This unexpectable rainfall pattern combined with the insufficient water resources development have caused a considerably low productivity in rice production, the main economic activity in the study area, similar to almost rural area in the Northeast.

Every year more than half of approximately 75,000 rai of paddy fields in Amphoe Phra Yun of the study area is considered as uncultivated due to lack of water.

Another factor of the low agricultural productivity may be referred to the salt-affected soil and water resources for agricultural purposes at various degrees in this region.

Besides, there is no proper installations for products-distribution such as a market in the study area. Small family typed shops selling several daily necessities and foods are observed in each Muban. Some small-scaled rural industries are intensively practiced such as the production of plastic sunshades in Muban Non Bo, the production of plastic mats in Muban Ton and Muban Pom. Besides, the production of "madmee" (a kind of Thai traditional silk cloth) is observed in Amphoe Chon Na Bot near the study area.

The total population in these area practice also paddy cultivation as the main job with other side-jobs such as weaving mats and making clothes etc.

1-4-4 Swamps and ponds

As water is a very important factor in living conditions, existence of numerous swamps/ponds is another specific socio-economic aspect observed in the study area.

Due to the topographic aspect and dwelling situation, more natural swamps and artificial ponds are observed in the east than in the west. Almost dwelling agglomerations are observed at nearby roads and swamps/ponds which are considered as two main factors effecting living conditions of local inhabitants.

From our survey in wet and dry seasons, all these swamps and ponds, however, are affected by saline concentration from soil and/or water sources at various degrees. Drinking purpose, therefore, could not be used as a preferable source (Most of local people drink collected rain water.) Only a few ponds have been used for irrigation purpose.

Since the Northeast has been frequently affected by drought, the existence of these swamps and ponds has contributed as a relief source for domestic use, especially during the drought period. Most of swamps and ponds have been used for cattle, mainly buffalo, taking bath. A survey on 21 main swamps and ponds in the study area was carried out.

Table I-14 Area, Population and Households in the Study Area

	Area (km²)	Population	Population Density	Households	Persons / Household
I. Amphoe Phrayum (5 Tambons, 36 Villages)	172	30,696	178.5	5,695	5.4
II. Other Areas					
1. Amphoe Muang (1 Tambon, 10 Villages)					
2. Amphoe BanFang (1 Tambon, 10 Villages)	169	15,919	94.2	2,983	5.4
3. Amphoe Manjakhiri (1 Tambon, 10 Villages)					
Total (10 Tambons, 61 Villages)	341	46,615	136.7	8,678	5.4

Table I-15 Population and Households in Tambon and Muban of Amphoe Phra Yun

1. Tambol: Phra Yun (42㎢ or 26,250 rais)

Moo (No.)	Name of Villages	Population		Number of households
		number	%	
1.	Ban Phra Yun	1,491	14.25	271
2.	Ban Hua Bung	1,196	11.43	169
3.	Ban Na Lom	590	5.64	120
4.	Ban Non Boe	1,505	14.38	327
5.	Ban Nong Ku	667	6.37	124
6.	Ban Pa Moe	1,964	18.77	252
7.	Ban Hin Hurb	1,430	13.67	330
8.	Ban Ken Prad	640	6.12	138
9.	Ban Pa San 1	567	5.42	115
10.	Ban Pa San 2	414	3.95	102
Total		10,464	100.00	1,948

2. Tambol: Kham Pom (29㎢ or 18,125 rais)

Moo (No.)	Name of Villages	Population		Number of households
		number	%	
1.	Ban Kham Pom	1,496	(25.50)	248
2.	Ban Noi Chan Bung	498	(8.49)	99
3.	Ban Chad	1,032	(17.59)	189
4.	Ban Bo Kae	1,028	(17.52)	185
5.	Ban Nong Thung	164	(2.80)	26
6.	Ban Poe Thong	1,298	(22.13)	171
Total		5,865	(100.00)	984

3. Tambol: Phra Bu (28㎢ or 17,800 rais)

Moo (No.)	Name of Villages	Population		Number of households
		number	%	
1.	Ban Phra Bu	1,124	(26.88)	178
2.	Ban Phra Noe	1,047	(2.03)	182
3.	Ban Han	1,264	(30.22)	207
4.	Ban Jod Noi	314	(7.50)	48
5.	Ban Po Khum Din	358	(8.56)	59
6.	Ban Tha Ngam	75	(1.81)	15
Total		4,182	(100.00)	689

4. Tambol: Ban Tun (39㎢ or 24,375 rais)

Moo (No.)	Name of Villages	Population		Number of households
		number	%	
1.	Ban Ton	1,665	(30.54)	401
2.	Ban Ton	1,342	(24.61)	297
3.	Ban Jod Yai	546	(10.01)	134
4.	Ban Dong Kao	420	(7.70)	91
5.	Ban Dong Klang	1,301	(23.86)	256
6.	Ban Hin Kong	179	(3.28)	33
Total		5,453	(100.00)	1,212

5. Tambol: Nong Waeng (33㎢ or 20,625 rais)

Moo (No.)	Name of Villages	Population		Number of households
		number	%	
1.	Ban Nong Waeng	1,131	(23.90)	218
2.	Ban Nong Poe	1,042	(22.02)	173
3.	Ban Nong Ya Khao-Nok	1,160	(24.52)	198
4.	Ban None Tun	507	(10.71)	116
5.	Ban Nong Jik	392	(18.85)	157
Total		4,732	(100.00)	862

Amphoe Phra Yun. Total	30,696	5,695

Table I-16 Socio-Economic Conditions of Villages (Excluding Amphoe Phra Yun)

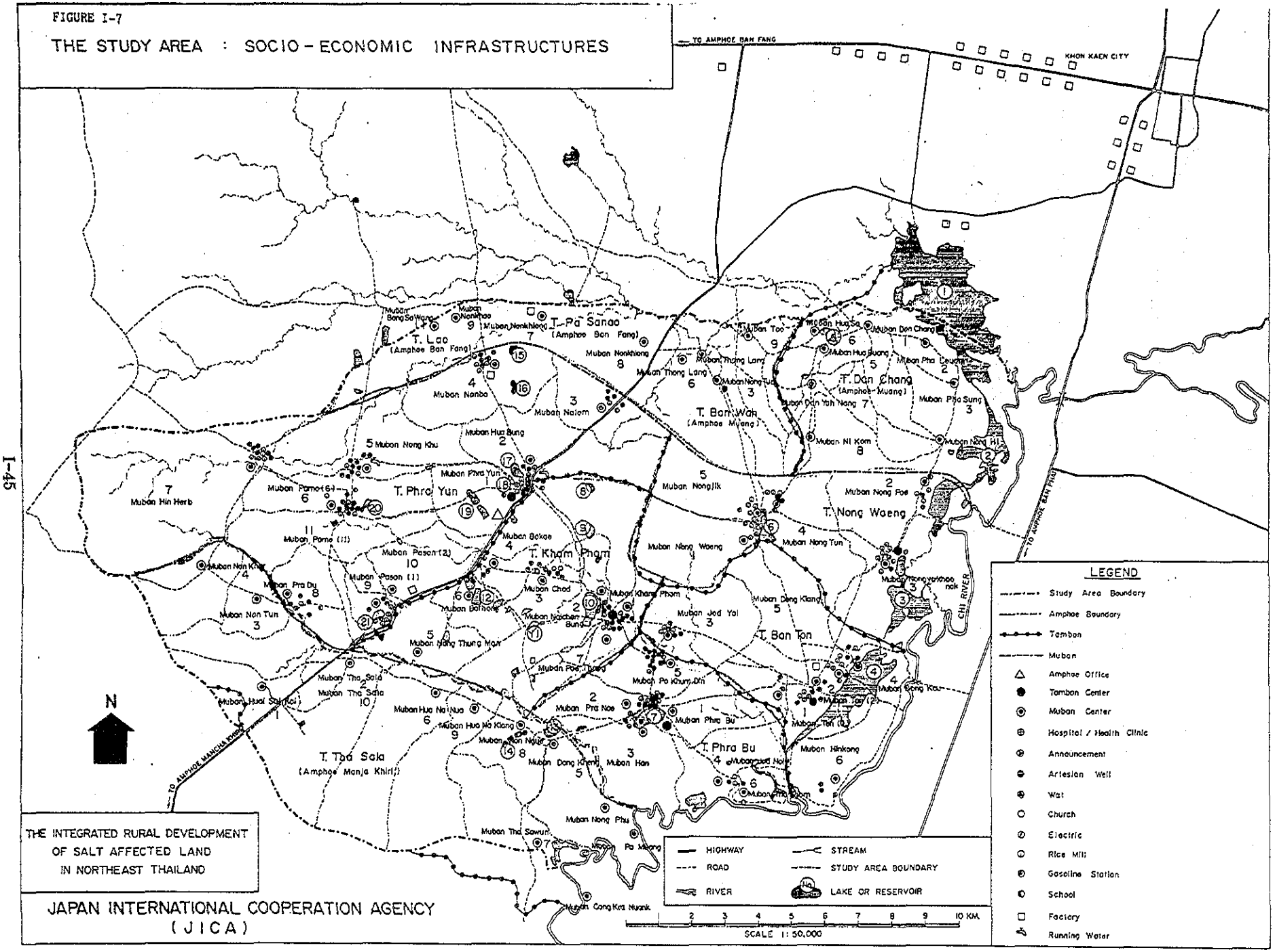
	Population	Total Household	Area (Rai)	Agriculture Land Rai (%)	Farming Household	School	Health Clinic	Other Occupation (Households)
I. AMPHOE NUANG								
1. Tambol Ban Wa								
No. 3 Ban Nong Tun	354	61	3,300	3,100 (91%)	50	2	2	—
No. 5 Ban Thong Lang 1	978	196	2,057	2,000 (98%)	100	2	2	—
No. 6 Ban Thong Lang 2	724	163	2,263	2,223 (99%)	5	2	2	Madmee
No. 9 Ban Tan	413	70	610	540 (88.5%)	8	2	2	Wickeware
2. Tambol Don Chang								
No. 1 Ban Don Chang	1,191	213	4,402	4,038 (92%)	189	2	2	Mat(150)
No. 2 Ban Pha Luam	318	96	1,500	1,406 (94%)	96	2	2	—
No. 3 Ban Pha Sung	360	71	1,224	450 (36%)	60	2	2	Mat (64)
No. 4 Ban Nong Hi	652	102	2,700	2,200(81.5%)	89	2	2	Mat (80)
No. 5 Ban Hua Bung	898	58	1,093	900(82.5%)	58	2	2	Mat (58)
No. 6 Ban Hua Sra	211	46	526	184 (35%)	43	2	2	Mat (10)
No. 7 Ban Don Yah Nang	467	91	1,310	1,310(100%)	91	2	2	Clothes(60)
No. 8 Ban Ni Khoe	217	32	361	300 (83%)	26	3	2	—
II. AMPHOE BAN PANG								
1. Tambol Ban Lan								
No. 9 Ban Non Khen	191	36	335	325 (90%)	36	3	2	Clothes (5)
No. 11 Ban Bun Sawang	651	113	1,322	1,272 (96%)	113	2	2	Clothes(13)
2. Tambol Pa Sanao								
No. 7 Ban Nong Khong 1	829	146	2,785	2,622 (94%)	146	〃	〃	
No. 8 Ban Nong Khong 2	784	143	2,655	2,585 (97%)	143	〃	〃	
III. AMPHOE MAWA KHIRI								
1. Tambol Tha Sala								
No. 1 Ban Huai Sai Kei	435	121	1,490	1,300(87.8%)	110	3	1	1 Ricemill
No. 2 Ban Tha Sala 1	818	174	2,100	1,500(71.5%)	170	2	1	4 Ricemill
No. 3 Ban Non Tun	353	65	493	300 (61%)	64	2	2	1 Ricemill
No. 4 Ban Non Khun	508	105	1,090	1,600 (99%)	105	2	1	2 Ricemill
No. 5 Ban Dong Khen	1,170	161	8,438	7,956 (94%)	72	2	1	3 Ricemill
No. 6 Ban Hra Na Nao	419	102	2,294	2,000 (87%)	96	2	1	—
No. 7 Ban Tha Sawaun	1,464	227	2,940	2,510 (85%)	222	2	1	—
No. 8 Ban Hua Na Klang	528	92	1,500	955 (64%)	91	2	1	—
No. 9 Ban Non Ngio	490	96	2,900	1,700 (59%)	50	1	2	—
No. 10 Ban Tha Sala 2	290	57	1,205	1,125(93.4%)	45	2	1	2 Ricemill
Total	15,919	2,983	3,463	46,401 (86%)	2,358	47	39	

Table I-17 Survey on Ponds Existing in Study Area

Pond Name	Locaton (Muban, Tamblol, Auplhoe)	Area (m2)	Depth Dry/Wet (m)	Reservation-Capacity (m3)		Water Quality EC(MS/cm/25°C)		Utilization					Remarks
				Dry Season	Wet Season	Dry Season	Wet Season	Irrigation (ha)	Drink-ing	Domestic Water	Fisheies	Live slock	
Bang Kaeng Nam Ton T.	Amyphoe Muang	6,777,000	2.0/2.5	13,554,000	16,942,500	940	1,976	Paddy=288 Upland=48/80			O		NEA Pumping Station Brakish
Kul Phan	Ban Non Waeng	2,027,000	3.0/4.0	6,081,000	8,108,000	544	472	Paddy=96 Upland=5/0		O	O		Good for irrigation
Kut Mak Theng	Ban Non Waeng	1,280,000	1.0/2.0	1,280,000	2,560,000	621	659	Paddy=96			O	O	Salar Pump Good for irrigation
Kut Khok	Ban Ton	2,560,000	1.0/2.0	2,560,000	5,120,000	770	430	Paddy=800 Upland=3.2/0		O	O		Cooperative Pumping Station Good for irrigation
Nong iiua Bung	Ban iiua Bung	15,000	0.4/1.5	1,000	22,500	n.a.	6,203	——		O	O		Brakish
Nong Waeng Hi	Ban Nong Waeng Hi	232,000	2.8/3.0	679,000	696,000	250	136	Paddy=480 Upland=16/16		O	O		Canal=1 km Good for irrigation
Nong Phra Bu	Ban Phra Bu	195,000	1.0/2.0	195,000	390,000	1,535	4,573	Paddy=320 Upland=32/0		O	O		Brakish
Nong iiua	Ban Phra Yun	49,600	0.0/1.0	0	49,600	239	224	——		O	O		Good for irrigation
Nong Waeng Klang	Ban Phra Yun	100,800	3.0/4.0	302,400	403,000	196	149	——		O	O	O	Community Pond Good for Potable
Nong Pan Nam	Ban Chal	216,000	0.6/2.0	129,600	432,200	n.a.	164	Paddy=240	O	O	O	O	Weir Canal Pipeline Spilway Good for Potable
Nong Chang To	Ban Kbam Tom	100,800	0.5/2.0	50,400	201,600	2,699	2,343	——		O	O	O	Brakish
Nong Bai Si	Ban Bo Kac	15,000	0.5/2.0	2,000	0,000	2,571	4,704			O	O		Brakish
Nong Bo	Ban Dong Kheng Amphoc Manja Khiri	50,000	1.5/3.0	75,000	150,000	2,895	5,394	Paddy=24 Upland=4.8/8	O	O	O		Brakish
Nong Ban	Ban Non Ngiu Amphoe Manja Khiri	4,000	0.0/2.0	-	8,000×4	7,191	8,488	——		O	O		Brakish
Nong Bo	Ban Non Bo	3,500	0.0/1.2		4,200	669	858	——		O	O		Good for irrigation
Nong Bo Yai	Ban Non Bo	25,000	0.8/2.0	8,000	50,000	2,166	3,880	——		O	O		Brakish
Nong Phra Yun	Ban Phra Yun	22,500	0.5/1.0 (3.0)	5,000	67,500	334	294	——		O	O		Good for irrigation
Nong Phra Yun	Ban Phra Yun	2,500	2.0/5.0	1,800	12,500	332	570	——		O	O		Brakish
Nong Kung	Ban Phra Yun	10,000	1.0/2.5	3,000	25,000	878	1,311	——		O	O		Brakish
Nong Kam	Ban Pa Mo	13,000	0.5/2.0	1,500	26,000	1,651	2,367	——		O	O		Brakish
NongBai Klmai	Ban Pa San	10,000	0.6/1.5	1,500	15,000	n.a.	1,580	——		O	O		

FIGURE I-7

THE STUDY AREA : SOCIO-ECONOMIC INFRASTRUCTURES



THE INTEGRATED RURAL DEVELOPMENT OF SALT AFFECTED LAND IN NORTHEAST THAILAND

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

1-5. Questionnaire Survey on Socio-Agro Economy

Along with the collection and analysis of data from the official NESDB's NRD 2C investigation. A survey on agro-socio economy was carried out by 3 means as follows:

- Questionnaire on socio-agro economic conditions to local inhabitants and their representatives in the study area.
- Visits to concerned officials in Amphoes Phra Yun, Muang, Manja Khiri and Ban Fang, Changwat-office in Khon Kaen, DTEC and NESDB in Bangkok.
- Collection and analysis of concerned data and materials on agro-socio economy, especially related to Northeast Thailand.

The purpose of this 3-way survey is to grasp the situation of following aspects:

i) Actual living conditions.
ii) Present agricultural production including the farming system.
iii) Problems in daily life and agricultural production.
iv) Incomes and expenditures.
v) Farmers' intentions.

Information from the 3-way survey will be evaluated together for obtaining a real figure as much as possible in each aspect concerned in order to provide basic directives for formulating the Master Plan.

This quetionnaire-survey on agro socio-economy was carried out at individual households with the assistance by a DLD staff group dispatched from Bangkok (Land Use Planning Division).

This was done for collecting 224 samples (4 samples per village) in the study area.

This is a random survey by choosing 4 households (2: medium, 1: rich and 1: poor) for conducting the interview with, sometimes, participation of local representatives such as Kamman (Tambon-Chief) or Buyai-ban (village-Chief).

From this questionnaire survey, basic data and information on each aforementioned aspects were gathered for enumeration and further evaluation.

The ultimate purpose for surveys in agro-socio economy is how to solve the poverty problem in the Northeast reportedly affected by severe natural conditions such as saline soils and erratic rainfall patterns up to now.

From these survey works, real figures as much as possible on each related aspect were obtained accordingly to be notified and summarized in attached tables.

* Understanding on Constraints

The major cause of low agricultural productivity resulted in low-income farming in the study area as well as most parts in the Northeast Thailand is in the mainly rainfed rice cultivation which most local inhabitants practice for producing this stable crop as food for self-consumption and capital in case of surplus. This is their traditional economic activity making their own rural life-style up to now.

Most of farm-sizes in the study area are ranged between 15-20 rais, considered as small-sized farms and rather smaller than the average farm-size in changwat Khon Kaen as well as Northeast Thailand.

Due to the considerable insufficiency of agricultural water and the erratic rainfall pattern in the Northeast, these farms are almost made into small plots, sometimes 2-3 wah, for the convenience in keeping and controlling water ; but for mechanization this is inconvenient except for using buffalo as draught force and applying small-sized power tillers.

From these farming conditions of seriously lacking agricultural water, half of paddy fields have been reportedly uncultivated every year.

Another factor contributing to the low yield of agricultural production is the salt-affected soil patches (approx. 15 % of the total area) and

water resources found in the study area, similar to various parts in the Northeast Thailand.

For paddy fields in the study area, the average yield per rai is approximately 200-250 kg per annum, lower than the average productivity of 320 kg/rai for the whole country.

From above production conditions, in case of normal production (non-drought year), the average agricultural production per household calculated in currency, therefore, is approximately 15,000 Baht (or approximately 3,000 kg of rice) per annum for supporting a 5-member family with and average of 2.5 labor forces.

But their paddy production is mainly for self-consumption.

From this background, each household in the study area has no cash-income, except for doing other off-farm jobs or selling their surplus rice.

But other sectors such as business and manufacturing are not intensively applied in the study area as well as almost rural areas in Northeast until recent years. The total share of these two sectors is considered not more than 20 percent of its GDP at now.

Recent rural development projects have been carried out in order to solve off-farm job opportunities with some particular rural industries based on local techniques. But a sufficient supporting system for these rural industries (plastic sunshade production in Muban Non Bo and plastic mats in Muban Ton and Kham Pom) such as production cooperative and distribution system is not observed at the time being.

Considerable market-intitutions are not existing in the study area except for a sunday-market on a road of muban Phra Yun and activities of the cooperative.

In Northeast, the fundamental problem of rural poverty is in the insufficient development of business and rural industries; and for agriculture, the attitude of farmers sticking to rice-culvation only. As

the rice price is not increased while other material prices are gradually increased, farmers are subjected to bear deficit in income yar by year.

For agriculture, the lack of agricultural water is a basic factor to the low agricultural productivity.

Salt-affected soils and water resources act also as an additional factor to this problem.

Therefore, agricultural works in the dry season are so limited that migrant laborers should be done for earning incomes. This is due to the scarcity of off-farm jobs in the rural areas.

Cottage-industries performed at home-base are still in production of simple products such as fabrics and mats with a low market ability, which require a proper development in techniques and markets with sufficient supports from the administrative side.

Table I-18 Data Sheets of Agro-Economic Survey

Survey No:	Date:
Village :	Collector:
Owner :	Emmerator:

FAMILIAL-SITUATION

Place: Living Condition: Landless: Y/N
Main Profession: Sub-Business 1. 2. 3.

Family-Position:	Age:	Main Profession:	Sub-Profession:	Income Main	Income Sub	Education	Remarkes
1.							
2.							
3.							
4.							
5.							
6.							
7.							
Total							

Other Incomes: y/N Souces 1. (Baht/Year) 2. (Baht/Year)

EXPENDITURE

	1.Housing	2.Staple Foods	3.Other Foods	4.Fuels	5.Trans-portion	6.Education	7.Clothes	8.Medical	9.Others
Cost									
Sufficiency y/N									

	Production	Land Cost	Seeds	Machinery	Fuel	Irrigation	Fetilizers	Perticides	Others
1.									
2.									
3.									
4.									
5.									

FARMING CONDITIONS

Farming Y/N How long? ··· years Type: 1.Family 2.Group 3.Labour
Land-holding Y/N Own Land: ··· rai/wah Tevant land ··· rai/wah Rented land ··· rai/wah Leased land ··· rai/wah

Product	Calender	Area	Land-Type	Yield	Consumption /Marketing	Market Price Route	Irrigation Y/N	Machinery	Ferti-lizers	Others
1.										
2.										
3.										
4.										
5.										

Rental Fee:

Lea ed Fee:

Tenant System:

Comments ① Farm Land: ② Production: ③ Costs:

FARMERS' INTENTION

	SUFFICIENT NOT AT ALL	SUFFICIENT A FEW	SUFFICIENT	TOO MUCH	REMARKS
1. Seeds					
2. Irrigation					
3. Tools/Machinery					
4. Fertilizers/Perticides					
5. Credit					
6. Extension					
7. Marketing					
8. Land Tenure					
9. Harvest-Damages					

10. Inquires for Better Living and Farming Conditions with following priority
(1) (2) (3) (4) (5)

Table I-19 Preliminary Results from Agro-Economic Survey

Total Samples investigated : 224 House holds (100%) Average members / family : 5.0 / family
Total villages investigated : 56 (4 samples / Villages) Average Labourforce / family : 2.5 / family

	Poor House No: 51 (23%)		Medium House No: 125 (56%)		Rich House No: 48 (21%)		Total No: 224 (100%)		Remark
	(No)	(%)	(No)	(%)	(No)	(%)	(No)	(%)	
Agriculture	51	(23)	125	(56)	48	(21)	224	(100)	① Agriculture(100%)
Business	40	(23)	100	(56)	38	(21)	178	(100)	② Business (55%)
Others	38	(24)	84	(53)	36	(23)	158	(100)	
Land less	3	(100)	-	-	-	-	3	(100)	① More than 60%
Rental Land	8	(62)	3	(23)	2	(15)	13	(100)	have under 25 rai
Land Ownership									
0 - 10 rai	32	(70)	14	(30)	-	-	46	(100)	
11 - 25 rai	9	(9)	88	(88)	3	(3)	100	(100)	
more than 25 rai	7	(9)	23	(31)	45	(60)	75	(100)	
Main : Income									
0.0 - 15,000 B/year	43	(41)	51	(48)	12	(11)	106	(100)	Approx. 50% have
15,100 - 30,000 B/year	7	(10)	53	(73)	12	(17)	72	(100)	annual income of
more than 30,00 B/year	1	(2)	21	(46)	24	(52)	46	(100)	0 - 15,000 B.
Other Income									
1,000 - 5,000 B/year	16	(25)	34	(52)	15	(23)	65	(100)	
- 10,000 B/year	12	(28)	23	(53)	8	(19)	43	(100)	
more than 10,000 B/year	12	(17)	43	(60)	17	(23)	72	(100)	
Total Expenditure									More than 50% have
- 10,000 B/year	4	(40)	5	(50)	1	(10)	10	(100)	total expenditure
- 20,000 B/year	27	(33)	48	(59)	6	(8)	81	(100)	between 20,000~
- 30,000 B/year	10	(15)	45	(70)	10	(15)	65	(100)	30,000 B
more than 30,000 B/year	10	(15)	27	(40)	31	(45)	68	(100)	
Food Expenditure									Approx. 50% have
- 5,000 B/year	1	(50)	1	(50)	-	-	2	(100)	food expenditure
- 10,000 B/year	7	(17)	30	(73)	4	(10)	41	(100)	between 10,000~
- 20,000 B/year	30	(30)	55	(54)	16	(16)	101	(100)	20,000 B
more than 20,000 B/year	13	(16)	39	(49)	28	(35)	80	(100)	
Production Expenditure									
- 5,000 B/year	44	(38)	59	(51)	12	(10)	115	(100)	
- 10,000 B/year	3		46		15		64		
- 20,000 B/year	4		20		14		38		
more than 20,000 B/year	-		-		7		7		
Production Problem									
Water	51		117		48		216		① Lack of Water
Soil	18		57		15		90		② Poor Soil
Fertilizer	13		10		3		26		③ Other inputs
Pesticide	15		25		7		47		(Pesticide, Fert-
Money	6		26		-		32		ilizer, Credit)
Labour Force	-		-		-		-		
Needs									
Road	36		105		35		176		① Domertic Water
School	9		7		2		18		② Common Transport
Hospital	36		74		27		137		③ Stadium
House	-		-		-		-		④ Road
Stadium	37		96		45		178		⑤ Health Care
Toilet	2		6		3		11		
Telephone	16		54		25		95	1	
City Water	49		114		46		209		
Severage	14		24		5		43		
Bus	41		105		41		187	2	
Tuktuk	18		47		3		68		

Table I-20 Survey on Income Distribution in the Study Area
TAMBOL PRAYUN (1)

(TK)

Per Household	Main Income			Other Income			Total Income		
	Less Than 15,000	15,000～30,000	More Than 30,000	Less Than 15,000	15,000～30,000	More Than 30,000	Less Than 15,000	15,000～30,000	More Than 30,000
1－1－1			47,700						47,700
2	13,000				19,200				32,200
3		15,600		10,000				25,600	
4	11,000				20,000				31,000
1－2－1	12,200			6,000				18,200	
2		23,400				36,000			59,400
3	13,500			8,000				21,500	
4	7,300						7,300		
1－3－1		26,500		2,000				28,500	
2			50,000		18,000				68,000
3	6,000					33,600			39,600
4	10,800			12,000				22,800	
1－4－1	3,000			3,600			6,600		
2	11,650				20,000				31,650
3		15,250		8,000				23,250	
4	3,300			5,000			8,300		
1－5－1		29,900		120					30,020
2			44,510	7,020					51,530
3			38,232						38,232
4	3,900						3,900		

T. PRAYUN (2)

(TK)

Per Household	Main Income			Other Income			Total Income		
	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000
1-6-1			66,500			40,000			106,500
2		25,900						25,900	
3	8,808			6,000			14,808		
4	9,300						9,300		
1-7-1	13,200			9,900				23,100	
2			128,650	5,300					133,950
3		10,900					10,900		
4			41,000						41,000
1-8-1		19,750			15,000				34,750
2			31,800	3,000					34,800
3	4,200			2,000			6,200		
4		17,106		6,780				23,886	
1-9-1		20,100		3,800				23,900	
2	9,000						9,000		
3	8,400						8,400		
4	7,500			2,000			9,500		
1-10-1		16,600						16,600	
2		16,200		5,000				21,200	
3	13,320			3,000				16,320	
4		15,850						15,850	
Total	169,378	253,056	448,392	108,520	92,200	109,600	94,208	306,606	780,332

TAMBOL KHAN POM (3)

(TK)

Per Household	Main Income			Other Income			Total Income		
	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000
2-1-1		25,400		6,820					32,220
2			39,950						39,950
3		26,100		6,000					32,100
4	7,200			2,000			9,200		
2-2-1		28,300		6,000					34,300
2			30,940	3,200					34,140
3	7,900			4,500			12,400		
4	1,800					49,000			50,800
2-3-1	9,000			6,600				15,600	
2	10,320						10,320		
3	11,500			1,000			12,500		
4	3,300					36,000			39,300
2-4-1			32,700						32,700
2	12,700						12,700		
3		15,600						15,600	
4	13,500				20,000				33,500
2-5-1	450			6,000			6,450		
2	3,000			6,000			9,000		
3	6,000			12,000				18,000	
4	3,600				15,000			18,600	
2-6-1			36,900						36,900
2			68,310	4,000					72,310
3	6,900					40,800			47,700
4		28,900				30,000			58,900
2-7-1			64,475		20,000				84,475
2			50,300						50,300
3			42,280	2,500					44,780
4	5,900			8,000			13,900		
Total	103,070	124,300	365,855	74,620	55,000	155,800	86,470	67,800	724,375

TAMBOL BANTON (4)

(TK)

Per Household	Main Income			Other Income			Total Income		
	Less Than 15.000	15.000~30.000	More Than 30.000	Less Than 15.000	15.000~30.000	More Than 30.000	Less Than 15.000	15.000~30.000	More Than 30.000
4-1-1		21.000		12.000					33.000
2		24.000		10.000					34.000
3	9.000			5.000			14.000		
4	6.000					30.000			36.000
4-2-1	12.000			7.000			19.000		
2	21.000					66.000			87.000
3	8.100			13.440				21.540	
4	1.500			5.400			6.900		
4-3-1		20.000			24.500				44.500
2		21.780						21.780	
3	14.000						14.000		
4		21.000						21.000	
4-4-1			48.000	7.000					55.000
2		17.400		10.000				27.400	
3		15.000		10.400				25.400	
4	3.600			12.000				15.600	
4-5-1			31.500						31.500
2	6.000			1.000			7.000		
3	11.800						11.800		
4	2.100			11.000			13.100		
4-6-1	11.500			14.600			26.100		
2	4.800				20.000			24.800	
3	7.500			1.900			9.400		
4	1.200			10.000			11.200		
Total	120.100	140.180	79.500	130.740	44.500	96.000	132.500	157.520	321.000

TAMBOL NON WAENG (5)

(TK)

Per Household	Main Income			Other Income			Total Income		
	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000
5-1-1	12,800						12,800		
2	13,250			6,000				19,250	
3		18,600		1,000				19,600	
4		27,000		7,000					34,000
5-2-1	11,850			11,820				23,670	
2	10,500					36,000			46,500
3		17,100		12,300				29,400	
4		23,625		6,600					30,225
5-3-1		18,200			23,600				41,800
2		21,250		7,500				28,750	
3	12,300			6,000				18,300	
4	10,500			3,600			14,100		
5-4-1			31,800	6,000					37,800
2			30,000		21,000				51,000
3		17,840						17,840	
4	13,000						13,000		
5-5-1			85,320			65,000			150,320
2		29,400		1,000					30,400
3	14,000			5,000				19,000	
4		12,500		2,000			14,500		
Total	98,200	185,515	147,120	75,820	44,600	101,000	54,400	175,810	422,045

TAMBOL PRABU (6)

(TK)

Per Household	Main Income			Other Income			Total Income		
	Less Than 15,000	15,000～30,000	More Than 30,000	Less Than 15,000	15,000～30,000	More Than 30,000	Less Than 15,000	15,000～30,000	More Than 30,000
3－1－1			42,100		16,000				58,100
2		21,000			16,800				37,800
3		15,000			20,000				35,000
4			76,000	6,500					82,500
3－2－1			38,450		25,200				63,650
2		28,800			18,000				46,800
3			72,400		15,000				87,400
4	9,000			6,000				15,000	
3－3－1	6,300			2,000			8,300		
2	4,500				21,600			26,100	
3				14,000			14,000		
4	3,000			10,000			13,000		
3－4－1			30,000						30,000
2		24,000		10,000					34,000
3		24,000		12,000					36,000
4	11,100			5,000				16,100	
3－5－1			32,100			32,400			64,500
2		26,400				100,800			127,200
3	13,500						13,500		
4	11,000			6,000				17,000	
3－6－1			53,000	10,000					63,000
2		26,400		1,250				27,650	
3		17,920		7,080				25,000	
4		19,850						19,850	
Total	58,400	203,370	344,050	89,830	132,600	133,200	48,800	146,700	766,050

TAMBOL BANWA (7)

(TK)

Per Household	Main Income			Other Income			Total Income		
	Less Than 15,000	15,000～30,000	More Than 30,000	Less Than 15,000	15,000～30,000	More Than 30,000	Less Than 15,000	15,000～30,000	More Than 30,000
6－1－1									
2									
3									
4									
6－2－1									
2									
3									
4									
6－3－1	3,300			12,000				15,300	
2	9,900			5,000			14,900		
3	3,000			5,000			8,000		
4	2,100			4,000			6,100		
6－4－1									
2									
3									
4									
6－5－1			150,700						150,700
2	6,500						6,500		
3		23,200		10,800					34,000
4	6,900			2,000			8,900		

(TK)

Per Household	Main Income			Other Income			Total Income		
	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000
6-6-1		28,800		12,300					41,100
2		18,000						18,000	
3						43,500			43,500
4	6,000						6,000		
6-7-1									
2									
3									
4									
6-8-1									
2									
3									
4									
6-9-1	900			4,000			4,900		
2		20,200		5,000				25,200	
3	10,500			4,000			14,500		
4	720				21,200			21,920	
6-10-1									
2									
3									
4									
Total	10	4	1	10	1	1	8	4	3

TAMBOL DONCHANG (9)

Per Household	Main Income			Other Income			Total Income		
	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000
7-1-1			40,800	2,000					42,800
2		20,900		2,700				23,600	
3			54,850						54,850
4		18,350		3,000				21,350	
7-2-1		19,200			22,720				41,920
2	12,150			4,000				16,150	
3	14,300			3,000				17,300	
4			57,082			43,400			100,482
7-3-1		23,000		5,000				28,000	
2		26,400						26,400	
3		15,000				48,780			63,780
4	4,950			5,000			9,950		
7-4-1			97,250						97,250
2			54,350						54,350
3		24,200		6,000					30,200
4			55,380			30,000			85,380
7-5-1		24,550			18,000				42,500
2	4,210			12,000			16,210		
3		19,750		8,000				27,750	
4	4,500			7,500			12,000		

Per Household	Main Income			Other Income			Total Income		
	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000
7-6-1			49,100	5,000					54,100
2			31,400	1,500					32,900
3				5,000			5,000		
4	3,960			500			4,460		
7-7-1			30,000			36,000			66,000
2			30,600						30,600
3		18,800						18,800	
4	10,000						10,000		
7-8-1		29,300		7,000					36,300
2	6,900			6,000			12,900		
3		27,300		13,400					40,700
4	3,300					35,820			39,120
Total	9	12	10	18	2	5	6	7	17

TAMBOL THASALA (11)

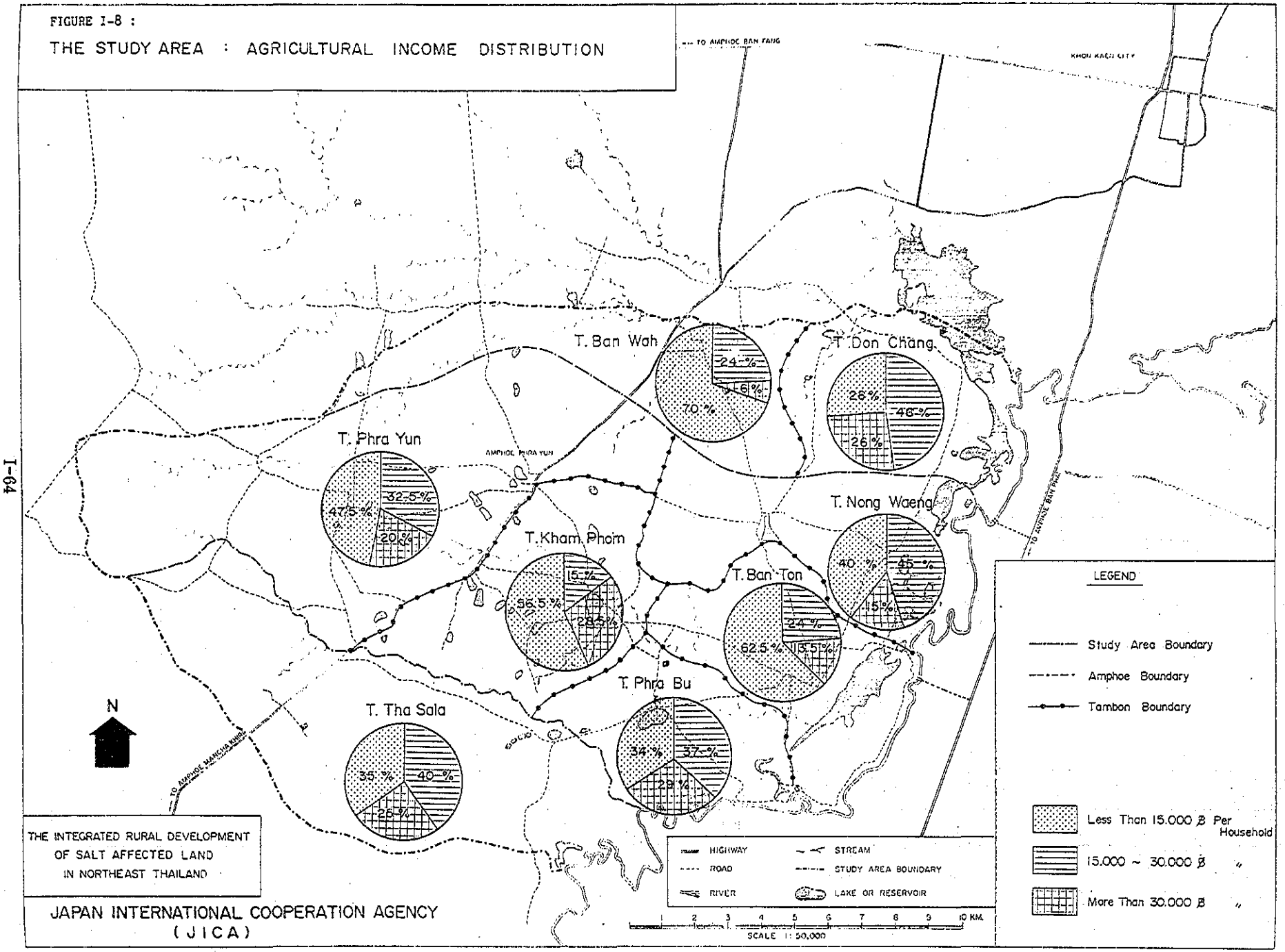
(TK)

Per Household	Main Income			Other Income			Total Income		
	Less Than 15.000	15.000~30.000	More Than 30.000	Less Than 15.000	15.000~30.000	More Than 30.000	Less Than 15.000	15.000~30.000	More Than 30.000
8-1-1	13.200			900			14.100		
2			32.500			36.500			69.000
3	10.000			4.000			14.000		
4	11.100			5.000				16.100	
8-2-1		24.900				115.200			140.100
2			73.600	4.000					77.600
3			30.500	5.000					35.500
4		25.830		1.000				26.830	
8-3-1		23.000			16.800				39.800
2		25.000			17.000				42.000
3		22.630		3.000				25.630	
4	9.500			4.000			13.500		
8-4-1	10.100			2.000			12.100		
2	14.300			5.500				19.800	
3		28.140		2.000					30.140
4		15.000		3.000				18.000	
8-5-1	12.840			5.000				17.480	
2			35.950			43.200			79.150
3		18.240		2.000				20.240	
4	8.200				19.200			27.400	

Per Household	Main Income			Other Income			Total Income		
	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000	Less Than 15,000	15,000~30,000	More Than 30,000
8-6-1			44,000	1,000					45,000
2			42,500	5,000					47,500
3		23,000		1,200				24,200	
4			63,000	5,000					68,000
8-7-1		23,600						23,600	
2			33,450						33,450
3		28,000		4,000					32,000
4	4,764				20,000			24,764	
8-8-1				6,000			6,000		
2		21,500		10,000					31,500
3	7,050				19,250			26,250	
4						25,000		25,000	
8-9-1			69,800						69,800
2			65,050		20,000				85,050
3	12,500					132,000			144,500
4		19,000		10,700				29,700	
8-10-1		23,400			20,000				43,400
2		19,780			12,000				31,780
3	5,950			2,000			7,950		
4		18,300				30,000			48,300
Total	12	16	10	23	8	6	6	14	20

FIGURE I-8 :

THE STUDY AREA : AGRICULTURAL INCOME DISTRIBUTION

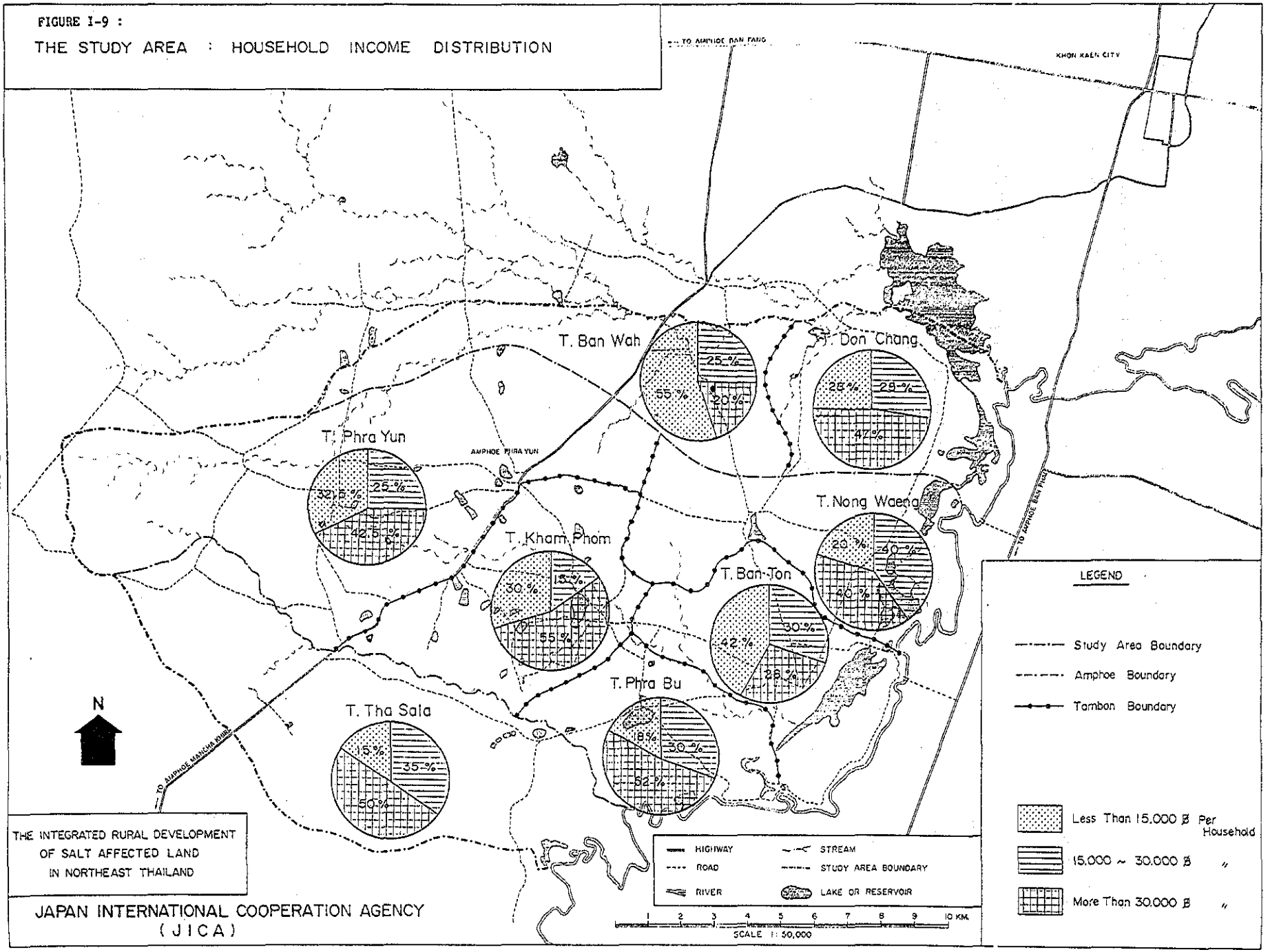


THE INTEGRATED RURAL DEVELOPMENT OF SALT AFFECTED LAND IN NORTHEAST THAILAND

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

FIGURE I-9 :

THE STUDY AREA : HOUSEHOLD INCOME DISTRIBUTION



THE INTEGRATED RURAL DEVELOPMENT OF SALT AFFECTED LAND IN NORTHEAST THAILAND

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

1-6. Farm Economy

In the study area, approximately 85 % of agricultural lands are for paddy fields. The average farm size, however, is below 19 rai (3 ha). Its agricultural net income, therefore, is proportionally become lower than the average figure in the Northeast. Average labor forces are 2.5 per farming household.

The major cause of low farm incomes in the Northeast as well as the study area is in the mainly rainfed rice cultivation which most local inhabitants practice for producing this stable crop as food for mainly self-consumption and sale in case of surplus cum emergency. This is the main activity considered in their farm economy.

Due to lack of water, half of paddy fields in the study area have been reportedly uncultivated every year.

Based on these conditions, the production of rice in this study area is estimated at approximately 8,000 ton for Amphoe Phra Yun, the main administrative unit in the study area.

From these figures, even with the condition of production from half of paddy fields, the production of rice for self-consumption is considered more or less sufficient as now.

But for cash income, this system of farm economy could not improve the situation of low income, depressed in the study area as well as the Northeast region.

Besides due to the limitation of agricultural practice and lack of off-farm job-opportunities in the dry season, the situation of idle labore force could not be avoided at the time being.

For rice consumption supposing a rate of 1.5 % per annum is computed as population growth, the population in 2,040 (after 50 years) would be approx. 60,000 for Amphoe Phra Yun approx. 30,000 for other areas in the study area.

This means, with condition of a full production form present paddy fields, rice production would be more or less sufficient for the population in the study area after 50 years.

As only approximately 15 % of agricultural land in the study area have been used for other farming purposes, farm incomes form these sources are estimated at more or less 15 % of the total farm income.

In the Northeast Thailand, including the study area, off-farm incomes, despite of a high percentage in this whole cash income (more than 40%), are considered low with an average figure of approximately 6,400 Bahts per annum per household compared with the average figure of 8,500 Bahts for the whole country.

Since the study area, in particular, is located near to Khon Kaen city, generation of off-farm incomes should be considered more important, industries such as manufactures of plastic sunshades in Ban Non and making clothes in villages of Amphoe Muang are observed.

From the evaluation of location conveniently accessing to Khon Kaen, Manja Khiri and surroundings, potentials in manufacture and business of the study area are very imminent for carrying out a proposed farm economy balancing both sources of farm and off-farm incomes.

Table I-21 Inputs for crop cultivation per rai in Thailand (1)
(Excluding harvesting and transportation fees)

Crops	Rice		Cassava		Kenaf		Tomato		Tamarind	
	Quantity kg/rai	Value B/kg	Quantity kg/rai	Value B/kg	Quantity kg/rai	Value B/kg	Quantity kg/rai	Value B/kg	Quantity kg/rai	Value B/kg
1. Land preparation (house/rai)	3.31	94.26	0.67	255.22	0.99	90.00	1.20	102.00	1.50	70.00
2. Seed	10.00	3.40	870.00	0.39	1.31	19.81	0.13	2,997.00	20.00	50.00
3. Fertilizer	7.83	3.21	34.09	1.21	10.86	4.58	64.94	4.00	13.71	6.20
4. Weeding kg cc	0.52 16.67	12.83	-	-		-	32.47	4.00	97.96 (cc)	0.02
5. Irrigation	-	-	-	-		-	-	-	-	-
6. Labour cost (man/rai)	9.13	40.00	10.57	42.61	9.47	40.00	10.00	41.00	13.67	40.00

Inputs for crop cultivation per rai in Thailand (2)
(Excluding harvesting and transportation fees)

Crops	Chili		Asparagus		Sesame		Papaya		Mango	
	Quantity kg/rai	Value B/kg	Quantity kg/rai	Value B/kg	Quantity kg/rai	Value B/kg	Quantity kg/rai	Value B/kg	Quantity kg/rai	Value B/kg
1. Land preparation (house/rai)	2.08	265.02	0.71	262.51	1.03	115.56	18.94	68.54	1.66	51.20
2. Seed	1.04	10.45	0.46	596.37	2.32	19.47	0.44	943.18	19.00	25.44
3. Fertilizer	82.46	5.54	1,121.43	0.95	-	-	415.59	2.81	27.50	1.05
4. Weeding	811.63 (cc)	0.20	3,035.71	0.11	-	-	0.63 kg 2,762.17 cc	0.15	0.21 kg 270.88 cc	0.39
5. Irrigation	-	-	-	-	-	-	-	-	-	-
6. Labour cost (man/rai)	32.38	44.18	42.94	41.29	3.29	16.53	15.70	38.00	13.07	42.80

(Source : DLD)

Table I-22. : Average Cash Income and Expenses per Farm by Region (1986/87)

(Unit: Baht)

Items		Northeast	North	Central	South	Whole Kingdom
Income	Crops	8, 135	15, 059	28, 640	15, 146	14, 197
	Livestocks	2, 761	2, 729	7, 078	4, 739	3, 709
	Others	122	236	343	664	259
	Total					
	Total	11, 018	18, 024	36, 061	20, 549	18, 165
	Agricultural	11, 020	18, 027	36, 062	20, 550	18, 165
	Off farm jobs	11, 246	9, 944	17, 605	21, 687	13, 296
	Total	22, 266	27, 971	53, 667	42, 237	31, 461
Expenses	Agricultural	4, 355	9, 375	22, 670	8, 281	9, 155
	Living	14, 129	17, 218	30, 627	25, 060	19, 043
	Total	18, 484	26, 593	53, 297	33, 341	28, 198
Net Income	Agricultural	6, 655	8, 652	13, 392	12, 269	9, 010
	Total	3, 782	1, 378	370	8, 896	3, 263

Source: Agricultural Statistics of Thailand, 1989/1990

Table I-23 Crop Farm Cash Income per Farm by Income Source

Unit: bahts/farm

Type of income sources	Region				Average Whole Kingdom
	North-Eastern	Northern	Central Plain	Southern	
Total	8,135.81	15,059.28	28,640.61	15,146.09	14,197.27
Food crops (1)	6,774.98	9,666.90	21,674.38	1,276.88	9,225.60
Non-glutinous rice (1)	1,597.81	4,788.40	9,813.14	1,080.66	3,695.62
Non-glutinous rice (2)	3.85	381.20	3,078.28	160.19	620.58
Glutinous rice	749.46	723.65	253.19	14.32	566.20
Maize	611.13	1,640.94	1,097.24	14.90	884.07
Sorghum	1.28	160.62	161.17	-	69.10
Cassava	3,417.65	716.83	3,225.13	0.31	2,224.00
Sugar cane	309.93	297.77	3,844.05	-	836.69
Mungbean	19.06	956.51	185.33	6.50	292.30
Other beans	64.79	20.98	16.80	-	38.96
Oil crops (2)	173.05	1,801.05	742.37	1,072.75	813.74
Soybeans	144.96	1,387.10	129.50	-	452.24
Groundnuts	15.79	253.45	90.51	21.05	91.45
Castor beans	1.23	6.99	6.23	-	5.40
Sesame	1.29	143.11	174.71	5.85	67.42
Sunflower	-	-	3.06	-	0.49
Oil palm	-	-	-	39.95	5.23
Coconut	9.78	10.40	338.36	1,005.90	193.51
Fibre crops	463.27	91.80	154.29	0.00	254.37
Kenaf	330.41	-	52.60	-	172.53
Jute-like fibres	23.55	-	31.24	-	15.47
Cotton	69.31	91.80	61.78	-	64.97
Reed	-	-	8.67	-	1.40
Fruit tree & tree crops (3)	250.37	648.20	3,073.80	12,383.07	2,401.05
Tea, Coffee, Pepper	-	91.25	-	1,360.92	197.12
Para rubber	-	-	316.43	8,710.54	1,192.28
Mango	34.09	8.62	135.42	9.72	40.52
Litchi	-	20.92	11.08	-	7.32
Longan	0.31	151.84	3.99	-	40.97
Rambutan	-	-	228.98	280.80	73.76
Durian	-	-	834.16	414.52	188.98
Pomelo	1.07	0.27	271.46	1.33	44.55
Grape	-	-	183.94	-	29.70
Son Pradipath	-	-	12.02	-	1.94
Kapok	19.70	8.79	19.82	-	14.25
Cashew nut	-	-	0.08	104.24	13.67
Other fruit trees	190.23	395.67	973.96	814.23	452.89
Other tree crops	4.97	0.86	82.46	666.77	103.09
Vegetable crops (4)	380.57	1,887.75	1,187.86	352.19	906.11
Chillis	34.93	213.79	189.10	17.51	104.88
Onion	-	363.28	36.22	-	102.00
Shallot	14.70	245.11	43.47	-	76.41
Garlic	2.86	544.95	-	0.34	145.55
Sweet potato, yam bean, yam	0.46	3.60	61.16	18.25	13.42
Taro, sago palm, truffle	0.04	0.27	7.56	-	1.31
Water melon	223.33	24.87	93.89	60.07	128.52
Long cucumber, short cucumber, musk melon	19.28	9.92	49.33	37.23	24.00
Tomato	7.88	92.73	29.05	1.44	32.91
Lettuces	8.00	73.80	38.18	20.97	32.02
Cabbage	18.75	13.98	27.26	-	16.41
Baby corn	3.19	3.56	11.33	-	4.19
Ginger	-	225.08	-	-	59.57
Water lily	7.56	-	4.23	-	4.03
Mushrooms	-	-	17.72	-	2.85
Vegetables	39.51	72.81	579.36	196.38	156.04
Other crops (5)	91.80	951.20	1,206.16	61.20	496.76
Pineapple	4.52	-	725.65	11.39	120.65
Tobacco	84.49	945.94	19.43	26.65	294.54
Other crops	0.64	-	25.06	-	4.33
Crop products	-	11.76	432.40	21.16	75.70
Forest products	2.15	-	3.62	-	1.54
Flowers & decorative (6)	1.27	6.38	601.80	0.00	99.54

Table I-24 Livestock Farm Cash Income

- 1986/87

Unit: bahts/farm

Type of income sources	Region				Average Whole Kingdom
	North-Eastern	Northern	Central Plain	Southern	
Total	2,761.86	2,729.46	7,078.85	4,739.61	3,709.38
Livestock & Livestock products (1)	2,627.20	2,584.14	5,605.96	3,776.24	3,247.27
Elephants, horses, mules, asses	13.00	7.94	-	-	7.86
Cattles, buffalnes	1,722.82	1,253.37	908.00	1,307.24	1,412.57
Swines	524.28	1,034.34	1,484.08	1,650.63	961.81
Goats, sheep	-	0.43	-	8.18	1.19
Chicken, hen eggs	59.32	78.24	1,076.64	288.37	258.59
Duck, duck eggs	27.10	24.74	277.22	37.26	68.19
Geese	0.01	0.17	11.17	0.44	1.91
Dairy cattle	7.46	0.44	140.37	29.32	29.92
Beef cattle	190.79	29.14	732.94	48.80	216.93
Bird, cock, others	1.51	2.05	8.58	1.31	2.85
Rabbits	0.30	-	-	-	0.13
Fresh milk	-	-	26.13	-	4.22
Eggs	8.36	126.45	836.11	384.63	222.55
Other livestock products	72.05	26.83	104.72	20.06	58.55
Aquatic animals (2)	134.66	145.32	1,472.89	963.37	462.11
Fish	122.75	112.59	1,180.33	402.54	327.46
Shrimp	1.80	6.29	270.39	429.09	102.86
Mollusk	1.06	10.29	19.09	125.99	22.78
Fishery products	5.51	0.48	1.20	3.12	3.17
Other fisheries	3.54	13.67	1.88	2.63	5.84

Table I-25 Other Farm Cash Incomes

- 1986/87

Unit: bahts/farm

Type of income sources	Region				Average Whole Kingdom
	North-Eastern	Northern	Central Plain	Southern	
Renting out farm land	106.95	221.55	328.41	69.00	169.31
Renting out farm building	6.24	0.10	-	-	2.76
Renting out farm equipment	0.78	6.03	3.04	2.07	2.74
Government & relative aid	8.42	11.26	11.99	593.43	84.45
Total	122.39	238.94	343.44	664.50	259.16

Table I-26 Non-Farm Cash Expenses

1986/87

Unit: bahts/farm

Type of income sources	Region				Average Whole Kingdom
	North-Eastern	Northern	Central Plain	Southern	
Total	11,246.00	9,944.95	17,605.14	21,687.55	13,296.31
Hiring out draught animals	48.30	105.08	61.13	13.94	60.90
Hiring out farm equipments	260.09	430.17	824.35	210.41	389.70
Customs hauling with own draft vehicles	243.32	129.77	156.74	96.76	180.08
Non-farm custom work	2,588.67	2,016.07	3,317.51	4,650.85	2,824.96
Farm custom work	964.74	1,318.73	1,746.03	2,971.71	1,447.51
Salaries	2,417.16	1,916.64	3,898.33	4,806.72	2,836.88
Bonus and compensate	154.34	11.94	97.42	279.11	123.81
Selling off-farm crops	67.02	39.50	119.36	108.28	73.59
Selling off-farm animals	281.94	58.65	628.62	337.79	286.13
Interest & dividend	76.59	50.47	413.44	216.95	142.45
Lottery & gamblings	357.40	160.53	462.98	371.17	324.14
Prodit on other business	984.18	1,169.90	2,153.58	2,367.67	1,403.39
Personal aid	1,008.97	662.90	1,025.26	886.95	904.02
Selling other home-made goods	382.13	206.59	424.23	435.05	349.40
Heritage	66.20	71.95	53.44	2.82	57.36
Sale of other assets	94.21	124.58	76.64	1,598.94	296.55
Selling forestry products	40.61	42.17	13.55	110.14	45.77
Employed in rural fund flight program	21.26	14.15	60.62	31.07	27.02
Broker	108.19	12.59	42.00	10.12	59.35
Renting out non-agricultural land	1.51	4.96	13.83	42.64	9.80
Life insurance	6.73	8.81	41.57	5.90	12.80
Risk insurance	9.66	-	9.68	0.52	5.91
For children scholarship	2.48	9.47	2.63	9.24	5.24
Others	1,060.30	1,379.33	1,962.18	2,122.80	1,429.55

Table I-27 Crop Farm Cash Expenses 1986 / 1987

Unit: bahts/farm

Type of expenditure sources	Region				Average Whole Kingdom
	North-Eastern	Northern	Central Plain	Southern	
Total	2,918.61	6,217.27	14,764.84	3,715.76	5,808.72
Variable expenditure	2,777.51	5,514.59	13,687.07	3,636.84	5,375.90
Seeds	61.13	548.04	1,013.48	150.93	355.53
Insecticides	116.70	496.12	1,694.94	246.16	488.89
Chemical fertilizer	808.70	615.62	2,874.17	1,145.39	1,135.18
Animal manure	68.63	42.98	133.66	13.79	65.16
Paid out for labour	901.87	1,494.30	3,694.26	1,140.03	1,531.02
Paid our for drought custom	21.70	29.75	49.92	9.49	26.78
Paid out for machinery custom	398.72	1,072.40	1,250.53	510.02	729.14
Food in community labour exchange	53.76	144.94	194.40	33.05	97.89
Lime	0.56	0.23	14.51	0.39	2.70
Fuels	69.32	808.20	959.11	151.83	419.36
Irrigation fees	0.94	8.96	5.26	3.32	4.07
Farm electricity bill	0.52	2.57	20.31	2.95	4.58
Transportation	210.87	99.02	942.92	47.85	278.10
Repairs of farm equipments	25.46	100.40	405.74	45.73	109.35
Repairs of farm building	13.89	23.44	215.21	19.74	49.69
Other equipments	24.74	27.62	278.65	116.16	78.46
Fixed expenditure	141.10	702.68	1,077.77	78.92	432.82
Rented farm land	40.65	358.65	541.09	26.05	203.71
Rented farm building	0.49	3.46	0.14	0.90	1.37
Loan interest	60.70	302.06	428.65	4.80	176.66
Land tax and others	39.26	38.51	107.89	47.17	51.18

Table I-28 Livestock Farm Cash Expenses 1986 / 1987

Unit: bahts/farm

Type of expenditure sources	Region				Average Whole Kingdom
	North-Eastern	Northern	Central Plain	Southern	
Total	683.88	1,544.42	5,428.16	1,929.38	1,810.79
Variable expenditure	678.02	1,528.03	5,285.85	1,908.91	1,808.20
Purchase of livestock	431.93	987.46	1,448.97	387.61	737.37
Purchase of animal nutrition	177.21	447.12	2,974.93	1,197.96	834.08
Purchase of medicine	24.34	27.25	235.77	27.98	59.72
Paid out for herdman	10.10	13.36	178.30	78.76	47.11
Food in village labour exchange	0.86	0.35	1.76	-	0.76
Sterilization and breeding	10.04	12.98	23.40	6.55	12.52
Fuels	3.84	2.86	98.45	141.16	36.52
Irrigation fees	0.04	0.10	1.88	-	0.35
Farm electricity bill	0.89	2.76	92.74	9.97	17.40
Transportation	0.86	0.48	8.17	5.28	2.52
Repairs of equipments	2.12	2.51	54.57	0.04	10.42
Repairs of stalls	8.39	23.36	150.93	21.27	37.05
Other equipments	7.40	7.44	17.98	32.33	12.38
Fixed expenditure	5.86	16.39	142.31	20.47	32.59
Rented land for herding	-	0.01	56.80	15.42	11.19
Rented farm building	1.52	0.87	4.75	0.93	1.79
Loan interest	3.97	15.42	55.46	3.81	15.29
Land tax and others	0.37	0.09	25.30	0.31	4.32

Table I-29 Other Farm Cash Expenses 1986 / 1987

Unit: bahts/farm

Type of expenditure sources	Region				
	เฉียงเหนือ North-Eastern	Northern	Central Plain	Southern	ประเทศ Average Whole Kingdom
Total	753.51	1,613.96	2,477.21	2,636.63	1,506.26
Farm land levelling	6.20	13.57	140.46	-	29.02
Farm land redeeming and mortgage	30.64	40.25	125.43	12.45	46.11
Purchase of farm machinery	139.67	367.08	453.30	233.28	262.76
Purchase of farm land	369.18	952.50	1,012.84	1,482.86	773.40
Purchase of farm equipment less than 100 baht piece	74.69	56.23	80.44	72.65	70.46
Farm land clearing	45.04	56.71	63.33	695.10	136.25
Dike for dam water	6.09	8.56	19.06	6.60	8.90
Others	82.00	119.06	582.35	133.69	17[illegible]6

Other Farm Cash Expenses

1986/87

Unit: bahts/farm

Type of expenditure sources	Region				
	North-Eastern	Northern	Central Plain	Southern	ประเทศ Average Whole Kingdom
Total	14,129.79	17,218.60	30,627.85	25,060.62	19,043.05
Expenditure related to consumption	3,791.95	5,725.26	10,905.03	8,483.66	6,068.75
Rice	687.83	956.68	2,065.86	1,202.58	1,048.91
Food	697.43	746.03	692.62	586.78	695.03
Meat	1,095.78	1,659.31	3,675.83	3,333.81	1,954.69
Vegetables and fruits	295.26	598.33	1,187.88	795.75	585.16
Vegetable oil and food ingredients	408.34	758.85	1,390.56	1,087.53	748.68
Soft drink	69.85	157.65	378.65	365.21	181.65
Spirituous liquors	274.49	413.32	832.52	430.59	421.78
Cigarette, areca and chewing	262.96	435.09	681.10	681.41	430.85
Other expenditure	10,337.84	11,493.34	19,722.82	16,576.96	12,976.30
Clothing	690.25	1,253.61	1,372.88	1,367.00	1,126.80
Beauty and ornament	237.27	453.02	529.01	488.72	374.42
Rented and water supply	33.28	20.58	52.28	18.94	31.11
Fuels	680.88	811.77	2,113.92	1,597.47	1,066.98
Electricity	280.37	370.58	776.69	461.87	408.16
Household utensils and supplies	315.72	336.88	519.60	338.21	357.18
Furnitures	332.00	548.74	572.90	656.12	470.72
Medical care	965.65	1,051.00	1,785.41	1,151.40	1,145.37
Fare	388.14	497.38	578.41	722.96	491.64
Vehicles and transportation	107.94	7.15	99.99	114.76	89.87
School fees	803.09	1,131.11	2,342.48	3,256.73	1,459.91
Chargeable fees	67.29	75.09	101.48	89.33	77.76
Loan interest	189.24	253.94	521.70	246.33	267.52
Other insurance premium	42.91	189.92	262.94	348.66	157.40
House improvement	2,493.01	1,872.47	3,270.50	2,429.59	2,445.99
Purchase of non-farm land	132.91	69.30	41.15	229.22	113.88
Recreation and entertainment	124.11	156.20	226.22	168.81	154.95
Rituals and ceremonies	782.13	961.06	2,603.89	1,484.89	1,215.68
Lottery & gambling	409.20	441.54	459.03	350.42	418.11
Purchase of non-farm equipment	168.03	503.75	216.77	471.38	304.50
Miscellaneous spending	893.42	488.25	1,275.57	584.15	807.35

1-7. Social Service Plan

In order to improve socio-economic conditions a social service plan is considered necessary in the study area.

Components of this social service plan are as follows.

(1) Construction of Phra Yun Central Market (1) and Tambon Markets (4).

(2) Construction of the Technical Training Center. (TTC) and facilities in Amphoe office compound.

(3) Others

1-7-1 Construction of Phra Yun Central Market and Tambon Markets.

(1) A Central Market for Amphoe Phra Yun to be built in Muban Phra Yun as first priority for the distribution of products in the study area. Details are proposed as follows:

Area : 5-10 rai (8,000-16,000 sq.m)

Office storage compound

Floor area : 900 sq.m (30×30)

Construction : RC (Brick-wall)

Market compound

Floor area : 3,200 sq.m (80×40)

Construction : Steel frame type

Tiled floor, booth stands, no wall

Others

Slaughter house

Lavatory

Fence, lighting, parking area etc.

(2) Tambon-markets as second priority for distribution of products in Tambon. Details are same as the central market but reducing to half size only. The construction of Tambon-markets in 4 other Tambons is subjected to the Second Phase of project implementation.

1-7-2 Construction of Technical Training Center and Facilities in Amphoe Office compound.

In order to support economic activities, the construction of a Technical Training Center (TTC) and related facilities is considered necessary.

Components of this TTC are as follows:

i) A training building
ii) A handicraft factory
iii) A food-processing plant

(1) Training Building

The Training Building would be an RC building with necessary facilities.

i) Total Floor Area : 1,100 m²
(1F:20×30=600m² & 2F:20×25=500m²)

ii) Floor Partitition

Training-Room	:	700 m² (1F,2F)
Show-Room	:	60 m² (1F)
Dormitory	:	120 m² (2F)
Corridors & Stairs	:	220 m² (1F+2F)

iii) Furniture, Office Equipments and Training Equipments (1 set)

(2) Handicraft Factory

This factory is a one-floor building.

Purposes : Manufacture of "madmee" and fabric products.

Details are as follows :

Total Floor Area : 25×30=750 m²
Steel Frame Structure
Pre-Fabricated Block-Wall
Water Supply
Lighting & WC
Sporting Ground

(3) Food Processing Plant

This factory to be built as some constructor of the Handicraft

Factory.

Purposes : Manufacture of processed foods

(4) Related Facilities

The soccer ground in front of the present Amphoe-Office would be made into a new sports ground.

Details of the sports ground are as follows.

i) A soccer ground

ii) A 4m-width running track around the soccer ground (L:400~450 m)

iii) A 100-seat concrete-stand with roof, locker-room and shower & WC

iv) Sports equipment (1 set)

v) Lighting installation (1 set)

1-7-3 Others

Seven (7) pick-up cars serving as ambulance and transportation-cars for public-spurposes are recommended with following allocations.

Phra Yun Amphoe Office	:	2 cars
5 Tambon Offices	:	5 (one each)

Table I-30 : Equipments for Technical Training Center

List of Equipments (1)

TECHNICAL TRAINING CENTER

1.	Video TV set	:	5 units
2.	Personal Computer	:	2
3.	Word Processor	:	3
4.	Copy Machine	:	1
5.	Camera	:	2
6.	Drafter & Tool	:	5
7.	Workshop Tool	:	5
8.	Van	:	2
9.	Bike	:	3
10.	Tractor	:	1
11.	Mobile Generator	:	1
12.	Audio-Room (50 seats)	:	1
13.	Workshop Unit	:	1
14.	Dormitory (20 beds)	:	1
15.	Showroom Furniture	:	1
16.	Office Furniture	:	1
17.	Air Conditioner	:	2
18.	Electric Fan	:	10
19.	Refrigerator	:	1
20.	Water Treatment	:	1
21.	Drainage Treatment	:	1
22.	Miscellaneous	:	1

List of Equipments (2)

HANDICRAFT FACTORY

1.	Mudmmee Weaving Tool	:	50 units
2.	Sewing Machine	:	50
3.	Fiber Setting Toor	:	50
4.	Ceiling Fan	:	10
5.	Dryer Fan	:	5
6.	Dyeing Apparatus	:	2
7.	Storage Furniture	:	1
8.	'Tailor's Tool	:	50
9.	Washing Basin	:	10
10.	Miscellanous Set	:	1

Food Processing Plant

1.	Boiler	:	1 units
2.	Refrigerator & Freezer	:	1
3.	SS Jacketed Batch	:	6
4.	SS Processing Table	:	6
5.	Chopper & Mixer	:	4
6.	Sausage Packer	:	1
7.	Smoking Maker	:	1
8.	Semi-Auto Filler	:	4
9.	Incubator	:	4
10.	Weighter	:	2
11.	Laboratory Tool	:	1
12.	Miscellanous Set	:	1

1-8. Situation in the Pilot Area

1-8-1 Social Aspect

The Pilot Area is located in the middle part of the Study Area, Covering an area of 45.6 km² with 15 related villages of 2 Tambons Phra Yun and Kham Pom.

At the middle-north, the provincial highway which divides the Pilot Area into 2 parts (east and west) is bordered by 2 most populated Mubans, Pra Yun and Hua Bung, while in the middle-south the area is bordered by 2 most dry and salt affected Mubans of Tambon Pra Yun, Pa San 1 and Pa San 2.

As most of the people in the Pilot Area are living upon agriculture, mostly rainfed paddy cultivation, living conditions in villages are suffered from insufficient water and salt-affected lands.

From rather scare precipitation of rainfall in the area, a lot of artificial ponds as have been constructed rainfall reservoirs for domestic water, fishery and bathing for cattle, rather than for drinking purpose.

Every year, during the dry season, due to no agricultural works many farmers have to go to other regions for works such as migrant laborers in sugarcane/rubber plantations.

Other social aspects such as electrification, health-care, education, communications, religion etc., are considered almost sufficient, requiring only slight improvements, especially for communications.

A considerable market system is not existing in the Pilot Area. A sunday market is observed on a road in Muban Pra Yun. The Phra Yun Agricultural Cooperative with its 2 branch-offices in Muban Ken Pradu and Nalom buy agricultural products and supply some goods to its members. Besides some small shops selling daily necessities are observed, mainly in Muban Phra Yun and Muban Kham Pom.

Almost all the villages in the Pilot Area have practiced some kind(s) of cottage industries such as weaving, making mats but mainly for self-consumption due to difficulties in marketing. Local people are lacking in sufficient capital and proper technology for making marketable products.

1-8-2 Agro Economic Aspect

In general, the situation of agro-economy in the Pilot Area is almost similar to the Study Area where most households are engaged in rainfed paddy cultivation as their prime and basic economic activity for producing this staple-food for self-consumption.

In some land portions, especially some uplands in Tambon Phra Yun, upland-crops such as cassava, mulberry, kenaf etc. are planted as cash crops.

Other farming activities such as livestock, inland fishery etc. are practiced to some extent as their minor economic activities.

The idea of producing paddy for self-consumption has been originated form severe natural conditions, especially previous drought experiences, making their basic structure of farming as well as its traditional agro-economy up to now in the rural Northeast.

Paddy cultivation, every year, starts from June-July with the rainy season and its harvest is done by the end of December. During this season farmers try to stock available rainfall in small paddy plots for paddy cultivation to cope with the erratic rainfall pattern in this region.

As a matter of facts, all paddy-plots are hardly to be cultivated in a same time due to lack of rainfall precipitation. Yields of each plot, therefore, are based on this production procedure, estimated as only one-half of its total paddy area is cultivated.

The production of paddy is for self-consumption, not for selling, even in case of exceeding the required quantity of annual consumption. Farmers store the whole yield for avoiding its purchase in case of no production in a drought year.

Recently, some farms have produced tomato, watermelon, chilli and eggplant under contracts of some seed firm(s), but these areas are very limited by available sources of agricultural water.

Next to the lack of agricultural water, the lack of a marketing system of agricultural inputs and outputs has made difficulties for farmers to have opportunities for earning other farming incomes.

Agricultural works in the dry season, therefore, are so limited that migrant laborers should be done for earning incomes. This is due to the scarcity of industrial and business facilities operating in the Pilot Area as well as in the nearby area.

Regarding off farm incomes cottage industries such as weaving, mat-making etc. have been practiced but in small scale, almost for home use. These works could not produce proper incomes at the time being due to products of low technology and marketability.

1-8-3 Social Service Plan

In order to improve the situation a sufficient supporting system form the administration should be considered for implementing following items:

- water-development
- promotion of proper agriculture
- training of off-farm skills
- sufficient financial support to farmers, especially regions of hard natural conditions
- network of marketing system

This inquires a proper plan consisting of following items.

i) The Phra Yun Central Market
ii) The Technical Training Center and Related Facilities
iii) Others

(1) Phra Yun Central Market

For the Pilot-Area, the Central Market is reduced to half size, similar to Tambon markets with following specifications:

Area : 25~5rai (4,000~8,000m²)
Office storage compound :
Floor area : 450 m² (30×15)
Construction : RC (Brick-wall)
Market compound :
Floor area : 1,600 m² (40×40)
Construction : Steel frame, Conventional Roof
Others : WC, parking area, slaughter house

(2) Technical Training Center and Related Facilities

In order to support economic activities, the establishment of the Technical Training and related facilities is considered necessary.

Components are as follows :
i) A training building & equipments
ii) Two (2) training factories & equipments
iii) A staff of administration and training

1) Training Building

The Training Building would be and RC building with necessary facilities.

(i) Total Floor Area : 1,100m²
(1F: 20×30=600m² & 2F: 20×25=500m²)

(ii)Floor Partition

Training-Room	:	700 m² (1F,2F)
Show-Room	:	60 m² (1F)
Dormitory	:	120 m² (2F)
Corridors & Stairs	:	220 m² (1F+2F)

Furniture, Office Equipments and Training Equipments (1 set) are as follows;

2) Training Factories

(i) Handicraft Factory

This factory is a one-floor building.

Purposes : Manufacture of "madmee" and fabrics products.

Details are as follows :

Total Floor Area : 25×30=750 m²

Steel Frame Structure

Pre-Fabricated Block-Wall

Water Supply

Lighting & WC

Sporting Ground

(ii) Food Processing Factory

This factory construction is similar to the Handicraft Factory.

Purposes : Manufacture of processed foods.

Details of the building is similar to the Handicraft Factory.

FIGURE I-10
THE PILOT AREA : SOCIO-ECONOMIC INFRASTRUCTURES

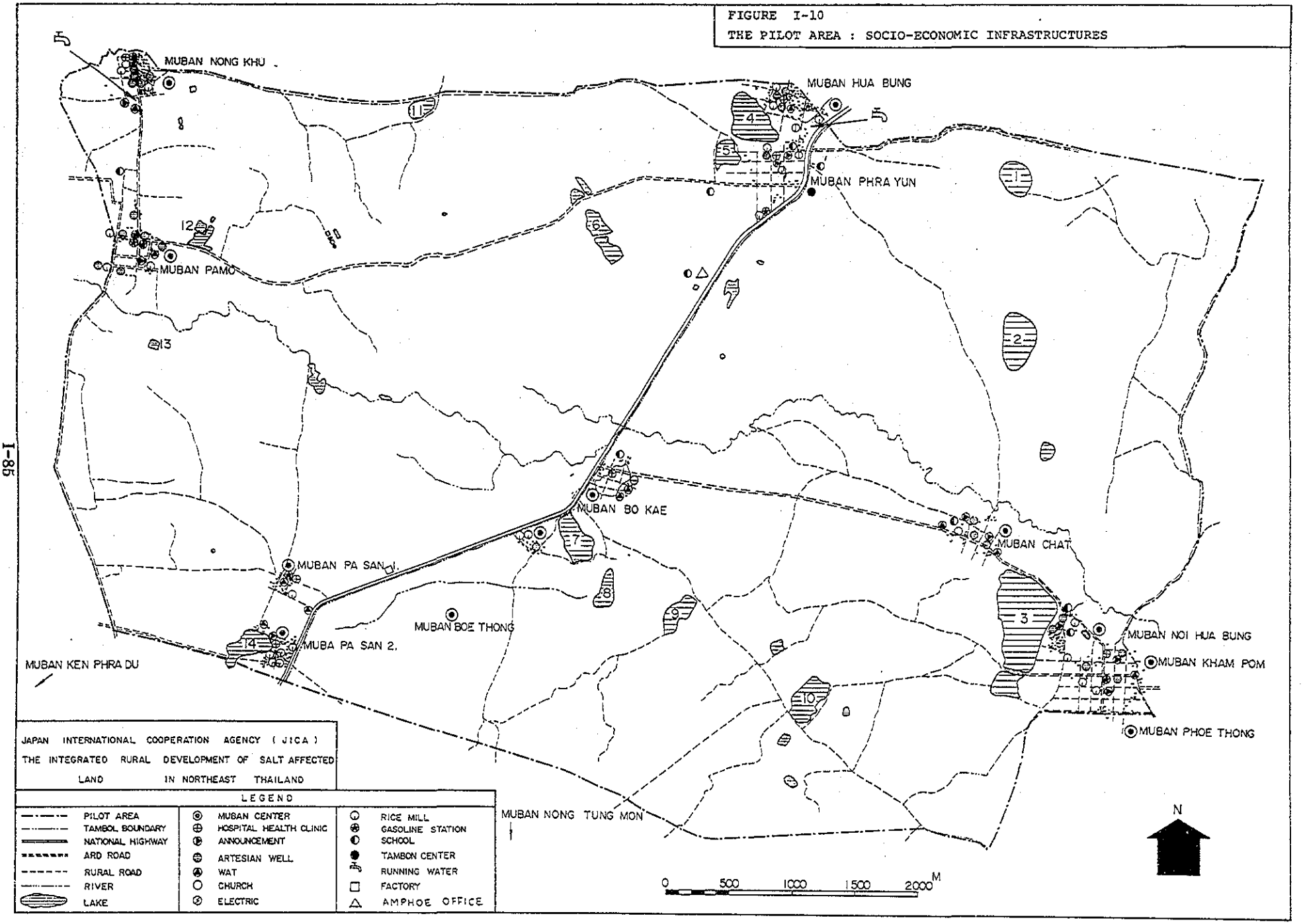


TABLE I-31 Socio Economic Situation in the Pilot Area

Tambon & Muban	Households	Population	School		Health Care		Drinking Water			Electri-city	Post Office	Bamk	Cooperative
			Primary	Secondary	Hospital	Clinic	Rain	Well	City				
Tambon Pra Yun													
1. Pra Yun	289	1,682	1	1	1	1	Yes	available	No	OK	1	1	1
2. Hua Bung	178	1,169	1	0	1	1	Yes	available	No	OK			
3. Mong Khu	124	614	1	0	0	1	Yes	No	Yes	OK	–	–	–
4. Pa Mo 6	169	866	1	0	0	0	Yes	available	No	OK	–	–	–
5. Ken Pradu	120	664	1	0	0	0	Yes	available	No	OK	–	–	–
6. Pa San 1	101	548	1	0	0	0	Yes	No	No	OK	–	–	–
7. Pa San 2	86	424	1	0	0	0	Yes	No	No	OK	–	–	–
8. Pa Mo 11	112	598	0	0	0	0	Yes	available	No	OK	–	–	–
(Sub-total 1)	(1,179)	(6,565)	(7)	(1)	(2)	(3)					(1)	(1)	(1)
Tambon Khan Pon													
1. Khan Pon	289	1,324	1	0	0	1	Yes	available	No	OK	–	–	–
2. Noichan Bung	95	484	1	0	0	0	Yes	available	No	OK	–	–	–
3. Chad	190	1,015	1	0	0	0	Yes	available	No	OK	–	–	–
4. Bo Kae	189	954	1	0	0	0	Yes	available	No	OK	–	–	–
5. Mong Thung Mon	24	141	1	0	0	0	Yes	available	No	OK	–	–	–
6. Bo Thong	63	316	0	0	0	0	Yes	available	No	OK	–	–	–
7. Phoe Thong	168	862	1	0	0	1	Yes	available	No	OK	–	–	–
(Sub-total 2)	(1,018)	(5,096)	(6)	(0)	(0)	(2)					–	–	–
Toral	2,197	11,661	13	1	2	5					1	1	1

Source : Village Survey, 1989, NSO

Table I-32 Situation of Agro-Economy in the Pilot Area

Tambon & Muban	Total Households	Farming: Agricultural H.H.	Farming: Paddy made H.H.	Cropping Area (ha): Paddy	Cropping Area (ha): Cassava	Cropping Area (ha): Mulberry	Cropping Area (ha): Kenaf	Cropping Area (ha): Sugarcane	H.H. with Cottage Industries	Households by Income Class: Under 6,000 ฿/year	Households by Income Class: 6,000-10,000	Households by Income Class: 10,000-20,000	Households by Income Class: Over 20,000
Tambon Pra Yun													
1. Pra Yun	289	250	250	459	12	13	-	-	-	50	150	20	49
2. Hua Bung	178	169	169	241	-	7	-	-	140	102	3	-	-
3. Nong Khu	124	123	121	403	19	27	12	-	123	50	73	-	-
4. Pa Mo 6	169	265*	250*	218	38	28	8	22	150*	84*	76*	60*	40*
5. Ken Pra Du	120	117	95	121	22	12	7	-	-	-	-	-	-
6. Pa San 1	101	106	100	290	22	6	-	-	20	50	25	10	21
7. Pa San 2	86	78	78	142	20	6	-	-	-	78	-	-	-
8. Pa Mo 11	112	(* : 6+11)	(* : 6+11)	127	44	20	-	10	(* : 6+11)	-	-	-	-
(Sub-total 1)	(1,179)	(1,108)	(1,063)	(2,001)	(177)	(119)	(27)	(32)	(433)	(414)	(327)	(90)	(110)
Tambon Kham Pom													
1. Kham Pom	229	224	224	308	19	8	6	-	-	176	30	25	-
2. Noi Chan Bung	95	93	93	134	-	4	3	-	-	33	50	10	-
3. Chad	190	190	190	324	4	10	-	-	184	86	60	18	12
4. Bo Kae	189	189	189	167	9	2	-	-	50	100	70	10	8
5. Nong Thung Mon	24	24	24	33	7	1	-	-	-	8	16	-	-
6. Bo Thong	63	63	60	50	6	3	-	-	-	28	10	3	1
7. Phoe Thong	168	137	54	167	4	3	-	-	-	63	40	60	-
(Sub-total 2)	(1,018)	(920)	(834)	(1,183)	(49)	(31)	(9)	(-)	(234)	(494)	(276)	(126)	(21)
Total	2,197	2,028	1,897	3,184	226	150	36	32	667	908	603	216	131

Sources : 1. " Village Survey, 1988 ", NSO

2. Amphoe Agricultural Extension Office : Cropping Area 1989

Table I-33 Evaluation for Development of Villages in Pilot Area (1988)

Indicators	Number of villages by level		
	1. Lower than average standard	2. In average standard	3. More than standard
1. Basic Structure			
1) Ownership document	-	14	-
2) Electric	-	-	14
3) Communication	-	2	11
4) Rice-mill	1	2	11
5) Housing	-	-	14
6) Wood source and fuel	1	1	12
7) Profession and job	-	-	14
8) Animals for work	2	11	1
9) Salary rate	4	4	0
10) Land ownership	1	3	10
2. Production			
1) Rice production	10	2	2
2) Farming production	11	-	-
3) Other professions	13	-	-
4) Migration for other works	2	12	-
5) Agriculturist group	3	1	10
6) Agricultural credit source	-	1	13
7) Agricultural in the dry season	14	-	-
3. Health			
1) Public health service in village	1	-	13
2) Public health service in Tambon	-	-	14
3) Sanitation in family	6	4	4
4) Health and sanitary	3	11	-
5) Treatment procedure	1	6	7
6) Weight of new-born baby	-	3	11
7) New-born baby to five years	6	3	5
8) Vaccine injection	-	-	14
9) Family planning	2	4	8
4. Water Source			
1) Drinking water and domestic water	5	3	6
2) Agricultural water	14	-	-
5. Knowledge			
1) Education level of the whole population	-	4	10
2) Knouledge for government	5	7	2
3) Promotion for knowledge	2	7	5
4) Places in village for knowledge promotion	3	6	5
5) Data and news service place	-	8	6
6) Sports, cultural and religious activities	2	5	7

Table I-34 Summary of Pond Survey in the Pilot Area (14 Ponds)

No.	Name of Pond	EC(μS/cm)	Area(m²)	Volume(m³)	Utilization					Remarks
					Irrigation	Drinking	Domestic	Fisheries	Livestock	
PP-1	Nong Bua	280	39,770	28,110			O	O	O	
PP-2	Nong Waeng Klang	150	80,270	124,100				O	O	for fisheries purpose
PP-3	Nong Pan Nam	1,000	-	-	O for paddy nursery only		O	O		piping to Khampom for domestic use
PP-4	Nong Phra Yun	220	71,090	107,490			O	O		
PP-5	South of PP-4	380	27,850	2,330			O	O		
PP-6	Along Pa No road	3,200					O	O		
PP-7	Nong No N	960	7,570	14,680			O	O	O	control by committee
PP-8	Nong No S	980	83,770	313,140			O		O	almost no water
PP-9	Nong Khong	2,300	41,900	27,000			O		O	almost no water
PP-10	Nong Bai Si	2,700	69,330	158,610	O for paddy nursery only			O	O	
PP-11	Along Nong Khu road	70	12,520	13,030						almost no water
PP-12	East of Ban Pa No	820			O for vegetables			O		very deep
PP-13	South of Ban Pa No	18	610	190	O for emergency cases only		O	O		very shallow
PP-14	Ban Pa San	2,600	11,000	12,800	O		O	O	O	control by committee

Note: EC were measured on the end of Aug. 1991
Areas of pond water calculate based on actual survey
Volume of water calculate based on a depth of center and banks of ponds

APPENDIX J ENVIRONMENT

CONTENTS

LIST OF TABLES

LIST OF FIGURES

J-1 General

The items on environmental aspects studied within the frame work of the present study are as follows:

(1) Physical Resources
- Soil Salinity
- Soils
- Rivers & Streams
- Ponds
- Ground Water
- Water Quality
- Erosion
- Geology
- Geography

(2) Human Use Values
- Agriculture
- Paddy Field
- Upland Crop Area
- Fisheries
- Cattle Raising
- Agro-Forestry
- Power Generation
- Flood Control
- Water Supply
- Agro-Industries
- Mineral Extraction
- Transportation
- Recreation

(3) Quality of Life
- Public Health
- Socio-Economics
- Resettlement
- Archaeology
- Cultural Heritage
- Aesthetics

(4) Ecological Resources

Widelife

Forests

Aquatic Biology

J-2 Physical Resources

(1) Saline Soil

The accumulation of salt in the land within the study area is the major problem of which the present study is aimed at. Different intensities of salt accumulation over the study area affect economic activities taking place within the study area in different degrees. However, as a result of measures to be taken, ranging from the introduction of light village industrial and commercial establishment to various agricultural practices, including agroforestry significant improvement on the salt affected land is expected.

(2) Soils

In general, because of countermeasures to be taken for the salt affected soil, other type of soils, predominantly loamy sand within the study area will not be affected by the programme anticipated to take place within the frame work of the present study. If further deforestation took place over the soils previously not affected, severe soil erosion may take place. However, at present, because of the ban on felling trees within the forest areas in the country, the Government of Thai imposed in January 1989, further soil erosion in relation to deforestation is not anticipated. With the measures to be taken, total increase of agroforestry and forest land by 36% and grassland by 5.5% is anticipated. It would be sufficient to make significant improvement of soil fertility.

(3) Rivers and Streams

River banks and low lying areas formed by relatively small scale rivers and streams are the basis for agriculture since the introduction

of agriculture to the study area. By and large, they are continued to be the only reliable area of agriculture. In this contest, rivers and streams are playing important rote to the agriculture in the study area. In view of improving soil for agriculture as well as the behavior of groundwater, improvement for the river and stream channels including construction of small scale weirs will have to be conducted. These woks may require to sacrifice considerable area of agricultural land for construction works. As is indicated in Table 4-3, approximately 3.3% of the total area of the study area is required (this figure includes agricultural ponds), and 100 ha of land is required for the construction works. The river channel improvement works may induce to significant changes of aquatic biology, vegetation along the rivers and the present patterns of water use for agriculture. Upon decision made for such works, further detailed in-depth study on bio-socio-ecological use of natural resources should be imperative to conduct.

(4) Ponds

Water body occupies relatively significant portion of the study area. Although not fully utilized at present, ponds within the study area, including 12.6 sq.km of swamps in the east, are alternative source of water supply for agriculture. Their banks, especially around the swamps are used for grazing ground to some extent.

Depending on the geographical conditions of their locations, during the rain season, ponds are subject to receiving run-off with relatively high salt content, the swamp in the east of study area in particular and the other agricultural ponds in general, the latters depending on their locations. The behavior of in-flow with high salt content to the swamp tends to submerge and form a layer of high density at the bottom of swamps over time. In the event that the area was hit by severe drought, swamps are dried up, as was the case in 1986, and salt accumulation at the swamp bed occurs. Although it is dissolved during the rainy season, salt content of the water in the swamp by repeated process, will significantly increase over a long period of time.

Provided that it became high salt content, the swamp water may affect future developments projects or on-going interface project, such as the PWA's water in-take (see Figure J-1) for water supply to the Khon Kaen city area. Although PWA is responsible for maintaining water quality of the national standard, close contact and well organized coordination between the responsible government organization is imperative if such was the cause of problem.

It may also affect, to a slight extent, the project being conducted by NEA (see Figure J-2 & J-3). Mahasarakam Diversion Weir is planned to supply fresh water for irrigation along the Chi River and approximately the eastern half of the study area is subject to the NEA's future irrigation plan. Under their programme, impounded water on the River Chi will be led to one of the swamps within the study area, Bung Kaeng Nam Tom being the most likely location for which water is pumped up slope and supply irrigation water to the planned NEA's open channel.

Although the quantity of NEA's irrigation water may be large enough to dissolve salt water of the swamp, and expected to cause a very slight change in water quality, further study and long term monitoring to the water at this location is imperative. Clearing water standard for irrigation set out by RID is mainly the responsibility of NEA in this respect. However, study on water quality and further coordination between concerned government organizations is important.

(5) Ground Water

As is described in the Chapter 4-4-2, quality of ground water in the study area is not suitable for drinking as well as for irrigation due to its high salt content. On the other hand, with in the frame work of study, ground water level is required to lower in order to avoid water logging and salt accumulation on the ground surface. Various measures are designed to take place in order to control ground water. However, with them, no significant change on the quality of ground water is expected to take place as a result of measures to be taken.

(6) Water Quality

As mentioned above, water quality within the study area will not be subject to significant change whereas that of outside the study area is subject to further study.

(7) Soil Erosion

Past and present soil erosion, and subsequent salt accumulation, within the study area is due mainly to heavy deforestation for acquisition of agricultural lands as well as for residential areas. This has been banned by the government regulations today and became illegal. Thus no significant soil erosion should take place under the present conditions.

The measures to be taken within the frame work of the present study for improving soil fertility, and at the same time for preventing salt accumulation to the soil, anticipated to increase organic content of soil However, introduction of diversified modern cash crops, increase of grassland for grazing and agro-forestry require modern agricultural practice designed to achieve high economic efficiently. It is anticipated that some of these practice require wider areas of bare soil surface per unit of farmland than the actual planted area. Thus it is vulnerable to soil erosion. In the case of grazing grassland, unless there is a strict grazing control measures are taken for replenishment of annual growth, grassland will rapidly become bare land for which further soil erosion is inevitable. Further considerations on management of cash crop areas and grassland has to be elaborated.

(8) Geology

No significant geological condition is anticipated to change within the frame work of the present study. However, it is a government regulation that construction materials, for instance skeletal plilnthustults, or laterite, for road construction, has to be obtained within the amphoe. For this purpose, the material is excavated in the western part of the study area and it may cause, to a slight extent, a change of geological condition, as well as geographical condition, depending of the scale of construction operation.

(9) Geography

The rapid changes in geographical condition in the past within the study area has been the major cause of the emergence of salt affected soil. This is due mainly to the inevitable economic demand of the rural society. The demand on economic growth, coupled by the increase of population and rising standard of living is the governing factor of the changes of geographical condition.

The present project is designed to make best use of the environment for further economic growth and it is imperative to make some changes on the geographical conditions as a result of the individual project designed within the frame work of the present study. Despite the fact that the measures to be taken are for the improvement of the environment within the study area, therefore, some changes of geographic conditions, part of natural environment is changed to artificial environment, within the study area should occur as well as changes on agro-ecological conditions.

J-3 Human Use Values

(1) Rice paddy and Upland Crops

Rice growing is the major agricultural activities of the study area and it represent more than half of the present land use. Despite the fact that the available water for rice paddy is limited, large quantity of water stocked during the rain season over much of rice paddy has been playing a significant role for dissolving salt accumulated on the ground during the dry season. Reduction of the area for rice paddy and the increase of irrigated upland crops and agroforestry area under the present study is planned. However, this will not change overall conditions. On the other hand, increase of upland crop is, unless well organized strict mulching covers the bare ground between crops, exposed soil is subject to evaporation of ground water and soil erosion.

(2) Fishery

Communal and private ponds as well as rivers and streams are used to grow small fish. Also, to some extent, frogs are one of the most important protein food for which villagers can obtain without significant expenditure. The improvement of ponds, rivers and streams should affect ecology of such aquatic life. Unless positive measures to enhance growing conditions for them was designed within the frame work of the present study, opportunity for obtaining farmers' social delicacies should decline to some extent.

(3) Cattle Industry

Despite the fact that the present conditions on cattle and buffalo rearing within the study area is on the decline, as described in Chapter 3-3-3, some of the villagers aspire to possess as large cattle herd as possible for an occasional, even for constant, large cash income, as a result of the sale. Because of the attempt to increase grassland within the frame work of the present study, cattle industry will be improved to some extent. However destruction of vegetation is imperative because of over-grazing may take place as a result of the increase of cattle population in the future. Unless strict management of grassland is imposed over long period, cattle industry should be decline.

(4) Agroforestry

At present, no significant agroforestry activity is taking place within the study area, except kenaf and mulberry and other bushy crops are grown at a fraction of areas. Within the frame work of this study, agroforestry is designed to introduce for rehabilitation of the salt affected land. This ambitious programme to alter the present environment of the study area aims to prevent further salt affected land from occurring.

The programme includes planting trees for timber, shade and woodfuel, growing fruits, and rice and grazing grass for livestock. Since the programme is introduced mainly for improving the standard of rural life rather than to increase employment opportunities farmers will have to be deployed for growing various trees and crops in

different areas with different farming method and practice, an possibly by new farming machinery. Anticipated benefit of the programme is to achieve significant improvement on the environment within the study area other than the standard of living.

The programme would be successful if the implementation programme was conducted with precisely elaborated criteria and well designed patterns of agroforestry works. However, it is necessary to conduct further study on the social conditions, such as availability of labor for the programme. For instance, the programme requires collective effort to plant trees which have to be conducted in the beginning or before the rain season for better and quick growth. It is during this season that farmers also begin planting rice and other crops they hitherto have been growing. During the first two years of planting trees, intensive care has to be taken for young trees, depending on the selected species. All these effort may face social conflict unless well organized collective body of farmers pays respective effort. Conventional practice of taking wide bare ground between plants should cause unnecessary soil erosion. Implementation programme should be carefully planned in this respect.

(5) Power Generation

There is no programme for rural electrification within the frame work of the present study.

(6) Flood Control

Relatively flat topography and small catchment area requires no flood control measures within the frame work of the present study.

(7) Water Supply

No water supply programme is designed within the frame work of the present study.

(8) Agro-Industries

The high intensity salt affected area is planned to offer the area for the establishment of rural industry. Straw mat manufacturing, both in plastic and natural material, and food processing industries are two major components of the programme. The programme induces to increase socio-economic factors of income, employment and intangible economic effect on the rural society as a whole.

(9) Mineral Extraction

There is no mineral extraction has been and will be taking place within the study area.

(10) Transportation

Proposed rural road runs through the study area from southeast to northwest. The road is 6 m-wide, motorable, all-weather type with laterite surface paving. The rural road construction improves efficiency on the circulation of goods and communication. However, since the study result presented that high intensity salt affected areas are found on the side of roads, selection of route, design and construction method and material have to be carefully conducted in order to avoid unwanted salt accumulation in the soil.

(11) Recreation

There is no existing recreation areas nor valuable area or natural beauty within the study area. However, within the frame work of the study, programme to establish social services, such as a sport ground, enhance rural society's social value to some extent. Construction of the sport ground is planned to take place in the existing amphoe office in Ban Phra Yung.

J-4 Quality of Life

(1) Public Health

Most of the people living in the study area uses clean potable water stored in the large jars placed in the garden where rain water running off roof of their house. It is the most clean water supply in the study area. Despite the fact that sewage system is not well developed, sanitary conditions and its standard within the study area is very high. Within the frame work of the present study, no programme for improvement on public health is planned to conduct.

2) Socio-Economics

As is stated above, socio-economic conditions of the study area is anticipated to improve as a whole.

(3) Resettlement

There is no resettlement of the people involved within the frame work of the study.

(4) Archaeology

At the moment, there is no archaeological area within the study area. It is also not anticipated to find any valuable archaeological site on the route of the road, canal, weir, bridge and pond construction site.

(5) Cultural Heritage

No cultural heritage site of national value is existing nor anticipated to find within the study area.

(6) Aesthetics

There is no aesthetic value of natural beauty, such as national parks, etc. affected by the implementation of the programme within the frame work of the study.

J-5 Ecological Resources

(1) Wildlife

According to the Wildlife division of the Royal Forestry Department, there is no conservation areas directly or in directly affected by the project. Most of the wildlife conservation areas are located in the up-stream regions within the Northeast Thai. At present, there is no wildlife conservation areas within the study area or down-stream region of the Lam Chi (see Appendix Figure J-5).

No protected wild fauna and flora and ecologically valuable areas are also found within the study area.

(2) Forest

There is protected forest area in the south and west of the study area. Total area of the forest is approximately 2,000 ha, or 6% of the study area and it is under the supervision of the RFD. The area has been strictly protected and the government regulations allow no felling of trees in the area. Part of the forest area is commercially planted forest and licensed logging is conducted. The enrichment scheme of forestry programme within the frame work of the present study anticipates significant improvement on the forest ecology.

(3) Aquatic Biology

As is mentioned above, improvement of stream and river channels should affect aquatic life as well as the vegetation on the bank of streams and rivers to some extent. Individual case has to be studied and assessed if significant changes of aquatic life, especially fish and frogs for protein food, is anticipated to take place.

Table J-1 Summary of Potential Environmental Effects

Environmental Resources or Values	Net Effect: Negative Changes 10 5 0	Positive Changes 5 +10
PHYSICAL RESOURCES		
Salinity		⊙
Soils		⊙
Surface Water		
Rivers & Streams	⊙	
Ponds	⊙	
Ground Water		⊙
Water Quality		
Inside Study Area	⊙	
Outside Study Area	⊙	
Erosion		⊙
Geology	⊙	
Geography	⊙	
HUMAN USE VALUES		
Agriculture		
Paddy Field		⊙
Upland Crop Area		⊙
Fisheries	⊙	
Cattle Raising		⊙
Agro-Forestry		⊙
Power	⊙	
Flood Control	⊙	
Water Supply	⊙	
Agro-Industries		⊙
Mineral Extraction	⊙	
Transportation		⊙
Recreation		⊙
QUALITY OF LIFE		
Public Health	⊙	
Socio-Economics		⊙
Resettlement	⊙	
Archaeology	⊙	
Cultural Heritage	⊙	
Aesthetics	⊙	
ECOLOGICAL RESOURCES		
Wildlife	⊙	
Forests		⊙
Aquatic Biology	⊙	

Table J-2 Water Quality for Irrigation

Irrigation class	EC x 10^6 micro mhos/cm.	TDS (approx) ppm.
C_1	0-250	0-160
C_2	251-750	161-480
C_3	751-2,250	481-1,440
C_4	2,251-5,000	1,441-3,200
C_5	more than 5,000	more than 3,200

Class 1 Water is good for general plant.

Class 2 May have the problem about salt in the water. Drainage and leaching necessary.

Class 3 Water is good for the plant which bear to salt. Absorption of water, drainage must be arranged in order to prevent salt accumulation in the soil.

Class 4 This type of water can be used for particular plants which with stand salt. There should be very good drainage.

Class 5 It is not suitable to use.

(Source : Royal Irrigation department, Thailand "Water Analysis, 1987"

Note : EC - Electric Conductivity
TDS - Total Dissolved Solids

Table J-3 Drinking Water Standards

Chemical Properties	PWA			WHO		
	Surface water	Groundwater		1983 Guidelines	Highest Desirable	Maximum Permissible
		Highest Desirable	Maximum Permissible			
Color, Pt-Co Scale	5	5	50	15 *	5 *	50 *
Turbidity, NTU	5	5	20	5	5	25
pH	6.5-8.5	7.0-8.5	6.5-9.2	6.5-8.5	7.0-8.5	6.5-9.2
Total Solids	500	750	1500	1000	500	1500
Total Hardness a $CaCo_3$ -mg/l	300	300	500	500	200	500
Non Carbonate Hardness $CaCo_3$ -mg/l	-	200	250	-	-	-
Nitrates as NO_3 -mg/l	45	45	45	45	45	45
Detergents as ABS -mg/l	0.5	-	-	-	0.2	1.0
Calcium as Ca -mg/l	75	-	-	-	75	200
Chlorides as Cl -mg/l	250	200	600	250	200	600
Iron as Fe -mg/l	0.5	0.5	1.0	0.3	0.1	1.0
Manganese as Mn -mg/l	0.3	0.3	0.5	0.1	0.1	0.5
Iron + Manganese -mg/l	0.5	-	-	-	-	-
Copper as Cu -mg/l	1.0	1.0	1.5	0.2	1.0	1.5
Zinc as Zn -mg/l	5.0	5.0	15	-	5.0	15
Magnesium as Mg -mg/l	50	-	-	-	50	150
Sulphates as SO_3 -mg/l	200	200	250	400	200	400
Fluoride as F -mg/l	0.7	1.0	1.5	1.5	-	0.9-1.7
Bacteriological Quality						
Plate Count per ml	500	500	-	NIL	-	-
Most probable numbers						
- Coli form Organisms / 100 ml	<2.2	<2.2	-	NIL		
- E. Coli Organisms / 100 ml	NIL	NIL	-	NIL		

(Source : Public Water Authority, Thailand)

Table J-4 Survey Sheet on Natural & Social Environment (1/2)

Sample Marking 0 — 10

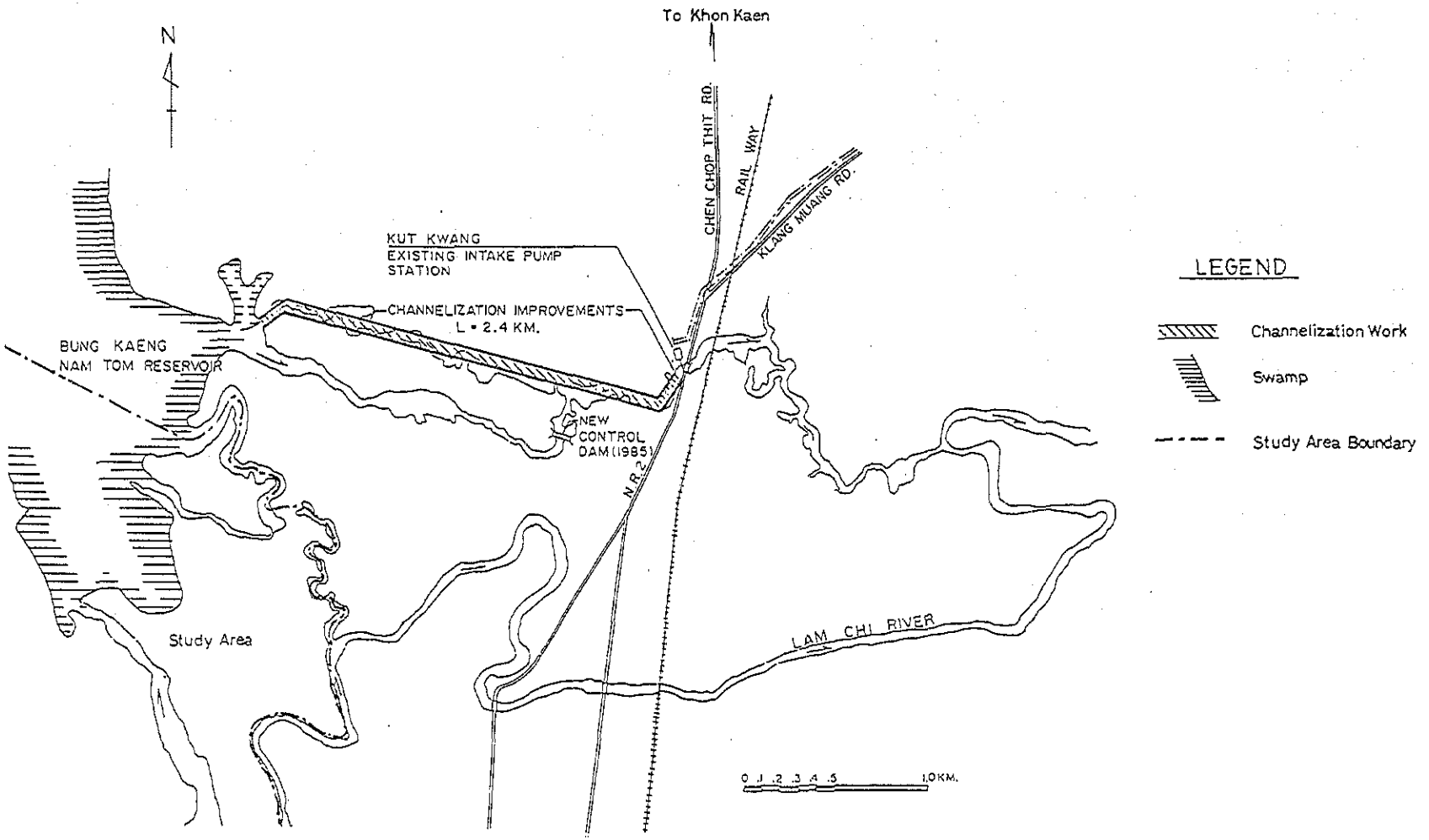
Resources \ Grade Point		Importance for the Daily Life Significant to not Sig.	Present Availability (Dry Season) Available to not Avail.	Present Availability (Rain Season) Available to not Avail.	Past Availability (During the Past 5 Years) Available to not Avail.	Complementality (Other Sources) Available to not Avail.	Complementality (Substitute) Available to not Avail.	Desirability More to Less	Frequency to Use Yearly, Monthly, Weekly & Daily	Remarks
1	Grazing Grass	0 — 10	0 — 10	0 — 10	0 — 10	0 — 10	0 — 10	0 — 10	Day Week Month Year	
2	Fruits, Nuts and Other Forest Products									
3	Tree for Energy									
4	Tree for Construction Materials									
5	Wildlife and Fish for Food, or for Sale									
6	Water for Cooking, Drinking and Washing									
7	Soil for Construction Materials									
8	Stone for Construction Materials									
9	Recreational Area or the Area of Beautiful Land Scape									
10	Other Important Materials (Specify:)									

Table J-4 Survey Sheet on Natural & Social Environment (2/2)

Sample Marking: 0 — 10

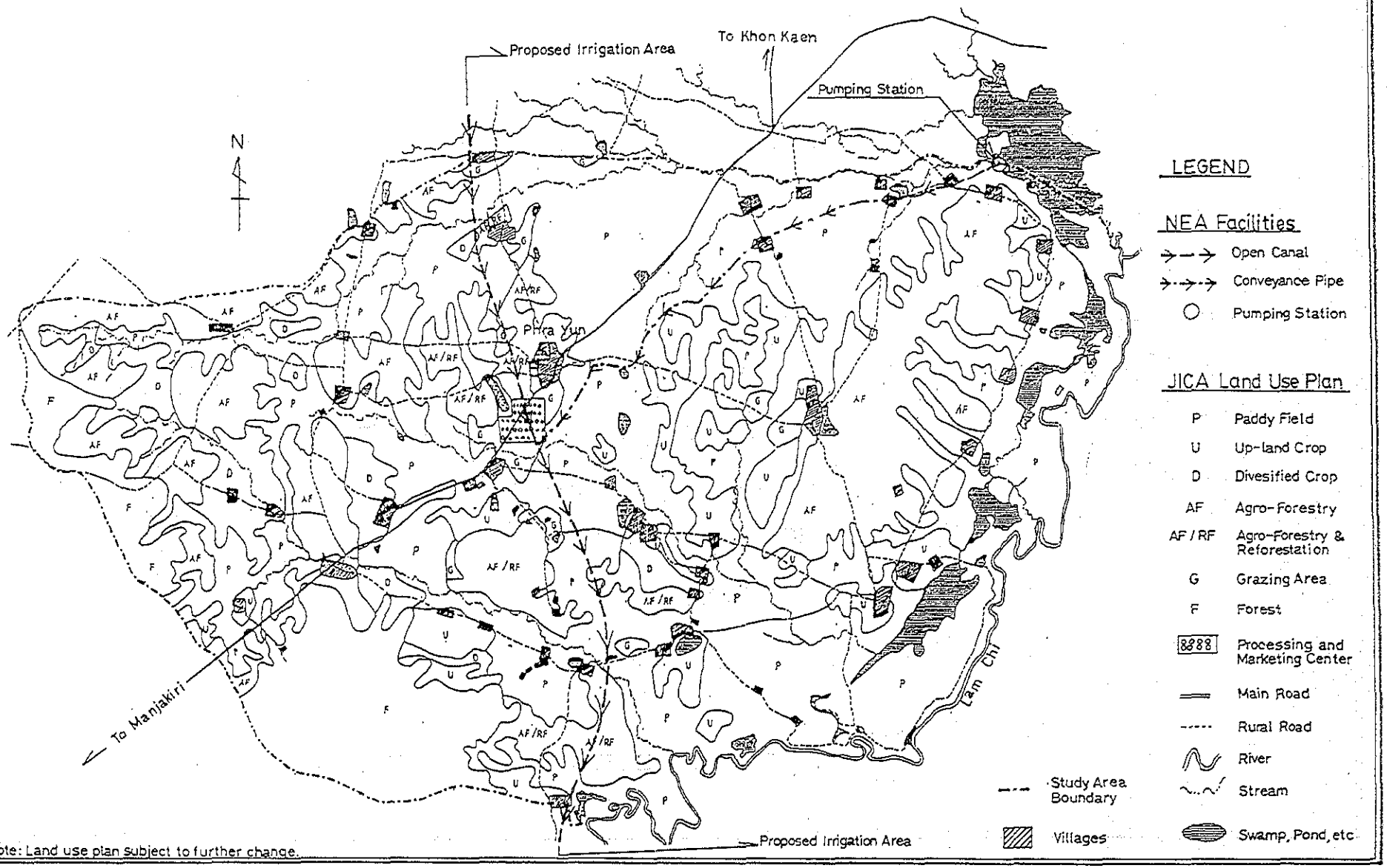
Measures to be taken \ Grade Point		Acceptability of the measures to be taken Accept to Object	Willing to cooperate with the measures to be taken (Offer Labor) Possible to Impossible	Willing to cooperate with the measures to be taken (Offer Land) Possible to Impossible	Willing to cooperate with the measures to be taken (Offer Social Works) Possible to Impossible	Willing to cooperate with the measures to be taken (Change Life Style, Works etc, if required) Possible to Impossible	Willing to cooperate with the measures to be taken (Natural Resources has to be maintained as sheet No.1) Possible to Impossible	Willing to cooperates with the measures to be taken (Natural Resources can be destroyed if necessary) Possible to Impossible	Remarks (Any Alternatives)
1	Construction of Drainage Canal for Desalination of Soil	0 — 10	0 — 10	0 — 10	0 — 10	0 — 10	0 — 10	0 — 10	
2	Construction of Ponds for Accumulation of Salt Water								
3	Other Construction Activities for Desalination of the Soil								
4	Transportation of the Accumulated Salt i.e. Road Construction in Your Area								
5	Afforestation of the Adjacent Area								

FIGURE J-2 Proposed PWA Channelization Work



(Source : Revised Master Plan & Feasibility Study, Khon Kaen Water Supply System, PWA)

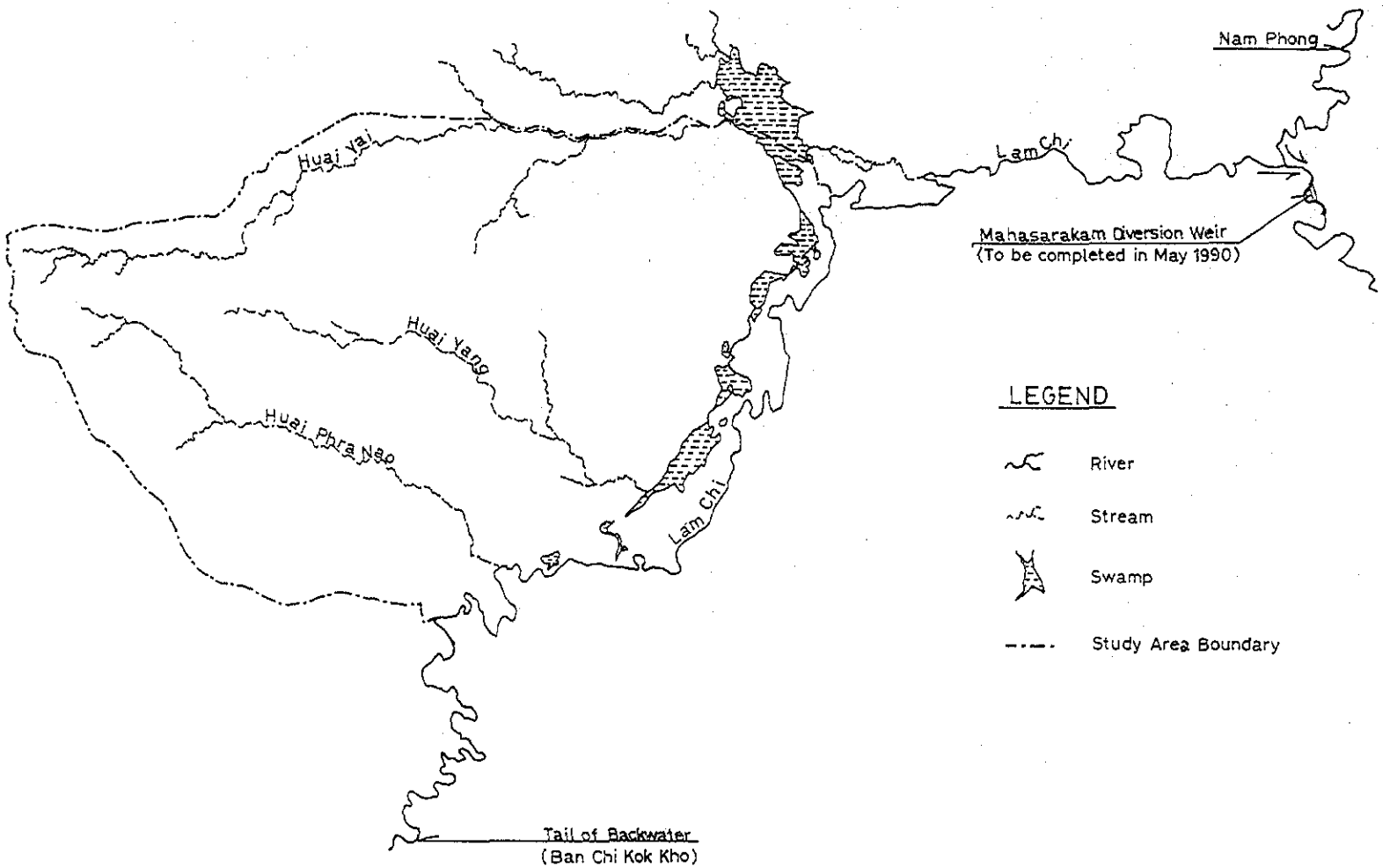
FIGURE J-4 Proposed NEA Irrigation Area



Note: Land use plan subject to further change.

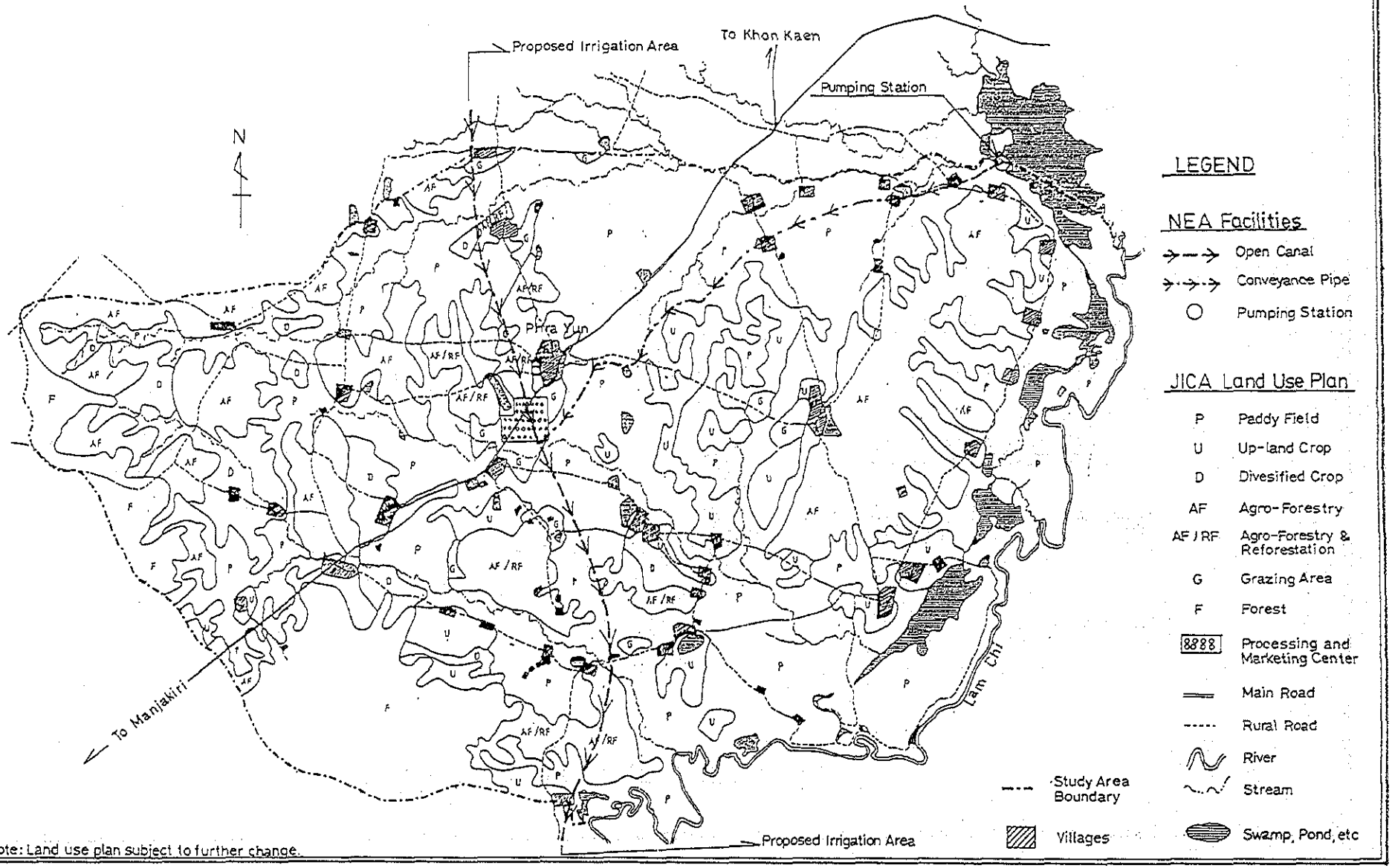
(Source: Engineering Office, Mahasarakam Diversion Weir, NEA)

FIGURE J-3 NEA Headwork on Lam Chi



(Source: Engineering Office, Mahasarakam Divesion Weir, NEA)

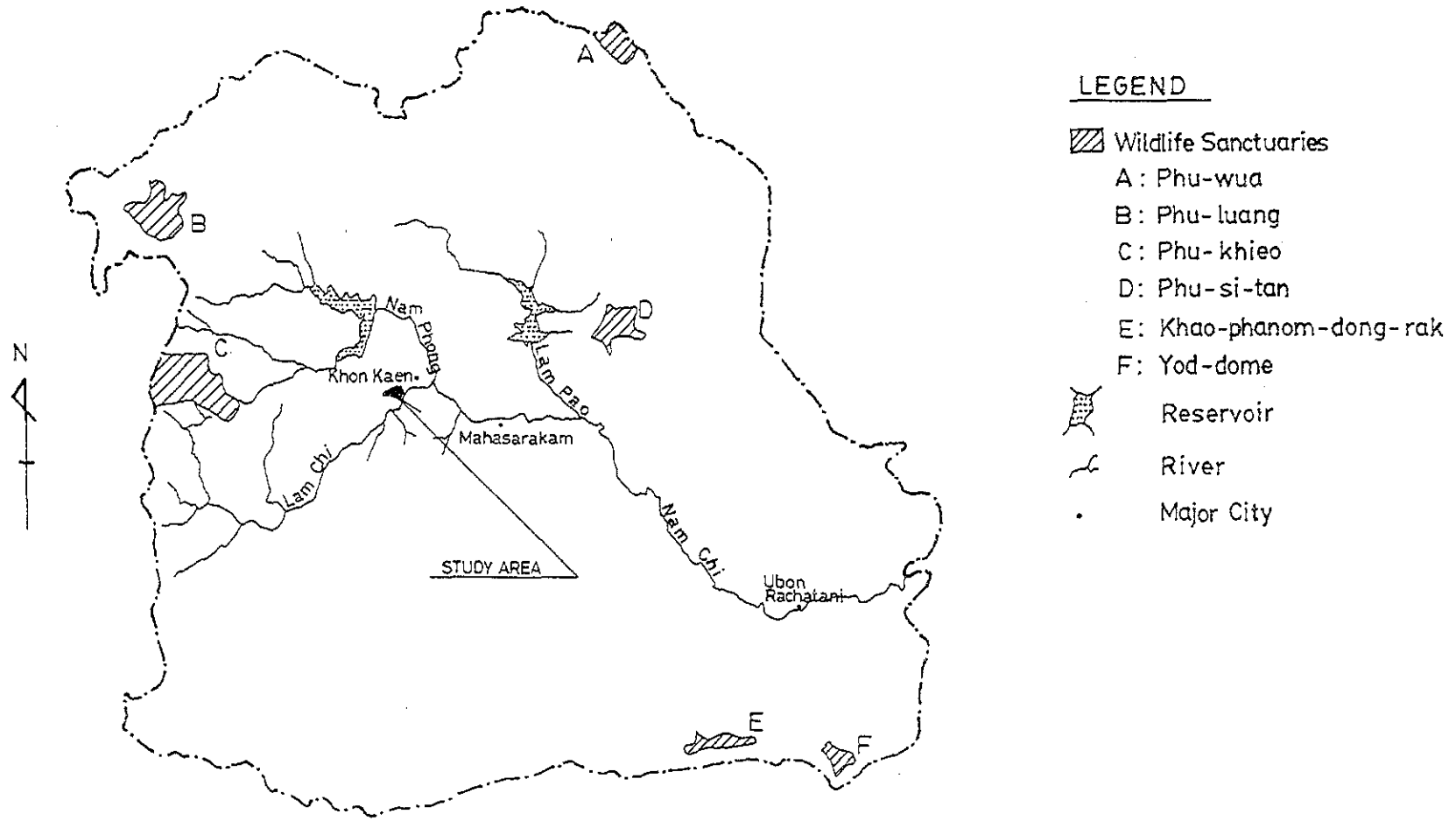
FIGURE J-4 Proposed NEA Irrigation Area



Note: Land use plan subject to further change.

(Source: Engineering Office, Mahasarakam Diversion Weir, NEA)

FIGURE J-5 Wildlife Sanctuaries in Northeast Thailand



(Source:Location of Wildlife Sanctuaries in Thailand, Royal Forestry Department 1990)

APPENDIX K PROJECT EVALUATION

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K-4 Comparison of Project Cost of Benefit

K-5 Farm Budget Analysis

Table K-1-1 Allocation of Capital Cost - Pilot Area (Financial)

(unit : '000฿)

Cost Item	Total Cost of Study Area	Specific Cost			Joint Cost *1			Allocated Cost of Pilot Area
		Total	Pilot Area	Extension Area	Total (28,860ha)	Pilot Area (3,990ha)	Extension Area (24,870ha)	
			(a)			(b)		(c)=(a)+(b)
1.Construction Works					(3,720ha*2)	(380ha)	(3,340ha)	
(1) Irrigation Facilities	566,974	550,122	73,964	476,158	16,852	1,721	15,131	75,685
(2) Drainage Facilities	63,350	60,816	7,858	52,958	2,534	350	2,184	8,208
(3) Rural Road	42,675	12,307*3	3,076	9,231	30,368*4	4,198	26,170	7,274
(4) Rural Water Supply Facilities	10,576	10,576	10,576	-	-	-	-	10,576
(5) Reforestation	52,075	51,873	6,022	45,851	202	28	174	6,050
(6) Social Service Facilities	60,685	-	-	-	60,685*5	22,121	38,564	22,121
Sub - Total	796,335	685,694	101,496	584,198	110,641	28,418	82,223	129,914
2.Equipment	36,595	-	-	-	36,595	5,059	31,536	5,059
3.Agricultural Extension Service	10,370	-	-	-	10,370	1,434	8,936	1,434
4.Land Acquisition	12,786	12,455	1,453	11,002	331	47	284	1,500
5.Project administration	23,890	20,570	3,045	17,525	3,320	459	2,861	3,504
6.Consulting Service	63,181	54,403	8,053	46,350	8,778	1,214	7,564	9,267
Total (1~6)	943,157	773,122	114,047	659,075	170,035	36,631	133,404	150,678
7.Physical Contingency	94,315	77,312	11,405	65,907	17,003	2,350	14,653	13,755
Total (1~7)	1,037,472	850,434	125,452	724,982	187,038	38,981	148,057	164,433

Note : *1 ···· Allocated by Using the Percentage of Total Cropping Area (Irrigated + Rainfed)
*2 ···· Allocated by Using the Percentage of Irrigated Area.
*3 ···· Village Road
*4 ···· Main Rural Road
*5 ···· Allocated by Using the Percentage of Population (study Area=31,000persons, Pilot Area=11,300persons)

Table K-1-2 Financial and Economic Project Cost

(unit : '000฿)

Cost Item	Total Cost				Cost Excluded Social Infrastructure			
	Financial		Economic *1		Financial		Economic *1	
	Study Area	Pilot Area	Study Area	Pilot Area	Study Area	Pilot Area	Study Area	Pilot Area
1.Construction Works								
(1) Irrigation Facilities	566,974	75,685	498,937	66,602	566,974	75,685	498,937	66,602
(2) Drainage Facilities	63,350	8,208	55,748	7,223	-	-	-	-
(3) Rural Road	42,675	7,274	37,554	6,401	30,368	4,198	26,723	3,694
(4) Rural Water Supply Facilities	10,576	10,576	9,306	9,306	10,576	10,576	9,306	9,306
(5) Reforestation	52,075	6,050	45,826	5,324	52,075	6,050	45,826	5,324
(6) Social Service Facilities	60,685	22,121	53,402	19,466	-	-	-	-
Sub - Total	796,335	129,914	700,773	114,322	659,993	96,509	580,792	84,926
2.Equipment	36,595	5,059	32,203	4,451	36,595	5,059	32,203	4,451
3.Agricultural Extension Service	10,370	1,434	9,125	1,261	10,370	1,434	9,125	1,261
4.Land Acquisition	12,786	1,500	-	-	12,786	1,500	-	-
5.Project administration	23,890	3,504	21,023	3,084	19,799	2,895	17,423	2,548
6.Consulting Service	63,181	9,267	55,599	8,155	52,364	7,657	46,080	6,7,8
Total (1~6)	943,157	150,678	818,723	131,273	791,907	115,054	685,623	99,924
7.Physical Contingency	94,315	13,755	82,997	12,104	79,191	11,505	69,688	10,124
Total (1~7)	1,037,472	164,433	901,720	143,377	871,098	126,559	755,311	110,048

Note : *1 ····· 0.88 of Construction Conversion Factor in Applied to Convert Economic Value.

Table K-1-3 Economic Cost Stream in the Study Area (1) - Total Cost -

(unit : '000₱)

Cost Item	Total	1st year	2nd year	3rd Year	4th Year	5th Year	6th Year
1.Construction Works							
(1) Irrigation Facilities	498,937	-	99,787	99,787	99,787	99,787	99,789
(2) Drainage Facilities	55,748	-	15,928	23,892	15,928	-	-
(3) Rural Road	37,554	-	-	14,083	14,083	9,388	-
(4) Rural Water Supply Facilities	9,306	-	-	9,306	-	-	-
(5) Reforestation	45,826	-	9,165	9,165	9,165	9,165	9,166
(6) Social Service Facilities	53,402	-	-	53,402	-	-	-
Sub - Total	700,773	-	124,880	209,636	138,963	118,342	108,952
2.Equipment	32,203	-	32,203	-	-	-	-
3.Agricultural Extension Service	9,125	4,012	1,023	1,023	1,023	1,023	1,021
4.Land Acquisition	-	-	-	-	-	-	-
5.Project Administration	21,023	-	8,408	3,154	3,154	3,154	3,153
6.Consulting Service	55,599	24,556	6,209	6,209	6,209	6,209	6,207
Total (1~6)	818,723	28,568	172,723	220,021	149,349	128,726	119,336
7.Physical Contingency	82,997	3,061	17,580	22,309	15,242	12,873	11,932
Total (1~7)	901,720	31,629	190,303	242,330	164,591	141,599	131,268

Table K-1-4 Economic Cost Stream in the Study Area (2) - Cost Excluded Social Infrastructure -

(unit : '000฿)

Cost Item	Total	1st year	2nd year	3rd Year	4th Year	5th Year	6th Year
1.Construction Works							
(1) Irrigation Facilities	498,937	-	99,787	99,787	99,787	99,787	99,789
(2) Drainage Facilities	-	-	-	-	-	-	-
(3) Rural Road	26,723	-	-	10,021	10,021	6,681	-
(4) Rural Water Supply Facilities	9,306	-	-	9,306	-	-	-
(5) Reforestation	45,826	-	9,165	9,165	9,165	9,165	9,166
(6) Social Service Facilities	-	-	-	-	-	-	-
Sub - Total	580,792	-	108,952	128,279	118,973	115,633	108,955
2.Equipment	32,203	-	32,203	-	-	-	-
3.Agricultural Extension Service	9,125	4,012	1,023	1,023	1,023	1,023	1,021
4.Land Acquisition	-	-	-	-	-	-	-
5.Project Administration	17,423	-	6,857	2,851	2,572	2,572	2,571
6.Consulting Service	46,080	20,025	5,064	5,802	5,064	5,064	5,061
Total (1~6)	685,623	24,037	154,099	137,955	127,632	124,292	117,608
7.Physical Contingency	69,688	2,532	14,542	19,487	12,608	10,648	9,871
Total (1~7)	755,311	26,569	168,641	157,442	140,240	134,940	127,479

Table K-1-5 Economic Cost Stream in the Pilot Area - Total Cost -

(unit : '000₿)

Cost Item	Total	1st year	2nd year	3rd Year
1.Construction Works				
(1) Irrigation Facilities	66,602	-	49,951	16,651
(2) Drainage Facilities	7,223	-	7,223	-
(3) Rural Road	6,401	-	-	6,401
(4) Rural Water Supply Facilities	9,306	-	-	9,306
(5) Reforestation	5,324	-	2,662	2,662
(6) Social Service Facilities	19,466	-	-	19,466
Sub - Total	114,322	-	59,836	54,486
2.Equipment	4,451	-	4,451	-
3.Agricultural Extension Service	1,261	867	197	197
4.Land Acquisition	-	-	-	-
5.Project Administration	3,084	-	1,851	1,233
6.Consulting Service	8,155	4,893	1,632	1,630
Total (1~6)	131,273	5,760	67,967	57,546
7.Physical Contingency	12,104	857	6,302	4,945
Total (1~7)	143,377	6,617	74,269	62,491

Table K-1-6 Economic Cost Stream in the Pilot Area
- Cost Excluded Social Infrastructure -

(unit : '000฿)

Cost Item	Total	1st year	2nd year	3rd Year
1.Construction Works				
(1) Irrigation Facilities	66,602	-	49,951	16,651
(2) Drainage Facilities	-	-	-	-
(3) Rural Road	3,694	-	-	3,694
(4) Rural Water Supply Facilities	9,306	-	-	9,306
(5) Reforestation	5,324	-	2,662	2,662
(6) Social Service Facilities	-	-	-	-
Sub - Total	84,926	-	52,613	32,313
2.Equipment	4,451	-	4,451	-
3.Agricultural Extension Service	1,261	867	197	197
4.Land Acquisition	-	-	-	-
5.Project Administration	2,548	-	1,366	1,182
6.Consulting Service	6,738	3,613	1,205	1,920
Total (1~6)	99,924	4,480	59,832	35,612
7.Physical Contingency	10,124	644	4,735	4,745
Total (1~7)	110,048	5,124	64,567	40,357

Table K-1-7 O & M Cost And Replacement Cost

(unit : '000₱)

	Study Area	Pilot Area
A. O&M Cost		
1.Capital cost (Financial)		
- Total Cost	1,037,472	205,108
- Cost excluded social infrastructures	858,192	113,694
2. Total O&M Cost		
- Financial	15,362	3,037 (205,108/1,037,472 ×15,362=3,037)
- Economic *1	14,133	2,794
3.O&M Cost excluded social Facilities		
- Financial	12,707 (858,192/1,037,472 ×15,362×15,362)	1,683 (113,694/205,108 ×3,037=1,683)
- Economic *1	11,691	1,549
B. Replacement Cost		
1. Pump Facilities (25years *2)		
- Financial	129,890	17,958 *3
- Economic *1	119,499	16,521
2. Buildings (30years *2)		
- Financial	33,820	4,676 *3
- Economic *1	31,114	4,302
3. Vehicles(10years *2)		
- Financial	3,610	499 *3
- Economic *1	3,321	459

Note : *1··· 0.92 of standard conversion factor is applied.
*2···replacement period
*3···allocated by applying the percentage of the Pilot Area

K-2 Prices

Table K-2-1 Farm-Gate Prices of Agricultural Products

Commodities	Unit	Financial	Economic
1) Paddy	฿/ ton	3,460	3,970
2) Vegetable(Tomato)	฿/ ton	1,650	1,650
3) Pulse (Groundnuts, unshell, dried)	฿/ ton	8,140	8,990
4) Orchard(Mango)	฿/ ton	5,320	6,420
5) Cocoon	฿/ ton	72,800	75,100
6) Cassava	฿/ ton	980	1,220
7) Cattle	฿/ head	10,000	10,000
8) Fresh water fish	฿/ ton	30,000	30,000

Table K-2-2 Price Structure of Paddy

Item	2000		
	Financial (฿/ton)	Conversion Factor	Economic (฿/ton)
1) IBRD Projection price in 2000 at 1985 constant price (5% broken white rice, FOB Bangkok) *1	(US$/ton 190)		(US$/ton 190)
2) Converted to 1990 constant price *2	(US$/ton 280)		(US$/ton 280)
3) Baht Equivalent *3	7,140		7,140
4) Grade Differencial (less 15%) *4	6,926		6,926
5) Port Charge *5	200	0.70	140
6) Business & Municipal Tax *6	10		-
7) Exporter's Margin *7	277	0.70	194
8) Wholesaler's Margin *8	208	0.70	146
9) Transportation & Handling Charge *9	280	0.87	244
10) Ex-mill price of Rice	5,951		6,202
11) Ex-mill price of Paddy *10	3,999		4,168
12) Value of Milling by-product	210	0.92	193
13) Milling Tax	204		-
14) Milling Cost plus Miller's Margin *11	302	0.70	211
15) Imputed Price of Paddy at Mill	3,703		4,150
16) Margin of Grain Dealer *12	169	0.70	188
17) Transport Cost, Farm to Mill *13	77	0.87	67
18) Farm Gate Price of Paddy	3,457 (≒3,460)		3,965 (≒3,970)

Note: *1 Commodity prices and price projections in 1985 constant Dollars, December, 1990, IBRD
*2 G-5, GNP Deflator 1985=100, 1990=147.17 in inflation indices, IBRD
*3 US$1.0=25.5
*4 Weighted average price : Viz. exported rice is assumed to be 97% of f.o.b.price of 5% broken.
*5 Includes wharfage dues, storage, arrstre and stevedoring charges and ancillary services fee.
*6 0.15% of f.o.b. price
*7 4% of f.o.b. price
*8 3% of f.o.b. price
*9 Based on 450km Khon Koen to Bangkok at 280 ฿/ton)
*10 67.2% of rice conversion rate at medium large rice mill
*11 Includes bagging, cleaning and handling costs adjusted by a conversion for processing of 0.92.
*13 Based on an average distance of 1km at 3.5 Baht/mt/km and two handling charges of 7.5 Baht/mt.

Table K-2-3 Price Structure of Groundnuts (Unshell)

Item	2000		
	Financial (฿/ ton)	Conversion Factor	Economic (฿/ ton)
1) FOB Bangkok *1	(us$/ton 391)		(us$/ton 391)
2) Converted to Thai Baht *2	9,970		9,970
3) Port handuling	200	0.70	140
4) Business tax *3	500		-
5) Exporter margin *4	440	0.70	308
6) Wholesale price, BKK	8,830		9,522
7) Transport/handling to BKK	280	0.87	244
8) Local merchant margin *5	410	0.70	288
9) Farm gate price	8,140		8,990

Note:*1···Export value of groundnut (unshell) is averaged as follows.
(Agricultural Statistics of Thailand, 1988/89, MOAC, Department of Customs)

Year	Quantity Not Shelled	Value Not Shelled	FOB	Exchange Rate	FOB	1989 Constant Price
	(MT)	(1,000Baht)	(Baht/MT)	(Baht/US$)		(US$/MT)
1984	435	4,456	10,244	27.15		
1985	418	4,150	9,928	26.65	377	(1.4955) 558
1986	422	4,289	10,164	26.13	373	(1.2364) 481
1987	1,213	10,606	8,744	25.07	389	(1.0975) 383
1988	708	9,251	13,066	25.24	349	(1.0317) 534
Average			10,429		518	489

Value by year is converted to 1989 constant prices using inflation indices (G-5 GNP Deflator, 1985=100),July, 1989, Workd Bank. Average FOB Price is estimated at 456 US$/MT.

*2··· Price projection table by World Bank does not include groundnut(not shelled). Hence, price projection in 2000 for groundnut isassied by used of trend of pice projection of groundnut mean estimated by World Bank.

Year	Soybean Price Projection ,IBRD	Groundnuts Thailand FOB
1989	199US$/t (100)	489 US$/t
2000	150US$/t (75.4)	369 US$/t

*3··· US$1.0=Baht 25.5
*4··· Bushiness tax is assumed at about 5% of FOB Prices.
*5··· Exporter margin is assumed at about 5% of wholesale price in BKK.
*6··· Local Merchant Margin is Assumed at About 5% farm gate price.

Table K-2-4 Price Structure of Mango

Item	2000		
	Financial (Baht/ ton)	Conversion Factor	Economic (Baht/ ton)
1) FOB Bangkok *1	(us$/ton 323)		(us$/ton 323)
2) Converted to Thai Baht *2	8,237		8,237
3) Port Vandling - Transport BKK to Part,Vandling and Vanning to Boat	500	0.70	350
4) Certification Fee	100		-
5) Cargo Damaged Loss *3	412	0.92	379
6) Exporter Tax *4	412		-
7) Exporter Margin *5	435	0.70	305
8) Wholesaler margin *6	217	0.70	152
9) Wholesale price in BKK	6,161		7,051
10) Transport Cost Khon Koen to BKK	280	0.87	244
11) Packing cost *7	560	0.70	392
12) Farm Gate Price	5,321 (≒5,320)		6,415 (≒6,420)

Note:*1･･･Export Value of Fresh Mango is Averaged as follows.

Year	Quantity	Value 1,000 Baht	FOB	Exchange Rate	FOB	1989 Constant Price US$/MT	
	(MT)		(Baht/MT)	(Baht/US$)	(US$/MT)		
1984	3,175	31,256	9,844	27.15	363		
1985	8,311	57,170	6,879	26.65	258	(1.4955)	386
1986	9,400	54,287	5,775	26.13	221	(1.2304)	273
1987	3,736	28,309	7,577	25.07	302	(1.0975)	331
1988	6,713	49,727	7,408	25.24	294	(1.0317)	303
Average			7,497				323

Source : Agricultural Statistics of Thailand,1988/89, MOAC,Department of Custom

*2･･･ US$1.0=Baht 25.5
*3･･･ Cargo Damaged Loss is Assumed at 5% of Ex-Portprice.
*4･･･ Exporter Tax is Assumed at 5% of FOB Price
*5･･･ Exporter Margin is Assumed at 7% of Wholesale Price in BKK.
*6･･･ Wholesale Margin is Assumed at 3.5% of Wholesale price in BKK.
*7･･･ Packing Cost Include Carton Box and Labor.
Mango Packing Standard is Medium Size (Net Weight 6.8-7.5Kg)
140Box Per ton × 4 Baht = 560 Baht

Table K-2-5 Price Structure of Cocoon

Item	Financial (฿/ton)	Conversion Factor	Economic (฿/ton)
1) Input Price of Cocoon to Silk Factory in Khon Khen	80,870	-	80,870
2) Transport and Handling costs from Middleman to Silk Factory *1	435	0.87	378
3) Middleman's Margin *2	7,300	0.70	5,110
4) Transport and Handing Costs From farmer to Middleman	350	0.70	245
5) Farmgate Price of Cocoon	72,785 (≒72,800)	-	75,137 (≒75,100)

*1 Based on 40 km from the Project Area to Factory (Chonnabot) at 9.0 Baht/ton/km and two Handling Charges of 75.0 Baht/ton

*2 Approximately 10% of Farmgate Price of cocoon

Table K- 2-6 Price Structure of Cassava

Item	2000		
	Financial (฿/ton)	Conversion Factor	Economic (฿/ton)
1) Pallets, FOB, Bangkok *1	3,140		3,140
2) Business Tax	55		-
3) Exporter's Cost and Margin *2	140	0.70	98
4) Pellets' Delivered Godown Price	2,945		3,042
5) Delivering Cost to Godown	40	0.92	37
6) Pelletizing Cost	100	0.70	70
7) File Cost	30	0.92	28
8) Saving on Chip Requirement	50	0.92	46
9) Pelleter's Margin	50	0.70	35
10) Chips, Delivered Pelletiser	2,675		2,827
11) Transport	280	0.87	244
12) Chipspre-Delivered to Pellerer	2,395		2,583
13) Root Fresh Farm-Gate Price	615	0.70	430
14) Chips After Dring	1,780		2,153
15) Cost of Root Weight Loss(60%)	1,068		1,292
16) Chipping cost	10	0.70	7
17) Transportation cost Farm-Gate to Chip Mill	77	0.87	67
18) Root Fresh Farm-Gate Price	981 (≒980)		1,218 (≒1,220)

*1 Average Price Jan.to Nov.1989, Office of Agri. Economics

*2 4.5% of FOB Price

*3 25% of chips pre- Delivered to Pelleted

TABLE K-2-7 Price Structure of Urea (46% of N)

Cost Item	2000		
	Financial (฿/ton)	Conversion Factor	Economic (฿/ton)
1) Import Price, any Origin, Bagged, F.O.B. N.W Europe *1	(US$/ton177)		(US$/ton177)
2) Ocean Freight and Insurance to Bangkok Port	(US$/ton 35)		(US$/ton35)
3) Import Price, CIF Bangkok	(US$/ton212)		(US$/ton212)
4) Import Tax (3% on Import Price)	(US$/ton 7)		-
5) Baht Equivalent *2	Baht 5,585		5,585
6) Port Charge	30	0.70	21
7) Administrative and Storage Costs	42	0.70	29
8) Importer's/ Wholesaler's Margin	599	0.70	419
9) Transport Cost, Bangkok to the Project Area	280	0.87	244
10) Input Price at Dealer's Store	6,536		6,298
11) Margin of Commodity Dealer	351	0.70	246
12) Transport and Handling Costs from Dealer to Farmgate	85	0.70	60
13) Farmgate Price	6,972		6,604
14) Farmgate Price, Nutrient Basis	15,155 (≒15,200)		14,357 (≒14,400)

*1 Based on World Bank's Commodity Price Projection Dec. 1990
*2 US$ 1.0 =฿ 25.50

TABLE K-2-8 Price Structure of Potasicem Chloride (60% of K_2O)

Cost Item		2000		
		Financial (฿/ton)	Conversion Factor	Economic (฿/ton)
1)	Import Price, Bulk F.O.B. Vancouver *1	(US$/ton106)		(US$/ton106)
2)	Ocean Freight and Insurance to Bangkok Port	(US$/ton 35)		(US$/ton 35)
3)	Import Price, CIF Bangkok	(US$/ton141)		(US$/ton141)
4)	Import Tax (3% on Import Price)	(US$/ton 5)		-
5)	Baht Equivalent *2	Baht 3,723		3,723
6)	Port Charge	30	0.70	21
7)	Administrative and Storage Costs	42	0.70	29
8)	Importer's/ Wholesaler's Margin	398	0.70	279
9)	Transport Cost, Bangkok to the Project Area	280	0.87	244
10)	Input Price at Dealer's Store	4,473		4,296
11)	Margin of Commodity Dealer	240	0.70	168
12)	Transport and Handling Costs from Dealer to Farmgate	85	0.70	60
13)	Farmgate Price	4,798		4,524
14)	Farmgate Price, Nutrient Basis	7,995 (≒8,000)		7,539 (≒7,540)

*1 Based on World Bank's Commodity Price Projection Dec. 1990
*2 US$ 1.0 =฿ 25.50

TABLE K-2-9 Price Structure of Triple super Phosphate (45% of P_2O_5)

Cost Item	2000		
	Financial (฿/ton)	Conversion Factor	Economic (฿/ton)
1) Import Price, any Bulk F.O.B. US Golf *1	(US$/ton168)		(US$/ton168)
2) Ocean Freight and Insurance to Bangkok Port	(US$/ton 35)		(US$/ton 35)
3) Import Price, CIF Bangkok	(US$/ton203)		(US$/ton203)
4) Import Tax (3% on Import Price)	(US$/ton 7)		0
5) Baht Equivalent *2	Baht 5,355		5,355
6) Port Charge	30	0.70	21
7) Administrative and Storage Costs	42	0.70	29
8) Importer's/ Wholesaler's Margin	581	0.70	407
9) Transport Cost, Bangkok to the Project Area	280	0.87	244
10) Input Price at Dealer's Store	6,288		6,056
11) Margin of Commodity Dealer	341	0.70	239
12) Transport and Handling Costs from Dealer to Farmgate	85	0.70	60
13) Farmgate Price	6,714		6,355
14) Farmgate Price, Nutrient Basis	14,922 (≒14,900)		14,124 (≒14,100)

*1 Based on World Bank's Commodity Price Projection Dec. 1990
*2 US$ 1.0 = ฿ 25.50

Table K-3-1 (1) Crop Budgets per Hectore - Present & Without Project -

Items	Paddy		Cocoon		Cassava	
	Financial	Economic	Financial	Economic	Financial	Economic
1. Yield (tons/ha)	1.75	1.75	0.11	0.11	12.50	12.50
2. Farm Gate Price (฿/ton)	3,460	3,970	72,800	75,100	980	1,220
3. Gross Production Value (฿/ha)	6,060	6,950	8,010	8,260	12,250	15,250
4. Cost of Production (฿/ha)						
- Seeds or Seedling	220	250	1,250	1,290	390	480
- Fertilizer	220	210	420	400	340	330
- Pesticides	0	0	120	110	0	0
- Labor	350	1,650	700	3,300	2,070	2,880
- Machinery & Animals	2,490	2,290	1,370	1,260	2,910	2,670
- Others	520	480	780	720	870	800
Total Cost	6,800	4,880	4,640	7,080	6,580	7,160
5. Net Production (฿/ha)	2,260	2,070	3,370	1,180	5,670	8,090

Table K-3-1 (2) Crop Budgets per Hectore - With Project -

Items	Irrigated Paddy		Rainfed Paddy		Vegetable (Tomato)		Pulse (Groundnuts)	
	Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic
1. Yield (tons/ha)	3.00	3.00	1.90	1.90	23.00	23.00	2.30	2.30
2. Farm Gate Price (฿/ton)	3,460	3,970	3,460	3,970	1,650	1,650	8,140	8,990
3. Gross Production Value (฿/ha)	10,380	11,910	6,570	7,540	37,950	37,950	18,720	20,680
4. Cost of Production (฿/ha)								
- Seeds or Seedling	220	250	220	250	410	410	2,160	2,390
- Fertilizer	1,090	1,040	230	220	3,000	2,850	720	680
- Pesticides	50	50	0	0	580	550	270	260
- Labor	540	2,500	360	1,730	0	7,930	0	2,760
- Machinery & Animals	3,490	3,210	2,500	2,300	4,940	4,540	2,560	2,360
- Others	840	770	540	500	2,000	1,840	960	880
Total Cost	6,230	7,820	3,850	5,000	10,930	18,120	6,670	9,330
5. Net Production (฿/ha)	4,150	4,090	2,720	2,540	27,020	19,830	12,050	11,350

Table K-3-1 (3) Crop Budgets per Hector - With Project -

Items	Orchard (Mango)		Cocoon		Cassava	
	Financial	Economic	Financial	Economic	Financial	Economic
1. Yield (tons/ha)	3.10	3.10	0.36	0.36	18.80	18.80
2. Farm Gate Price (฿/ton)	5,320	6,420	72,800	75,100	980	1,220
3. Gross Production Value (฿/ha)	16,490	19,900	26,210	27,040	18,440	22,940
4. Cost of Production (฿/ha)						
- Seeds or Seedlings	220	260	1,560	1,610	390	480
- Fertilizer	3,500	3,330	2,200	2,090	460	440
- Pesticides	1,580	1,500	600	570	0	0
- Labor	0	2,200	1,820	5,150	3,510	4,630
- Machinery & Animals	840	770	3,610	3,320	4,070	3,750
- Others	910	840	1,520	1,400	1,140	1,050
Total Cost	7,050	8,900	11,310	14,140	9,570	10,350
5. Net Production (฿/ha)	9,440	11,000	14,900	12,900	8,870	12,590

Table K-3-2 Crop Benefit at the Target Year - Study Area -

Crops	Harvested Area (ha)	Economic ('000฿)	
		Gross Production	Net Production
1. Without Project			
- Paddy	6,270	43,577	12,979
- Cocoon	440	3,634	519
- Cassava	4,290	65,423	34,706
Total	11,000	112,634	48,204
2. With Project			
- Paddy			
i. Irrigated	3,160	37,636	12,924
ii. Rainfed	5,590	42,149	14,199
- Vegetable (Tomato)	100	3,795	1,983
- Pulse (Groudnuts)	220	4,550	2,497
- Orchard	1,320	26,268	14,520
- Cocoon	1,350	36,504	17,415
- Cassava	3,780	86,713	47,590
Total	15,520	237,615	111,128
3. Annual Crop Benefit			62,924

Table K-3-3 Crop Benefit at the Target Year - Pilot Area -

Crops	Harvested Area (ha)	Economic ('000฿)	
		Gross Production	Net Production
1. Without Project			
- Paddy	920	6,394	1,904
- Cocoon	80	661	94
- Cassava	170	2,593	1,375
Total	1,170	9,648	3,373
2. With Project			
- Paddy			
i. Irrigated	320	3,811	1,309
ii. Rainfed	1,060	7,992	2,692
- Vegetable (Tomato)	10	380	198
- Pulse (Groudnuts)	20	414	227
- Orchard	180	3,582	1,980
- Cocoon	290	7,842	3,741
- Cassava	350	8,029	4,407
Total	2,230	32,050	14,554
3. Annual Crop Benefit			11,181

Table K-3-4 Livestock Benefit
- Cattles & Buffaloes -

Items	Unit	Study Area	Pilot Area
1. Without Project			
(1) Total Numbers of Livestock	head	17,850	1,570
(2) Shipment Number of Livestock	〃	3,570	314
(3) Farm-gate Price	฿/head	10,000	10,000
(4) Gross Production	'000 ฿	35,700	3,140
(5) Cost of Production	〃	23,210	2,040
(6) Net Production	〃	12,490	1,100
2. With Project			
(1) Total Number of Livestock	head	21,440	2,660
(2) Shipment Number of Livestock	〃	5,360	665
(3) Farm-gate Price	฿/head	10,000	10,000
(4) Gross Production	'000 ฿	53,600	6,650
(5) Cost of Production	〃	26,800	3,325
(6) Net Production	〃	26,800	3,325
3. Benefit	〃	14,310	4,425

Table K-3-5 Net Production of Fresh-Water Fish

Items	Financial	Economic
1. Yield (tons/ha)	1.50	1.50
2. Price (฿/ton)	30,000	30,000
3. Gross Production Value (฿/ha)	45,000	45,000
4. Production Cost (฿/ha)		
- Fry (0.2฿ x 10,000try/ha)	2,000	1,840
- Labor	7,200	6,620
- Pump Cost (included fuel)	1,400	1,290
- Others	530	490
Total Cost	11,130	10,240
5. Net Production (฿/ha)	33,870	34,760
6. Total Benefit ('000฿)		
- Study Area(A) x 135ha	4,572	4,693
- Pilot Area(A) x 14ha	474	487

Table K-3-6 Benefit of Rural Water Supply

Items	Unit	Pilot Area
1. Cost of Water		
1) Without Project *1		
(a) Average Consumption of Water	m^3/family/month	11.6
(b) Labor Inputs	hours/family/month	34.1
(c) Economic Labor Cost(b)/(a)×3.57฿	฿/m^3	10.5
(d) Economic Expenditure for the Facilities	฿/family/month	45.4
(e) Expenditure per Cubic Meter(d)/(a)	฿/m^3	3.9
(f) Total Cost (c)+(e)	฿/m^3	14.4
2) With Project		
(g) Economic Labor Cost(c)×0.10	฿/m^3	1.1
(h) Economic Expenditure for the Facilities (e)×0.10	฿/m^3	0.4
(i) Total Cost (g)+(h)	฿/m^3	1.5
3) Benefit per Cubic Meter(f)-(i)	฿/m^3	12.9
2. Total benefit in the Service Area		
4) Total Water Supply	m^3/year	63,510
5) Total Benefit 12.9฿×63,510 m^3	'000฿	819

Note : *1 ··· Based on the JICA study in the Northeast Thailand, 1985 "Feasibility Study on the Sanitary District Water Works Project"

Table K-3-7 Benefit of Main Rural Road

Code No. of New Road	Variable Cost of Cars		Benefit ('000฿)
	Existing Route	New Route	
Route No.1	-Wet Season *1 16.0km/25km/hr×300cars ×87฿/hr×183days =3,056,832฿ -Dry Season 16.0km/35km/hr×300cars ×87฿/hr×182days =2,171,520฿ -Total = 5,228,352	(=improvement route) - Wet & Dry Season 16.0km/50km/hr×300cars ×87฿/hr×365days =3,048,480฿	2,180
Route No.2	(Provincial road No.2062 & National road No.12) 23.8km/50km/hr×200cars ×87฿/hr×365days =3,023,076฿	(=new route) 14.0km/50km/hr×200cars ×87฿/hr×365days =1,778,280฿	1,245
Rout No.3	-Wet Season 3.0km/15km/hr×100cars ×87฿/hr×183days =318,420฿ -Dry Season 3.0km/25km/hr×100cars ×87฿/hr×182days =190,008฿ -Total = 508,428฿	(=improvement route) - Wet & Dry Season 3.0km/50km/hr×100cars ×87฿/hr×365days =190,530฿	318
Total Benefit			3,743
Benefit in the Pilot Area *2			517

Note : *1 ··· Based on the variable cost of pick up car (100฿/hr) and the conversion factor of transportation (0.87)

*2 ···· Allocated by using the percentage of total cropping area(3,990ha/28,860ha)

Table K-3-8 Benefit Stream With Project - Study Area -
(Economic) (unit : '000฿)

Year	Net Production in the undevelop-ment Area	Net Production in the Development Area					Net Production with Project	Benefit
		Crops	Livestock	Fishery	Rural Water Supply	Main Rural Road		
1993	48,204	-	-	-	-	-	48,204	0
1994	48,204	-	-	-	-	-	48,204	0
1995	48,204	36,935	4,722	1,549	-	-	91,410	43,206
1996	38,563	55,962	7,155	2,347	-	-	104,027	55,823
1997	28,922	72,751	9,302	3,050	819	1,248	116,092	67,888
1998	19,282	87,301	11,162	3,661	819	2,495	124,720	76,516
1999	9,641	95.695	12,235	4,013	819	3,119	125,522	77,318
2000	-	104,089	13,308	4,364	819	3,743	126,323	78,119
2001	-	107,447	13,738	4,505	819	3,743	130,252	82,048
2002	-	109,686	14,024	4,599	819	3,743	132,871	84,667
2003	-	110,805	14,167	4,646	819	3,743	134,180	85,976
2004	-	111,924	14,310	4,693	819	3,743	135,489	87,285

Table K-3-9 Benefit Stream With Project - Pilot Area -
(Economic) (unit : '000฿)

Year	Net Production in the undevelop-ment Area	Net Production in the Development Area					Net Production with Project	Benefit
		Crops	Livestock	Fishery	Rural Water Supply	Main Rural Road		
1993	3,373	-	-	-	-	-	3,373	0
1994	3,373	-	-	-	-	-	3,373	0
1995	1,687	7,277	2,213	245	-	-	11,422	8,049
1996	-	11,352	3,452	381	-	-	15,185	11,812
1997	-	13,535	4,115	455	819	517	19,441	16,068
1998	-	14,263	4,337	479	819	517	20,415	17,042
1999	-	14,554	4,425	487	819	517	20,804	17,431
2000~	-	14,554	4,425	487	819	517	20,804	17,431

Table K-4-1 Economic Indicators of the Master plan Area
- Proto Type -

(UNIT : MILLION BAHRT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						6 %		8 %		10 %	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 1993	31.63	0.00	31.63	0.00	-31.63	26.56	0.00	25.11	0.00	23.76	0.00
4 1994	190.30	0.00	190.30	0.00	-190.30	150.74	0.00	139.88	0.00	129.98	0.00
5 1995	242.33	0.00	242.33	43.21	-199.12	181.08	32.29	164.93	29.41	150.47	26.83
6 1996	164.59	2.79	167.38	55.82	-111.56	118.00	39.35	105.48	35.18	94.48	31.51
7 1997	141.60	2.79	144.39	67.89	-76.50	96.03	45.15	84.25	39.61	74.10	34.84
8 1998	131.27	2.79	134.06	76.52	-57.54	84.11	48.01	72.43	41.34	62.54	35.70
9 1999	0.00	14.13	14.13	77.32	63.19	8.36	45.77	7.07	38.68	5.99	32.79
10 2000	0.00	14.13	14.13	78.12	63.99	7.89	43.62	6.54	36.18	5.45	30.12
11 2001	0.00	14.13	14.13	82.05	67.92	7.44	43.22	6.06	35.19	4.95	28.76
12 2002	0.00	14.13	14.13	84.67	70.54	7.02	42.08	5.61	33.62	4.50	26.98
13 2003	0.00	14.13	14.13	85.98	71.85	6.62	40.31	5.20	31.61	4.09	24.91
14 2004	0.00	14.13	14.13	87.29	73.16	6.25	38.61	4.81	29.72	3.72	22.99
15 2005	0.00	14.13	14.13	87.29	73.16	5.90	36.42	4.45	27.52	3.38	20.90
16 2006	0.00	14.13	14.13	87.29	73.16	5.56	34.36	4.12	25.48	3.08	19.00
17 2007	0.00	14.13	14.13	87.29	73.16	5.25	32.42	3.82	23.59	2.80	17.27
18 2008	0.00	17.45	17.45	87.29	69.84	6.11	30.58	4.37	21.84	3.14	15.70
19 2009	0.00	14.13	14.13	87.29	73.16	4.67	28.85	3.27	20.23	2.31	14.27
20 2010	0.00	14.13	14.13	87.29	73.16	4.41	27.22	3.03	18.73	2.10	12.98
21 2011	0.00	14.13	14.13	87.29	73.16	4.16	25.68	2.81	17.34	1.91	11.80
22 2012	0.00	14.13	14.13	87.29	73.16	3.92	24.22	2.60	16.06	1.74	10.72
23 2013	0.00	14.13	14.13	87.29	73.16	3.70	22.85	2.41	14.87	1.58	9.75
24 2014	0.00	14.13	14.13	87.29	73.16	3.49	21.56	2.23	13.77	1.43	8.86
25 2015	0.00	14.13	14.13	87.29	73.16	3.29	20.34	2.06	12.75	1.30	8.06
26 2016	0.00	14.13	14.13	87.29	73.16	3.11	19.19	1.91	11.80	1.19	7.32
27 2017	0.00	14.13	14.13	87.29	73.16	2.93	18.10	1.77	10.93	1.08	6.66
28 2018	0.00	17.45	17.45	87.29	69.84	3.41	17.08	2.02	10.12	1.21	6.05
29 2019	0.00	14.13	14.13	87.29	73.16	2.61	16.11	1.52	9.37	0.89	5.50
30 2020	0.00	14.13	14.13	87.29	73.16	2.46	15.20	1.40	8.67	0.81	5.00
31 2021	0.00	14.13	14.13	87.29	73.16	2.32	14.34	1.30	8.03	0.74	4.55
32 2022	0.00	14.13	14.13	87.29	73.16	2.19	13.53	1.20	7.44	0.67	4.13
33 2023	0.00	119.50	119.50	87.29	-32.21	17.47	12.76	9.43	6.89	5.15	3.76
34 2024	0.00	14.13	14.13	87.29	73.16	1.95	12.04	1.03	6.38	0.55	3.42
35 2025	0.00	14.13	14.13	87.29	73.16	1.84	11.36	0.96	5.90	0.50	3.11
36 2026	0.00	14.13	14.13	87.29	73.16	1.73	10.71	0.88	5.47	0.46	2.82
37 2027	0.00	14.13	14.13	87.29	73.16	1.64	10.11	0.82	5.06	0.42	2.57
38 2028	0.00	48.57	48.57	87.29	38.72	5.31	9.54	2.61	4.69	1.30	2.33
39 2029	0.00	14.13	14.13	87.29	73.16	1.46	9.00	0.70	4.34	0.34	2.12
40 2030	0.00	14.13	14.13	87.29	73.16	1.37	8.49	0.65	4.02	0.31	1.93
41 2031	0.00	14.13	14.13	87.29	73.16	1.30	8.01	0.60	3.72	0.28	1.75
42 2032	0.00	14.13	14.13	87.29	73.16	1.22	7.55	0.56	3.44	0.26	1.59
43 2033	0.00	14.13	14.13	87.29	73.16	1.15	7.13	0.52	3.19	0.23	1.45
44 2034	0.00	14.13	14.13	87.29	73.16	1.09	6.72	0.48	2.95	0.21	1.32
45 2035	0.00	14.13	14.13	87.29	73.16	1.03	6.34	0.44	2.73	0.19	1.20
46 2036	0.00	14.13	14.13	87.29	73.16	0.97	5.98	0.41	2.53	0.18	1.09
47 2037	0.00	14.13	14.13	87.29	73.16	0.91	5.64	0.38	2.34	0.16	0.99
48 2038	0.00	17.45	17.45	87.29	69.84	1.06	5.32	0.43	2.17	0.18	0.90
49 2039	0.00	14.13	14.13	87.29	73.16	0.81	5.02	0.33	2.01	0.13	0.82
50 2040	0.00	14.13	14.13	87.29	73.16	0.77	4.74	0.30	1.86	0.12	0.74
TOTAL	901.72	751.60	1653.32	3881.31	2227.99	812.67	982.92	695.19	698.78	606.36	517.85

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.21 (6%), 1.01 (8%), 0.85 (10%)
INTERNAL RATE OF RETURN (IRR) = 8.1 %

Table K-4-2 Economic Indicators of the Master plan Area
- Alternative (Cost Excluded Social Infrastructure) - (UNIT : MILLION BAHRT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						6 %		8 %		10 %	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 1993	26.57	0.00	26.57	0.00	-26.57	22.31	0.00	21.09	0.00	19.96	0.00
4 1994	168.64	0.00	168.64	0.00	-168.64	133.58	0.00	123.96	0.00	115.18	0.00
5 1995	157.44	0.00	157.44	43.21	-114.23	117.65	32.29	107.15	29.41	97.76	26.83
6 1996	140.24	0.00	140.24	55.82	-84.42	98.86	39.35	88.38	35.18	79.16	31.51
7 1997	134.94	0.00	134.94	67.89	-67.05	89.74	45.15	78.74	39.61	69.25	34.84
8 1998	127.48	0.00	127.48	76.52	-50.96	79.98	48.01	68.87	41.34	59.47	35.70
9 1999	0.00	11.69	11.69	77.32	65.63	6.92	45.77	5.85	38.68	4.96	32.79
10 2000	0.00	11.69	11.69	78.12	66.43	6.53	43.62	5.41	36.18	4.51	30.12
11 2001	0.00	11.69	11.69	82.05	70.36	6.16	43.22	5.01	35.19	4.10	28.76
12 2002	0.00	11.69	11.69	84.67	72.98	5.81	42.08	4.64	33.62	3.72	26.98
13 2003	0.00	11.69	11.69	85.98	74.29	5.48	40.31	4.30	31.61	3.39	24.91
14 2004	0.00	11.69	11.69	87.29	75.60	5.17	38.61	3.98	29.72	3.08	22.99
15 2005	0.00	11.69	11.69	87.29	75.60	4.88	36.42	3.69	27.52	2.80	20.90
16 2006	0.00	11.69	11.69	87.29	75.60	4.60	34.36	3.41	25.48	2.54	19.00
17 2007	0.00	11.69	11.69	87.29	75.60	4.34	32.42	3.16	23.59	2.31	17.27
18 2008	0.00	15.01	15.01	87.29	72.28	5.26	30.58	3.76	21.84	2.70	15.70
19 2009	0.00	11.69	11.69	87.29	75.60	3.86	28.85	2.71	20.23	1.91	14.27
20 2010	0.00	11.69	11.69	87.29	75.60	3.65	27.22	2.51	18.73	1.74	12.98
21 2011	0.00	11.69	11.69	87.29	75.60	3.44	25.68	2.32	17.34	1.58	11.80
22 2012	0.00	11.69	11.69	87.29	75.60	3.24	24.22	2.15	16.06	1.44	10.72
23 2013	0.00	11.69	11.69	87.29	75.60	3.06	22.85	1.99	14.87	1.31	9.75
24 2014	0.00	11.69	11.69	87.29	75.60	2.89	21.56	1.84	13.77	1.19	8.86
25 2015	0.00	11.69	11.69	87.29	75.60	2.72	20.34	1.71	12.75	1.08	8.06
26 2016	0.00	11.69	11.69	87.29	75.60	2.57	19.19	1.58	11.80	0.98	7.32
27 2017	0.00	11.69	11.69	87.29	75.60	2.42	18.10	1.46	10.93	0.89	6.66
28 2018	0.00	15.01	15.01	87.29	72.28	2.94	17.08	1.74	10.12	1.04	6.05
29 2019	0.00	11.69	11.69	87.29	75.60	2.16	16.11	1.25	9.37	0.74	5.50
30 2020	0.00	11.69	11.69	87.29	75.60	2.04	15.20	1.16	8.67	0.67	5.00
31 2021	0.00	11.69	11.69	87.29	75.60	1.92	14.34	1.08	8.03	0.61	4.55
32 2022	0.00	11.69	11.69	87.29	75.60	1.81	13.53	1.00	7.44	0.55	4.13
33 2023	0.00	131.19	131.19	87.29	-43.90	19.18	12.76	10.35	6.89	5.65	3.76
34 2024	0.00	11.69	11.69	87.29	75.60	1.61	12.04	0.85	6.38	0.46	3.42
35 2025	0.00	11.69	11.69	87.29	75.60	1.52	11.36	0.79	5.90	0.42	3.11
36 2026	0.00	11.69	11.69	87.29	75.60	1.43	10.71	0.73	5.47	0.38	2.82
37 2027	0.00	11.69	11.69	87.29	75.60	1.35	10.11	0.68	5.06	0.34	2.57
38 2028	0.00	46.13	46.13	87.29	41.16	5.04	9.54	2.48	4.69	1.23	2.33
39 2029	0.00	11.69	11.69	87.29	75.60	1.20	9.00	0.58	4.34	0.28	2.12
40 2030	0.00	11.69	11.69	87.29	75.60	1.14	8.49	0.54	4.02	0.26	1.93
41 2031	0.00	11.69	11.69	87.29	75.60	1.07	8.01	0.50	3.72	0.23	1.75
42 2032	0.00	11.69	11.69	87.29	75.60	1.01	7.55	0.46	3.44	0.21	1.59
43 2033	0.00	11.69	11.69	87.29	75.60	0.95	7.13	0.43	3.19	0.19	1.45
44 2034	0.00	11.69	11.69	87.29	75.60	0.90	6.72	0.40	2.95	0.18	1.32
45 2035	0.00	11.69	11.69	87.29	75.60	0.85	6.34	0.37	2.73	0.16	1.20
46 2036	0.00	11.69	11.69	87.29	75.60	0.80	5.98	0.34	2.53	0.15	1.09
47 2037	0.00	11.69	11.69	87.29	75.60	0.76	5.64	0.31	2.34	0.13	0.99
48 2038	0.00	15.01	15.01	87.29	72.28	0.92	5.32	0.37	2.17	0.15	0.90
49 2039	0.00	11.69	11.69	87.29	75.60	0.67	5.02	0.27	2.01	0.11	0.82
50 2040	0.00	11.69	11.69	87.29	75.60	0.63	4.74	0.25	1.86	0.10	0.74
TOTAL	755.31	654.88	1410.19	3881.31	2471.12	677.04	982.92	576.59	698.78	501.25	517.85

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.45 (6%), 1.21 (8%), 1.03 (10%)
INTERNAL RATE OF RETURN (IRR) = 10.5 %

Table K-4-3 Economic Indicators of the Pilot Area - Proto Type -

(UNIT : MILLION BAHRT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						6 %		8 %		10 %	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 1993	6.62	0.00	6.62	0.00	-6.62	5.56	0.00	5.26	0.00	4.97	0.00
4 1994	74.27	0.00	74.27	0.00	-74.27	58.83	0.00	54.59	0.00	50.73	0.00
5 1995	62.49	0.00	62.49	8.05	-54.44	46.70	6.02	42.53	5.48	38.80	5.00
6 1996	0.00	2.79	2.79	11.81	9.02	1.97	8.33	1.76	7.44	1.57	6.67
7 1997	0.00	2.79	2.79	16.07	13.28	1.86	10.69	1.63	9.38	1.43	8.25
8 1998	0.00	2.79	2.79	17.04	14.25	1.75	10.69	1.51	9.21	1.30	7.95
9 1999	0.00	2.79	2.79	17.43	14.64	1.65	10.32	1.40	8.72	1.18	7.39
10 2000	0.00	2.79	2.79	17.43	14.64	1.56	9.73	1.29	8.07	1.08	6.72
11 2001	0.00	2.79	2.79	17.43	14.64	1.47	9.18	1.20	7.48	0.98	6.11
12 2002	0.00	2.79	2.79	17.43	14.64	1.39	8.66	1.11	6.92	0.89	5.55
13 2003	0.00	2.79	2.79	17.43	14.64	1.31	8.17	1.03	6.41	0.81	5.05
14 2004	0.00	2.79	2.79	17.43	14.64	1.23	7.71	0.95	5.93	0.73	4.59
15 2005	0.00	2.79	2.79	17.43	14.64	1.16	7.27	0.88	5.49	0.67	4.17
16 2006	0.00	2.79	2.79	17.43	14.64	1.10	6.86	0.81	5.09	0.61	3.79
17 2007	0.00	2.79	2.79	17.43	14.64	1.04	6.47	0.75	4.71	0.55	3.45
18 2008	0.00	3.25	3.25	17.43	14.18	1.14	6.11	0.81	4.36	0.58	3.13
19 2009	0.00	2.79	2.79	17.43	14.64	0.92	5.76	0.65	4.04	0.46	2.85
20 2010	0.00	2.79	2.79	17.43	14.64	0.87	5.43	0.60	3.74	0.41	2.59
21 2011	0.00	2.79	2.79	17.43	14.64	0.82	5.13	0.55	3.46	0.38	2.36
22 2012	0.00	2.79	2.79	17.43	14.64	0.77	4.84	0.51	3.21	0.34	2.14
23 2013	0.00	2.79	2.79	17.43	14.64	0.73	4.56	0.48	2.97	0.31	1.95
24 2014	0.00	2.79	2.79	17.43	14.64	0.69	4.30	0.44	2.75	0.28	1.77
25 2015	0.00	2.79	2.79	17.43	14.64	0.65	4.06	0.41	2.55	0.26	1.61
26 2016	0.00	2.79	2.79	17.43	14.64	0.61	3.83	0.38	2.36	0.23	1.46
27 2017	0.00	2.79	2.79	17.43	14.64	0.58	3.61	0.35	2.18	0.21	1.33
28 2018	0.00	3.25	3.25	17.43	14.18	0.64	3.41	0.38	2.02	0.23	1.21
29 2019	0.00	2.79	2.79	17.43	14.64	0.51	3.22	0.30	1.87	0.18	1.10
30 2020	0.00	2.79	2.79	17.43	14.64	0.49	3.03	0.28	1.73	0.16	1.00
31 2021	0.00	2.79	2.79	17.43	14.64	0.46	2.86	0.26	1.60	0.15	0.91
32 2022	0.00	2.79	2.79	17.43	14.64	0.43	2.70	0.24	1.49	0.13	0.83
33 2023	0.00	19.32	19.32	17.43	-1.89	2.82	2.55	1.52	1.38	0.83	0.75
34 2024	0.00	2.79	2.79	17.43	14.64	0.38	2.40	0.20	1.27	0.11	0.68
35 2025	0.00	2.79	2.79	17.43	14.64	0.36	2.27	0.19	1.18	0.10	0.62
36 2026	0.00	2.79	2.79	17.43	14.64	0.34	2.14	0.17	1.09	0.09	0.56
37 2027	0.00	2.79	2.79	17.43	14.64	0.32	2.02	0.16	1.01	0.08	0.51
38 2028	0.00	7.56	7.56	17.43	9.87	0.83	1.90	0.41	0.94	0.20	0.47
39 2029	0.00	2.79	2.79	17.43	14.64	0.29	1.80	0.14	0.87	0.07	0.42
40 2030	0.00	2.79	2.79	17.43	14.64	0.27	1.69	0.13	0.80	0.06	0.39
41 2031	0.00	2.79	2.79	17.43	14.64	0.26	1.60	0.12	0.74	0.06	0.35
42 2032	0.00	2.79	2.79	17.43	14.64	0.24	1.51	0.11	0.69	0.05	0.32
43 2033	0.00	2.79	2.79	17.43	14.64	0.23	1.42	0.10	0.64	0.05	0.29
44 2034	0.00	2.79	2.79	17.43	14.64	0.21	1.34	0.09	0.59	0.04	0.26
45 2035	0.00	2.79	2.79	17.43	14.64	0.20	1.27	0.09	0.55	0.04	0.24
46 2036	0.00	2.79	2.79	17.43	14.64	0.19	1.19	0.08	0.51	0.03	0.22
47 2037	0.00	2.79	2.79	17.43	14.64	0.18	1.13	0.07	0.47	0.03	0.20
48 2038	0.00	3.25	3.25	17.43	14.18	0.20	1.06	0.08	0.43	0.03	0.18
49 2039	0.00	2.79	2.79	17.43	14.64	0.16	1.00	0.06	0.40	0.03	0.16
50 2040	0.00	2.79	2.79	17.43	14.64	0.15	0.95	0.06	0.37	0.02	0.15
TOTAL	143.38	148.23	291.61	785.03	493.42	146.52	202.22	127.11	144.57	112.55	107.69

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.38 (6%), 1.14 (8%), 0.96 (10%)
INTERNAL RATE OF RETURN (IRR) = 9.5 %

Table K-4-4 Economic Indicators of the Pilot Area
- Alternative (Cost Excluded Social Infrastructure) - (UNIT : MILLION BAHRT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						6 %		8 %		10 %	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 1993	5.12	0.00	5.12	0.00	-5.12	4.30	0.00	4.06	0.00	3.85	0.00
4 1994	64.57	0.00	64.57	0.00	-64.57	51.15	0.00	47.46	0.00	44.10	0.00
5 1995	40.36	0.00	40.36	8.05	-32.31	30.16	6.02	27.47	5.48	25.06	5.00
6 1996	0.00	1.55	1.55	11.81	10.26	1.09	8.33	0.98	7.44	0.87	6.67
7 1997	0.00	1.55	1.55	16.07	14.52	1.03	10.69	0.90	9.38	0.80	8.25
8 1998	0.00	1.55	1.55	17.04	15.49	0.97	10.69	0.84	9.21	0.72	7.95
9 1999	0.00	1.55	1.55	17.43	15.88	0.92	10.32	0.78	8.72	0.66	7.39
10 2000	0.00	1.55	1.55	17.43	15.88	0.87	9.73	0.72	8.07	0.60	6.72
11 2001	0.00	1.55	1.55	17.43	15.88	0.82	9.18	0.66	7.48	0.54	6.11
12 2002	0.00	1.55	1.55	17.43	15.88	0.77	8.66	0.62	6.92	0.49	5.55
13 2003	0.00	1.55	1.55	17.43	15.88	0.73	8.17	0.57	6.41	0.45	5.05
14 2004	0.00	1.55	1.55	17.43	15.88	0.69	7.71	0.53	5.93	0.41	4.59
15 2005	0.00	1.55	1.55	17.43	15.88	0.65	7.27	0.49	5.49	0.37	4.17
16 2006	0.00	1.55	1.55	17.43	15.88	0.61	6.86	0.45	5.09	0.34	3.79
17 2007	0.00	1.55	1.55	17.43	15.88	0.58	6.47	0.42	4.71	0.31	3.45
18 2008	0.00	2.01	2.01	17.43	15.42	0.70	6.11	0.50	4.36	0.36	3.13
19 2009	0.00	1.55	1.55	17.43	15.88	0.51	5.76	0.36	4.04	0.25	2.85
20 2010	0.00	1.55	1.55	17.43	15.88	0.48	5.43	0.33	3.74	0.23	2.59
21 2011	0.00	1.55	1.55	17.43	15.88	0.46	5.13	0.31	3.46	0.21	2.36
22 2012	0.00	1.55	1.55	17.43	15.88	0.43	4.84	0.29	3.21	0.19	2.14
23 2013	0.00	1.55	1.55	17.43	15.88	0.41	4.56	0.26	2.97	0.17	1.95
24 2014	0.00	1.55	1.55	17.43	15.88	0.38	4.30	0.24	2.75	0.16	1.77
25 2015	0.00	1.55	1.55	17.43	15.88	0.36	4.06	0.23	2.55	0.14	1.61
26 2016	0.00	1.55	1.55	17.43	15.88	0.34	3.83	0.21	2.36	0.13	1.46
27 2017	0.00	1.55	1.55	17.43	15.88	0.32	3.61	0.19	2.18	0.12	1.33
28 2018	0.00	2.01	2.01	17.43	15.42	0.39	3.41	0.23	2.02	0.14	1.21
29 2019	0.00	1.55	1.55	17.43	15.88	0.29	3.22	0.17	1.87	0.10	1.10
30 2020	0.00	1.55	1.55	17.43	15.88	0.27	3.03	0.15	1.73	0.09	1.00
31 2021	0.00	1.55	1.55	17.43	15.88	0.25	2.86	0.14	1.60	0.08	0.91
32 2022	0.00	1.55	1.55	17.43	15.88	0.24	2.70	0.13	1.49	0.07	0.83
33 2023	0.00	16.68	16.68	17.43	0.75	2.44	2.55	1.32	1.38	0.72	0.75
34 2024	0.00	1.55	1.55	17.43	15.88	0.21	2.40	0.11	1.27	0.06	0.68
35 2025	0.00	1.55	1.55	17.43	15.88	0.20	2.27	0.10	1.18	0.06	0.62
36 2026	0.00	1.55	1.55	17.43	15.88	0.19	2.14	0.10	1.09	0.05	0.56
37 2027	0.00	1.55	1.55	17.43	15.88	0.18	2.02	0.09	1.01	0.05	0.51
38 2028	0.00	6.31	6.31	17.43	11.12	0.69	1.90	0.34	0.94	0.17	0.47
39 2029	0.00	1.55	1.55	17.43	15.88	0.16	1.80	0.08	0.87	0.04	0.42
40 2030	0.00	1.55	1.55	17.43	15.88	0.15	1.69	0.07	0.80	0.03	0.39
41 2031	0.00	1.55	1.55	17.43	15.88	0.14	1.60	0.07	0.74	0.03	0.35
42 2032	0.00	1.55	1.55	17.43	15.88	0.13	1.51	0.06	0.69	0.03	0.32
43 2033	0.00	1.55	1.55	17.43	15.88	0.13	1.42	0.06	0.64	0.03	0.29
44 2034	0.00	1.55	1.55	17.43	15.88	0.12	1.34	0.05	0.59	0.02	0.26
45 2035	0.00	1.55	1.55	17.43	15.88	0.11	1.27	0.05	0.55	0.02	0.24
46 2036	0.00	1.55	1.55	17.43	15.88	0.11	1.19	0.04	0.51	0.02	0.22
47 2037	0.00	1.55	1.55	17.43	15.88	0.10	1.13	0.04	0.47	0.02	0.20
48 2038	0.00	2.01	2.01	17.43	15.42	0.12	1.06	0.05	0.43	0.02	0.18
49 2039	0.00	1.55	1.55	17.43	15.88	0.09	1.00	0.04	0.40	0.01	0.16
50 2040	0.00	1.55	1.55	17.43	15.88	0.08	0.95	0.03	0.37	0.01	0.15
TOTAL	110.05	91.02	201.07	785.03	583.96	106.52	202.22	93.40	144.57	83.40	107.69

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.90 (6%), 1.55 (8%), 1.29 (10%)
INTERNAL RATE OF RETURN (IRR) = 13.3 %

K-5 Farm Budget Analysis

Table K-5-1 Farm Budget With Project

Items	Without Project, Rainfed Paddy Farm	With Project	
		Rainfed Paddy Farm	Irrigated Paddy Farm
1.Holding Area (ha)	3.0	3.0	3.0
2.Harvested Area of Paddy (ha)	1.2	1.8	2.6
3.Paddy Yield (tons/ha)	1.75	1.90	3.00
4.Farm-gate Price of Paddy (฿/ton)	3,460	3,460	3,460
5.Gross Production (฿)	7,272	11,826	26,988
6.Cost of Production (฿)			
- Seeds	264	396	272
- Fertilizer	264	414	2,834
- Pesticides	0	0	130
- Labor	420	648	1,404
- Machinery & Animals	2,988	4,500	9,074
- Others	624	972	2,184*
Total Cost	4,560	6,930	16,198
7.Net Production (฿)	2,712	4,896	10,790

Note : * Others include operation and maintenance cost for water user's group of irrigation.