so significant as high price.

2.5.2 Rural Credit

A multitude of agencies both institutional and non-institutional are serving the credit needs of the farmers. As the institutional source, Agricultural Bank of Malaysia (BPM), Area Framers' Organization (PPK), People's Cooperative Bank of Malaysia and other commercial banks are available. Besides, there are several non-institutional sources such as traders, relatives, money lenders. Among the all sources, BPM is the most major credit source for the farmers. The bank has established branches in all five granaries as shown below and works closely with the LPP and PPK to cater the credit needs of farmers.

No. of Branches in the Five Granaries

Pulau Pinang	4 branches
Kerian / Sungai Manik	
- Kerian	3 branches
- Sungai Manik	1 branches
Seberang Perak	1 branches
Kemasin Semerak	3 branches
Besut	1 branches

Source: BPM

BPM provides various types of loan as explained in Table IV-17, such as paddy loan, agricultural machinery loan, etc. The paddy loan is utilized for the purchase of fertilizer, agro-chemical, wage payment, machinery rent and be paid back after the harvesting (usually its repayment period is 6 month in case of paddy loan). The disbursement and recovery rate of paddy loan for last five years are shown in the table below. Details on paddy loan, agricultural

machinery loan and other type of loan, are also tabulated in Table IV-18. For the paddy loan, the recovery rate is low in the east coast comparing to the west coast, especially in Kemasin Semerak. This would be explained mainly by crop failure caused by flood in these areas.

	Pulau Pinang		Kerian		Sg. Manik		Sb. Perak		Kms-Smr*		Besut	
Year	RM mil.	Recov.	RM mil.	Recov.	RM mil.	Recov.	RM mil.	Recov.	RM mil.	Recov.	RM mil.	Recov.
1992	2.17	65%	8.22	52%	3.93	77%	0.00	nil.	2.53	35%	0.92	46%
1993	2.40	66%	4.48	48%	4.28	80%	0.29	91%	0.96	21%	0.95	48%
1994	2.35	72%	5.36	33%	3.51	76%	0.98	98%	0.73	17%	0.94	54%
1995	2.47	90%	7.63	64%	3.96	75%	1.61	78%	0.66	20%	1.01	58%
1996	2.53	96%	6.93	64%	3.36	73%	2.02	86%	0.43	43%	0.67	50%

*: Kemasin Semerak
Note: Recovery rate is calculated by BPM based on their formula.
Source: Bank Pertanian Malaysia, 1997

PPK is another major source of credit besides BPM. It provides production loan, business loan and social-education loan. Besides, PPK offers various type of loan scheme in cooperation with BPM, FOA as summarized in Table IV-19. In most cases, the loan is asked for the production purpose. In the case of PPK, usually marketing of paddy is tied up with loan repayment. Farmers who borrow money from PPK must deposit their registration book which is necessary for selling paddy. Accordingly, farmers have to sell their products through PPK and PPK will reimburse their sale after the deduction of loan. Because of this system, its recovery rate becomes high. The credit status by PPK in each granary area is given in table below.

(RM'000')

	Loan Disbursement				
	Production	Business	Social	Total	Recovery
Pulau Pinang	796	708	0	1,504	1,441
Kerian/Sg.Manik	1,820	2,049	0	3,869	3,623
Seberang Perak	125	25	0	150	110
Kemasin Semerak	575	1,191	2	1,767	1,778
Besut	690	40	0	730	676

Source: Farmers' Organization Authority, 1995

According to the Farm Survey, utilization rate of loan in the five granaries is relatively low. The farmers who asked for the loan in the year 1995/96 were only 32% of total respondents. The utilization of loan becomes lower in the east coast (around 10%) comparing with the west coast (30~50%). Among the credit sources, the BPM is the most major source which accounts for 79% of total respondents, followed by the 12% of the Area Farmers' Organization (PPK). Farmers mentioned that major problems for utilizing rural credit are 1) complicated procedure and, 2) time lag for the loan to realize. The results of Farm Survey is shown in Table IV-20.

2.6 Farm Economy

2.6.1 Crop Budget

The typical crop budget per hectare is estimated for each granary area as shown in Table IV-21 and the summery are shown below.

(RM/ha)

	Pulau Pinang	Kerian	Sungai Manik	Seberang Perak	Kemasin Semerak	Besut
Yield (kg/ha)	3,090	2,990	2,990	3,520	2,770	3,460
Price (RM/kg)*1	0.74	0.74	0.74	0.74	0.74	0.74
Gross Return	2,300	2,225	2,225	2,620	2,061	2,575
Production Cost*2	1,284	1,339	1,403	1,562	1,448	1,721
Net Return (with subsidy)*3	1,165	1,006	972	1,208	774	1,051
Net Return (w/o subsidy)*4	1,015	886	822	1,058	613	854
Return/Cost Ratio*5	1.79	1.66	1.59	1.68	1.42	1.50

*1: Price is before the raise in Dec, 97. i.e. RM496.1/t of GMP plus RM248.1/t of subsidy.
*2: Including the cost of subsidized fertilizer
*3: Net return when the cost of subsidized fertilizer is omitted from the production cost.
*4: Net return when the cost of subsidized fertilizer is included in the production cost.
*5: Return / Cost Ratio = Gross Return / Production Cost
Source: IADP Office, 1995-6

Among five granary areas, two granary areas in the east coast (Kemasin Semerak and Besut) shows lower return comparing with those of the west coast. Especially, Kemasin Semerak shows lowest net return and return/cost ratio. The return/cost ratio is less than 2.0 in all granary area, while those of Changkat Jong and MADA are usually above 2.0. This indicates that there is a room for the improvement of cost performance.

As to the component of the cost items, the major cost item is machinery, especially for the rent of combine harvester. For the progressive farmers who apply additional fertilizers and agro-chemicals, cost of fertilizer and agro-chemical also becomes expensive component. However, it differs from one place to another according to their farm management level and their interests in paddy farming.

2.6.2 Farm Income

Family income for each project area and District-wise poverty area are summarized in the table below.

(RM/Year)

	Pulau Pinang	Kerian	Sungai Manik	Seberang Perak*1	Kemasin/ Semerak	Besut
Farm Income	6,407	1,693	3,479	3,713	1,409	2,784
Non-farm Income	9,169	5,923	4,337	4,086	4,027	3,336
Total Income	15,576	7,616	7,816	7,799	5,436	6,120
Poverty Rate (%)*2	0.8	3.4	3.9	5.9	15.4	13.0

*: Income is estimated from the figure of 1994.
Source: IADP Annual Report, 1993 & 1994, Ministry of Rural Development

In all five granary areas, the main source of income is non-farm income rather than farm income. This tendency becomes more significant in the area where the high industrialization is on the process. In the Pulau Pinang, industrialization is quite significant and there are more job opportunity such as factory, transportation, tourism etc. comparing with other areas. This results in the high non-farm income as shown in the table above. Besides, farm income itself is also high as RM6,407 per year. This is because of relatively large operating farm size (about 2.87ha) and high cropping intensity of 191% (based on the Socio-economic Survey, IADP Pulau Pinang, 1991). The income level in the two schemes in the east coast are relatively lower than those of west coast.

The District-wise poverty rate is calculated by dividing the number of households under the poverty line with the total number of households of the District. Since the total number of household for 1995 is not available, the figures of "Population Census, 1991" are used by assuming that the number of households are constant through 5 years from 1991 to 1995. The definition of poverty line is made by the Ministry of Rural Development. Those are;

Poor: Household that earns less than RM425 per month but above RM212.5 per month.
Hard-core: Household that earns less than RM212.5 per month.

According to the figure calculated by this procedure, the poverty rates in the west coast are lower than those in the east coast, which is consistent with the income level. In Kemasin/Semerak, because of low crop intensity (57 %) and low yield (2.72 ton/ha) of paddy, the farm income stays at the lowest level among five granary areas.

In Kelantan State, tobacco production is also quite popular among farmers and there are actually some farmers who produce tobacco after the harvesting of paddy. According to the study conducted by the Department of Agriculture in 1994, the net return per hectare of tobacco is about RM6,500, which is more than 6 times higher than average return of paddy in Kelantan. Because of this fact, farmers preference in tobacco production to paddy would be a possible obstacle unless there is no legal frame-work and improvement in paddy production.

2.7 Financial Analysis of Rompin Paddy Estate

2.7.1 General

NAP3 indicates that the involvement of private sector in large scale paddy production be encouraged and supported. With regard to this point, the assessment of the attractiveness of a large scale paddy production would be useful in order to investigate the possibility of the privatization of paddy estate. In this appendix, financial analysis of the paddy estate is made and some implication are derived based on the simulation of several cases. The data used here for the calculation were collected from the staff of LKPP Padi Sdn. Bhd.

2.7.2 Assumptions and Cases

For the calculation, following assumptions are set for all cases.

1) Project life is set as 25 years.
2) Yield is assumed to increase proportionally from 2.5 ton/ha to 5.0 ton/ha within 5 years.
3) Cropping Intensity is 200% .
4) Gross area of 1,000 ha will be cleared and, as a result, 800 ha of net irrigation area will be available for the cultivation. The land will be cleared and become cultivable as following schedule.

	1st year	2nd year	3rd year
Area I	300 ha	300 ha	300 ha
Area II		300 ha	300 ha
Area III			200 ha
Total	300 ha	600 ha	800 ha

5) The cost for dam construction and head race from the dam to pump house is not included in the cost stream of the analysis, because it had been already installed by the government under IADP Rompin-Endau.

In this analysis, six cases are assumed and specific assumptions for each case are briefly explained below.

Case I

- Paddy is sold at RM550.00/mt (GMP) without price subsidy.
- 100% of infrastructure cost is borne by private sector.

Case II

- Paddy is sold at RM798.10/mt (GMP with Price Subsidy).
- 100% of infrastructure cost is borne by private sector.

Case III

- Paddy is sold by RM550.00/mt (GMP) without price subsidy.
- 100% of infrastructure cost is subsidized by the government.

Case IV

- Paddy is sold by RM550.00/mt (GMP) without price subsidy.
- Infrastructure cost is subsidized by the government upto the construction of irrigation and drainage structure. Land leveling and road construction will be borne by private sector.

Case V

- Paddy is sold by RM550.00/mt (GMP) without price subsidy.
- Only cutting and clearing cost is subsidized by the government.

In addition to the cases mentioned above, a simulation has made for the case that unit yield increases more than 5.0 ton/ha.

2.7.3 Project Cost

(1) Fixed Cost

The fixed cost for the project is summarized as below and the detail and disbursement schedule of are shown in Table IV-22.

(RM 10^3)

Definition	Total
Infrastructure	
1. Surveying	504
2. Designing of all infrastructure	336
3. Machine mobilization	157
4. Construction of drain. & irrig. canal	1,578
5. Construction of culv. & water cont'l struc.	631
6. Cutting and clearing	2,155
7. Leveling of land	2,103
8. Road construction	1,787
9. Infrastructure maintenance	1,261
Sub-total	10,513
Machinery and Equipment	
1. Tractors	511
2. Trailer	21
3. Harvesting machine	106
4. Office building	127
5. Store	21
6. Pump house	300
Sub-total	1,087
Total	11,600

Source: LKPP Padi Sdn Bhd.

(2) Variable Cost

The variable cost for the project is summarized as below and crop budget are shown in Table IV-23.

(RM)

Items	Price/ha (RM)	Area (2 seasons)	Cost for Total Area
1. Land preparation	313	1,600	500,800
2. Planting	106	1,600	169,600
3. Weeding	98	1,600	156,800
4. Pesticide	370	1,600	592,000
5. Fertilizing	362	1,600	579,200
6. Irrigation	32	1,600	51,200
7. Harvesting	224	1,600	358,400
8. Machine maintenance	15	1,600	24,000
9. Land rental	25	1,600	39,536
Grand total	1,545		2,471,536

Source: LKPP Padi Sdn Bhd.

(3) Staff Cost

The staff number, basic salary are presumed to be as follows. Total annual payment to the staff will be RM202,800 per year and the payment is assumed to be raised by RM9,600 per year through the project life.

(RM)

Position	Number (no.)	Basic Salary (monthly)	Annual Payment	Monthly Increase	Increase payment
1. Operation Manager	1	3,500	42,000	100	1,200
2. Plantation Manger	1	2,700	32,400	100	1,200
3. Assistant Manager	1	1,250	15,000	50	600
4. Accounts Executive	2	1,250	30,000	50	1,200
5. Supervisor (Grade 1)	1	1,250	15,000	50	600
6. Supervisor	5	700	42,000	50	3,000
7. Mechanic	1	1,000	12,000	50	600
8. Clerk	2	600	14,400	50	1,200
Total			202,800		9,600

Source: LKPP Padi Sdn Bhd.

2.7.4 Project Return

The project area is newly cleared place and no production activity had been made before the project. Therefore the value under "without condition" is nothing and the return from this project will be solely the production value of paddy. The production value at the full developed stage will be estimated as follows.

Net Irrigation Area (ha)	800
Cropping Intensity (%)	200
Unit Yield (ton/ha)	5.0
Price (RM/ton)	550.00 (798.1)
Production Value (RM 10^3)	4,400 (6,348)

Note: The figures in parenthesis are for the "with price subsidy" case.

2.7.5 Result

The result of calculation is summarized in the table below and the cash flow of each case is shown in Table IV-24~28.

Cases	Assumptions		FIRR	NPV*
	Price Subsidy	Infrastructure Cost	(%)	(RM'000)
I	No	100% private	7.18	-2,658
II	Yes	100% private	19.59	10,577
III	No	100% government	33.60	6,200
IV	No	Upto irrigation structure are subsidized.	10.10	73
V	No	Only clearing and cutting are subsidized.	8.90	-869

*: NPV was calculated by 10% of discount rate.

From the result of calculation, following points can be observed.

i) Paddy estate farming is financially viable if the infrastructure cost is subsidized by the government. In this case, government support should cover, at least, upto the irrigation and drainage structure.

ii) Paddy estate farming is financially viable as far as the present price subsidy will be retained in the future. And it is still viable even if the infrastructure cost is borne by private sector under this condition.

iii) Paddy estate farming is not financially viable, if there is no support for the infrastructure cost and price subsidy.

On the other hand, a simulation on the case of yield increase indicates that at least 5.5 ton/ha of unit yield should be achieved in order for the paddy estate to be financially viable without any government support. (See Fig. IV-9)

2.7.6 Implication

For the private sector to come into the rice industry, either price subsidy or government support for the infrastructure investment would be a necessary condition. Considering the possibility that the price subsidy will not be retained because of the future environment of international trade, the government should provide a support for infrastructure investment to some extent. Otherwise paddy estate is not financially viable and not be attractive for the private sector to come in unless more than 5.5 ton/ha of unit yield is achieved.

2.8 Problems and Constraints to Agricultural Development

Based on the present conditions described in the previous chapter, the problems and constraints to the agricultural development in the view point of the various aspects are summarized as follows :

(1) Agriculture and Agro-economy

The paddy production in the study area still remains at low level against the NAP owing to low yield. From the agricultural and agro-economic viewpoints, the following factors which affect paddy production are observed :

a) Ageing farmers, shortage of labour force and successor

Young generation has found jobs other than agriculture. They have migrate to urban areas. The family labour force is quite limited now, and the farmers are ageing.

b) Problem on arrangement of machine by broker

Most machinery are operated by private owners on a contract basis. The brokers control operation schedule between farmers and private owners. The management by brokers sometimes cause the delay in starting farm operations. The shortage of machinery also occurs during a peak period.

c) Problems encountered for mechanized harvesting with combine harvesters

a) insufficient crossings/ramps and poor farm road conditions, b) high grain losses during harvesting, c) uneven ripening among adjacent fields and d) bogging down of machines.

d) Low return of the paddy income in comparison with other crop

Net return of the paddy production is lower than that of other crop such as tobacco. This fact leads farmers to shift their production incentive to the other crop, which can be significant in the Kemasin Semerak area.

e) Farmers' non-compliance to set irrigation schedule

The irrigation schedule for each season is decided collectively by a committee of Government Agencies and in consultation with the farmers' representatives. Some farmers in the study area do often not follow this irrigation schedule.

f) Inadequate input of nitrogenous fertilizer

The paddy production in the study area is still low against the NAP target. From the agricultural view points, many factors have adversely affected the paddy production. The low dosage amount of fertilizer (Nitrogen) is considered as the one of the main reason for low paddy production in the study area.

3. MASTER PLAN OF FIVE GRANARY SCHEMES

3.1 Agricultural Improvement Plan

3.1.1 Proposed Cropping Pattern and Cropping Intensity

The present irrigation schedule of each study area is summarized as shown in Fig. IV-7. Based on the water balance study according to the present schedule, the peak requirement of irrigation water in Besut scheme is beyond availability of water and the shortage of water is one of the reasons of low cropping intensity in Besut scheme. In Kerian scheme, water supply meets demand of 200 % of the annual cropping intensity. However, the mechanization in some areas of Kerian scheme is still limited due to low bearing capacity, and the working efficiency for farming is remarkably low. The non-adherence to the planting schedule is caused by the low working efficiency of the manual land preparation and transplanting, then the cropping intensity is confined to the low level as the result. In case of Pulau Pinang, Sungai Manik, Seberang Perak and Kemasin/Semerak, irrigation water is enough even for 200% of cropping intensity.

Based on the result of the water balance study, the proposed cropping schedule in Besut scheme is examined considering the water availability, flood effected period and rainfall during harvesting period. It is judged that the original cropping schedule is suitable from the viewpoints of water availability and farming activity, and applying the original cropping schedule, 175% of annual cropping intensity can be achieved.

A major problem in the compartments A, B and C of the Kerian scheme, which are ill-drainage areas, is the non-adherence to cropping schedule by farmers, resulting that harvesting time in some areas falls into the rain season due to delay of cropping season, and pest and disease control for paddy becomes difficult because of existence of different growth stages of paddy in the paddy field. The drainage improvement is very important to avoid delay of cropping schedule with mechanizing farming. In the organic soil areas mainly located in Compartment D, the tramline system (soil improvement along the line) is proposed also for utilization of agricultural machines. Considering the availability of irrigation water, dry direct seeding methods will be introduced at 100% in off season and wet direct seeding methods will be introduced in main season except for organic soil areas. The annual cropping intensity is expected to be 200% in Kerian scheme.

The annual cultivation area and cropping intensity are shown in Table IV-29 and summarized as below.

(Unit: %)

Name of Scheme	Main season	Off season	Annual
Pulau Pinang	100	100	200
Kerian	100	100	200
Sungai Manik	100	100	200
Seberang Perak	100	100	200
Ketara (Besut)	100	75	175
Kemasin/Semerak	100	100	200

3.1.2 Proposed Farming Practices

(1) The improvement of the mechanization

Presently, major farming works such as the land preparation, harvesting and transportation are done comparatively efficiently using agricultural machines, though the difference situations are recognized among the areas. However, the managing works like seeding and application of fertilizer and chemicals are still done by the manual operation or walking machines, and the work efficiency of these works is confined to the low value. In order to improve the working efficiency of the managing works, mechanization system by integrated works is proposed as shown below. Tractors for the management works will ran on the limited way which is set in the paddy fields.

Mechanization system for Wet seeding

Land preparation (tractor + rotary) → Paddling (tractor + paddy harrow) → Seeding (tractor + power blower/granule applicator or broadcaster) → Fertilizing and chemical application (tractor + granule applicator/carpet duster/boom sprayer) → Harvesting (combine harvester)]

Mechanization system for Dry seeding

Land preparation (tractor + rotary) → Seeding and pressing (tractor + power blower/granule applicator or broadcaster and rear bucket or land roller) → Fertilizing and chemical application (tractor + granule applicator/carpet duster/boom sprayer) → Harvesting (combine harvester)

(2) Fertilizer application

Fertilization application is one of the important factors which influence the paddy yield. Fertilizers, especially NPK (N: Nitrogen, P: Phosphate, K: Kalium, potassium) are needed for every season to get high and stable yield. Optimum fertilizer application is depend on the following factors :

i) Soil fertility status
ii) Fertilizing method such as the fertilizer application timing, fertilizer application amount and type (formulation) of fertilizer

iii) Farm/cultivation Management such as the method of land preparation, plant density, weed, pest and disease control and water management, etc.

The application ratio of NPK suggested for direct seeding is 100 : 40 : 30 kg/ha, which is recommended by MARDI and followed by DOA. It is obvious that subsidy fertilizer usage of 80 : 30 (40) : 20 kg/ha for transplanting are not sufficient at areas where direct seeding methods are adopted. Additional fertilizers are needed at most of the study areas because the nutrient composition in the subsidy fertilizer are insufficient for the direct seeding plant. Besides, the amount and timing of application of fertilizers should be done correctly as shown below considering the vegetative phase and generative phase stage.

N : 1st - 1/4, 2nd - 1/4 and 3rd - 1/2 on 15 - 21 days after sowing, 45 - 50 days after sowing and panicle initiation stage, respectively
P : 15 - 21 days after sowing } together with N
K : 15 - 21 days after sowing } together with N

The application rates and times of nitrogen fertilizer in FELCRA in Seberang Perak, Changkat Jong and Skinchang in which high paddy yields are obtained, are beyond MARDI and DOA recommendation amount. However, the most of farmer in the study areas depend on the only subsidized fertilizer. A majority of farmers apply fertilizer once or twice a season. The reasons of low dosage amount of nitrogen fertilizer are as follows:

(a) Farmers apply only government subsidized fertilizer for the production cost saving.
(b) Farmers do not have a will to earn more paddy production.

In order to solve the problem of the shortage of the farmers' fund for inputs, the promotion of the agricultural loan or group loan is effective. It is important to spread the technology and knowledge to the farmer through the agricultural extension and the practice in the pilot demonstration farm. The enhancement of agricultural extension through farmers groups is important for promoting the application of more fertilizer. It is one of the realistic and useful plans to promote some model farm groups in order to spread modern technology.

Other than NPK fertilizers, secondary element (Ca : calcium, Mg : magnesium and S : Sulfur) and micro element (Fe : iron, Zn : zinc, Cu : copper and B : boron) are also needed at certain areas.

The effect of the additional fertilizer usage for yield increment in each area depend on the soil fertility status and plant management level, etc. In order to identify the suitable amount and ratio of fertilizer application, soil and plant analysis of each season should be established. The results of some researches and studies done by DOA and MARDI (based on the DRIS : Diagnosis and Recommendation Integrated System) show the NPK optimum fertilizer amount and ratio for all granary areas in Peninsular Malaysia as follows :

N	:	80 - 120 kg / ha
P_2O_5	:	30 - 50 kg / ha
K_2O	:	30 - 40 kg / ha

Considering the above mentioned and discussion with concerned staff of MARDI, DOA and MADA, the fertilizer amount and timing recommended by MARDI will basically be followed. At the same time, introduce and acceleration of the DRIS is recommended in order to establish the suitable fertilizer application amount for each area.

(3) Introduction of the new recommendable variety

A new paddy variety, code-named MR185 is released in July, 1997. The seed of MR185 is available and the planting of MR185 has started. The growth period of this variety is almost same as MR84, and it is suitable for the direct seeding method. The result of the yield trial examination recorded the high yields. There is no inferiority in the quality of MR185 as well in comparison with MR84. DOA plans to diffuse MR185. DOA plans to increase production of the seed of MR185 gradually from 1997 and will produce the seed of MR84 with 5,800 tons (approximately 50%) and MR185 with 5,000 tons (approximately 43%) per year in 1999. DOA will place these two varieties in the main varieties after 2000. Two varieties of MR84 and MR185 should be introduced in order to avoid the spread of diseases in the single variety and promote variety diversification.

(4) Pest, disease and weed control

Weed control especially during initial stage of paddy plant is one of the important farming practices to expect higher yield. The use of herbicide is unavoidable for continuous large scale crop production successfully. Proper ploughing/puddling is important to ensure uniform germination in order to assist weed control through the management of the water depth in the paddy field. As for land preparation, more than three times of preparation are effective in weeds control and promotion of the germination of the paddy. According to the result of the field test in MADA, two times of land preparation and one paddling should be done for the Wet direct seeding and two times of land preparation and pressing after seeding should be adopted for dry direct seeding.

The indiscriminate use of agro-chemicals for pests and diseases is wasteful of farm budget and harmful from the health and environmental viewpoints. It is proposed to reduce the dosage amount and times of chemicals as much as possible through adoption of effective use of agro-chemicals, like a initial stage control. The rotation of patrol will be adopted among the member of farmers' group. The use of motorbike will be effective for mobility. In order to enable access to the trouble spot affected by pest and disease, the layout of narrow pass in the paddy field is important. The management works by walking in submerged paddy field are very hard and the working efficiency is very low. However, the introduction of the new technology (tramline) makes management works in the submerged paddy fields by machines possible, and it is expected the improvement of the working efficiency. The Integrated Pest Management (IPM) recommended by DOA should also be considered to be applied in the study areas as a mitigation measure for reducing possible adverse effects of using insecticides, herbicides and other forms of agro-chemical in rice production.

The proposed agriculture improvement plan is summarized below and details are shown in Table IV-30.

I. Land preparation	Wet	land preparation	2 times
		paddling	1 times
	Dry	land preparation	2 times
		pressing	1 times
II. Seeding	(60-80 kg/ha)		
	Wet	power blower/granule applicator/broadcaster	
	Dry	power blower/granule applicator/broadcaster	
III. fertilizer application		N:P2O5:K2O=100-120:30-50:30-40	
		Subsidized: Mixture 200kg/ha and Urea 100kg/ha	
		Additional: Mixture 100kg/ha and Urea 40kg/ha	
IV. Harvesting	Combine harvester		

(5) Others

(a) Compliance of the irrigation schedule and enhancement of the management system

The various farming practices, such as land preparation, water management, fertilizer application, pest and disease control, weed control, harvesting, etc. are done through the paddy cultivation period. Compliance of the irrigation schedule and uniformity of farm works at block level are essential to improve work efficiency.

Under the present condition, it can be seen in some areas that the paddy planting is delayed sometime by the unsuitable water distribution or shortage of irrigation water. However, these problems or constraints will be solved after implementation of improvement works proposed in this study. Hence, the farm management will become more important in order to make farmers follow the irrigation schedule. For managing inclusively, it is necessary to improve the management system for paddy farming as follows:

- Enhancement of the management system

It is important that farmers are aware of the significance of compliance of the irrigation schedule. The farm management function and activity of Project Management Unit (PMU) should be encouraged in order to take care of farmers and uniformly manage the farm works at scheme level. The proper arrangement for farm works is very important in order to smoothly carry out farm works. Generally, many farmers are not aware of the significance of the arrangement. The management staff should encourage farmers to undertake suitable activities. The main function of the management system is as follows:

i) preparation of farming schedule for clarifying work and necessary inputs
ii) arrangement and order of the agricultural inputs in accordance with farming schedule

iii) arrangement of time schedule of contract works for land preparation and harvesting, etc.

FOA which is a member of PMU will arrange time schedule of contract works for land preparation and harvesting according to the farming schedule based on the proposed resister or the data base.

- The quality control of the contract work

The agriculture in Malaysia faces the farm labor shortage and an aging farmer problem. In order to overcome these problems, the mechanized farming mainly carried out by contractors has spread as the country level. The group farming and farm collectivization as counter measures are also on the recent trend. The contractors will play a more important role in the Malaysian agriculture activities in future. As for the nature of the contractor, the quality of the contract work exerts a big influence on the paddy growth and the yields. Therefore, the training of the personnel who supervise the contract works and make the quality control of the contract work will be proposed. The farmer in the agricultural machinery section of the proposed farmers' groups will bear this duty.

The basic data and information on contractor such as number of machinery, work record, technical level etc. are not available at present. It is difficult for the staff of PMU to arrange time schedule of contract works without such kind of information. It is, therefore, proposed that PMU shall establish the data base system in order to grasp the present condition of the contractors. By establishing and effective use of the data base, the selection and arrangement of proper contractors will be done smoothly. When some problems occur, prompt copings will become possible.

- The effective use of Irrigation Monitoring and Feedback System

The proposed irrigation monitoring and feedback system is the quite effective as the information tool and in grasping the working progress. The effective use of this system will make farm works smooth and publication of the timely information possible.

(b) Land leveling

The various farming practices, such as land preparation, fertilizer application, pest and disease control, weed control, harvesting, etc. are done through the paddy cultivation period. The precise control of irrigation water is necessary to carry out farming practices effectively. Land leveling is indispensable to ensure uniform germination and plant growth, to assist weed control, and to use irrigation water effectively.

(c) Paddy lot size

The paddy plot size in the study area varies from 0.2 to 2.4 ha/plot. In order to attain the more effective farm management, the followings are considered:

i) The better work efficiency of machine is achieved under large plot size.

ii) The paddy plant will grow uniformly over the extensive area.

The large paddy plot size has the advantage of the better work in efficiency and possibility of uniform plant growth. Hence, land consolidation as the structural field adjustments for large farm operations is proposed based on the samples of advanced areas, like Kampong Pelet and Kubur Panjang in Malaysia. It does not involve legal realignment of lot boundaries and changes in ownership. It is expected that the sense of solidarity as group farmer will begin to grow in among the farmers, and this will contribute to the enhancement of the formation of the group for farming. The one plot size is proposed to be 3 ha in the schemes located on the east coast and 5 ha on the west coast considering different present conditions. It is essential to coordinate with the development stage of farmers' group.

3.1.3 Anticipated Yield

It is expected that unit yield of paddy would increase considerably on account of adequate irrigation water supply and improved farming practices through the modernization of irrigation water management. Under the implementation of the project, the anticipated yield of paddy in the study area is set up at 5.5 ton per ha. In estimating the anticipated yield of paddy, available yield data are taken into consideration. The yield records in paddy fields of Besut area which practice DRIS show the high level as shown in following table. Further, in the advanced areas such as Changkat Jong and Skinchang, the yields reach 6 -7 ton per ha. Judging from these available data, with the necessary production inputs and effective extension support, a yield level of 5.5 ton per ha are recommendable and achievable. The implementation of this project is expected to contribute to the achievement of the goal for NAP.

(Unit: t/ha)

DRIS plot	1	2	3	Average
Plot 1	6.0	5.5	5.2	5.6
Plot 2	5.8	5.5	5.4	5.6
Plot 3	5.5	5.7	5.3	5.5
Plot 4	5.7	5.5	5.2	5.5

Source: Special Meeting to Increase the Paddy (Rice) Production, Department of Agriculture, 1996

3.1.4 Agricultural Extension Improvement Plan

Since 1983, DOA has been making efforts towards organizing of the farmers' group and strengthening of group farming. The agriculture extension system has been modified to a "group farming approach" based on the T&V system. As for the extension system, the previous T&V system adopted by DOA will be followed. For the enhancement of the extension

activities, the recruitment of more officers is one of the effective counter measures. However, it is suggested to improve "tools for effective extension" such as computer, and computer network. The modernization of agricultural extension system and method is considered effective measure to improve agricultural extension as well as modernization of irrigation management system. The main points of the improvement plan for agricultural extension are as follows:

(a) Data collection, supply and extension through computer network system

The irrigation schedule monitoring and feedback system with computer network is proposed as one of the O&M system improvement plan. The proposed system should be used for agricultural data collection, supply and timely extension through computer two-way network system or effective use of existing DOA home-page.

(b) Promotion of DRIS (Diagnosis Recommendation Integrated System)

The introduction and acceleration of DRIS is essential for establishing the suitable fertilizer application amount for each study area. Other than NPK, secondary and micro elements should also be considered. DOA components in the study area have begun to introduce DRIS and this activity should be promoted.

(c) Review of management skills

For establishment of farmers' organizations and mini-estates, operational skills and management techniques of organizations need to be refined with cooperation of PPK. It is important that the skills include knowledge on management of equipment and machinery that enable farmers to consider cost and benefit; then, they can curtail expenditures.

(d) Project monitoring

When a project is implemented, it is important to evaluate the project and monitor issues and problems, which contribute to the improvement of the project activities. It is also suggested that a monitoring system for the project be formulated. Items to be monitored should be able to produce database for computer analysis, and these are listed as below.

(i) weather and hydrology, (ii) water management, (iii) record of maintenance and management of facilities, (iv) record of farming practice (farm schedule, cropping intensity, yield per unit, productivity, crop damage including diseases, insect attack and weed problems), (v) farmers' organization, (vi) information on contractors

3.2 Agro-economy Improvement Plan

3.2.1 Marketing

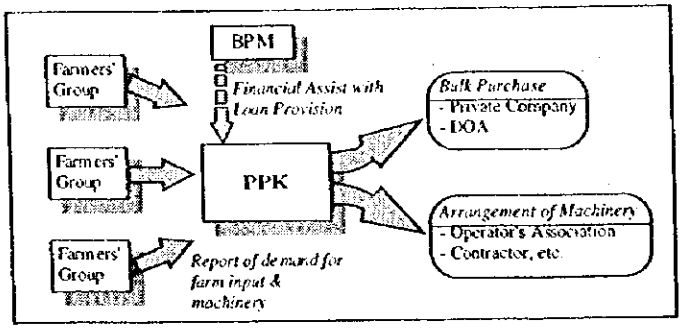
Marketing improvement plan consists of three components, namely, a) improvement of harvesting method, b) marketing by group and c) diversification of market destination.

(1) Modern harvesting method

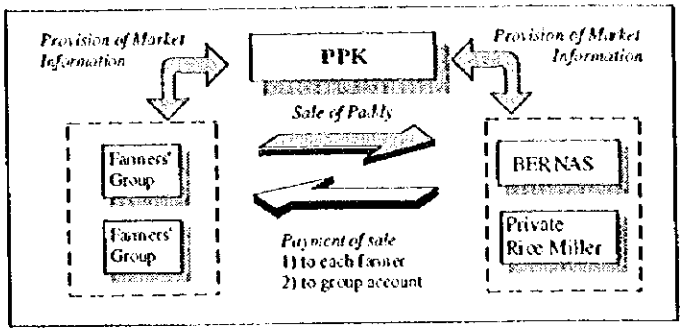
Bulk handling is the major harvesting method prevailing in the study area. This method has the advantages in reducing transportation cost, saving of manpower, elimination of drudgery. Therefore, where the *guni*-sack handling is still dominant such as Kerian, harvesting method should be shifted to bulk handling. Shifting to bulk handling would be the basic step for paddy marketing improvement. For the implementation, improvement of infrastructure (farm roads) and dissemination of knowledge regarding the advantages of bulk handling will be necessary.

(2) Group Marketing

In order to have a negotiation power to discount the purchase price of farm input, group purchase of farm input would be recommended. Besides, arrangement of machinery should be also promoted in order for farmers to be able to adhere cropping schedule and to attain cheaper hiring cost. In practical, necessary amount of farm input and requirement of machinery will be confirmed at each farmers' group level and be reported to PPK. PPK will purchase the input from private company, DOA or other concerning agencies based on the report from farmers' groups. Arrangement of machinery will be done in the same procedure. For the payment, PPK basically use its own fund and collect from the farmers after the harvest or deduct from farmers' sale. Supplementary, BPM will assist PPK's fund by providing loan such as revolving loan for the purchase of input. Conceptual diagram of farm input arrangement is shown as below.

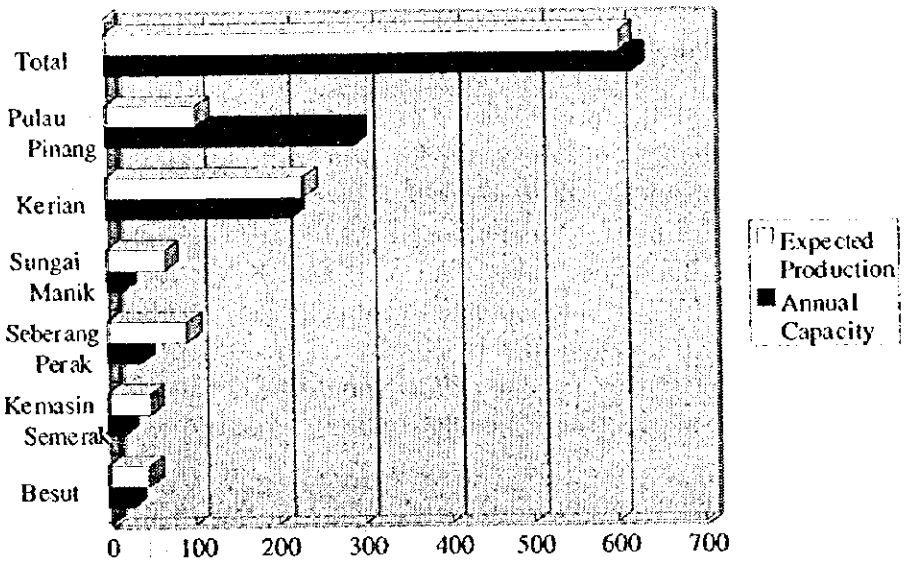


As to the marketing of paddy, group selling by farmers' group should be promoted in the first stage. Group selling has advantages in negotiation power, easiness in arrangement of harvester and transportation. In addition, in order to avoid concentration of paddy in one mill at same time, cropping schedule should be strictly adhered and market information should be provided through PPK. Presently, PPK collects paddy from member farmers and sells paddy to millers. In this process, information on rice mills are collected and utilized by PPK. These information would be provided also to farmers' groups. In the first stage, return of sale would be paid directly to each farmer. As the management capability of farmers' group be strengthened, sale will be paid to the group account and paid to each farmer after the deduction of loan amount. As the farm management is upgraded to mini-estate, sale of paddy will be done through PPK or estate management unit and sale will be distributed to the farmers according to their share holdings. Procedure of paddy marketing will be as follows.



(3) Market Diversification

Diversification of selling destination should be done because of two reasons. One is to avoid the concentration on one mill at a same time. As it is shown in the figure below, the present capacity of rice mills in each area will be not able to cover its expected production in the future except Pulau Pinang. In total of five granaries, however, milling capacity is large enough to cover the future production. In this regard, concentration on one mill at same time should be avoided, otherwise present rice mill facility is not capable to cope with future milling demand.



Note: Expected production is calculated assuming 5.5 t/ha and expected cropping intensity for each area.

Another reason for diversification is to have better selling condition such as higher price by selecting sale destination, since some private millers offer higher price or price incentives, transportation and so on. For the provision of information, which is important in selecting sale destination, PPK should play a main role. In addition, PPK should advice to allocate paddy so as not to concentrate on one mills at a same time.

3.2.2 Rural Credits

There are few problems observed in loan utilization by individual farmers. However, there is still a room for improvement by simplifying application procedure and shortening the

time for loan realization. Besides loan disbursement to individuals, demand for loan utilization by farmers' group will be expected to increase as the grouping of farmers proceeds. In this regard following points should be considered.

(1) Establishment of Farmers' Group

In the initial stage, farmers' group will need its own group account and fund for operating group. This fund would be collected from member farmers and, in some cases, financial assistance form outside agency would be needed. Besides, where the farmers' group become well managed, financial assistance would be necessary for upgrading themselves into mini-estate. For these purpose, BPM or LPP should provide loan to establish group account or assisting loan for upgrading especially in their initial stage.

(2) Loan for Farm Input Purchase

As the purchase of farm input will be done in group, seasonal demand for purchasing loan would be increase. In this regard, purchase loan such as Padi Loan, which is presently provided by BPM to individual farmers, should be available for group. In addition, Padi Loan by revolving loan system should also be considered in the future.

(3) Loan for Agricultural Machinery

In accordance with the mechanization of paddy farming, loan demand for agricultural machinery is expected to increase. Especially for farmers' group, procurement of machinery is important factor for their mechanization. Therefore, relating agencies such as BPM or PPK need to prepare enough fund for this purpose. As the loan scheme to be utilized for this purpose, BPM's agricultural machinery loan or FOA's KPPP loan would be considered. Presently, loan scheme for machinery procurement is already available both for farmers and contractors. However, utilization of this loan by contractors are not much common yet. Accordingly, loan disbursement for contractors should be enhanced so that various type of entities are able to come in paddy farming industry.

In connection with marketing improvement, loan repayment should be also changed. In the initial stage, collection of loan repayment would be made at group level especially for farm input purchase, and it would be collected by group leader or committee member of farmers' group. When paddy sale shift from individual selling to group selling, repayment should be deducted from the return before reimburse to member farmers. By applying this system, the problem of defaulter can be reduced especially for input purchasing.