

FIGURE H - 1

MARKETING FLOW CHART OF COFFEE

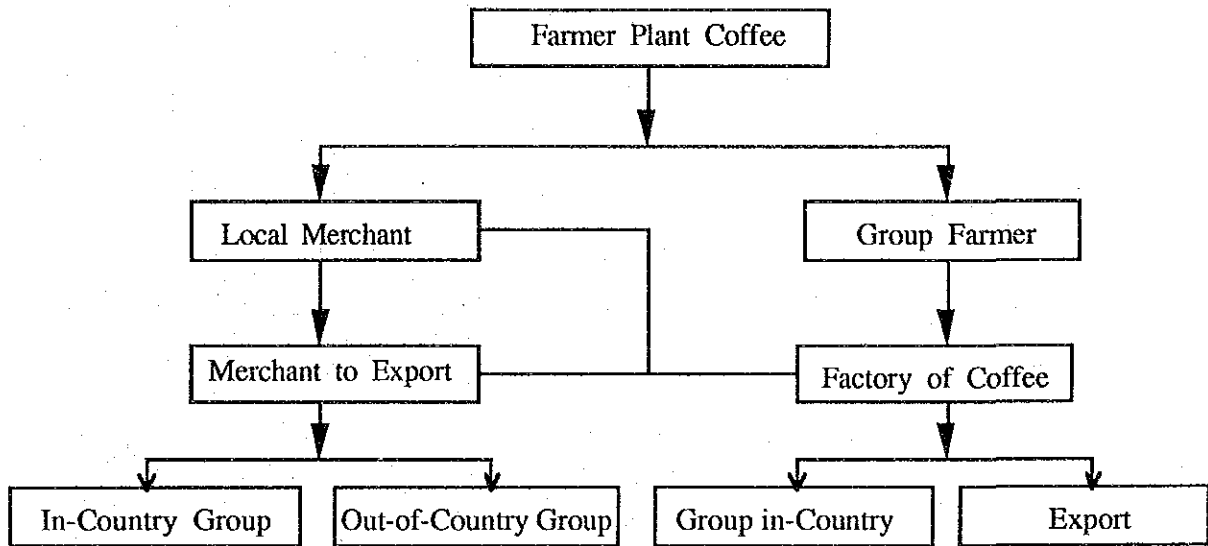


FIGURE H - 2

MARKETING FLOW CHART OF OIL PALM

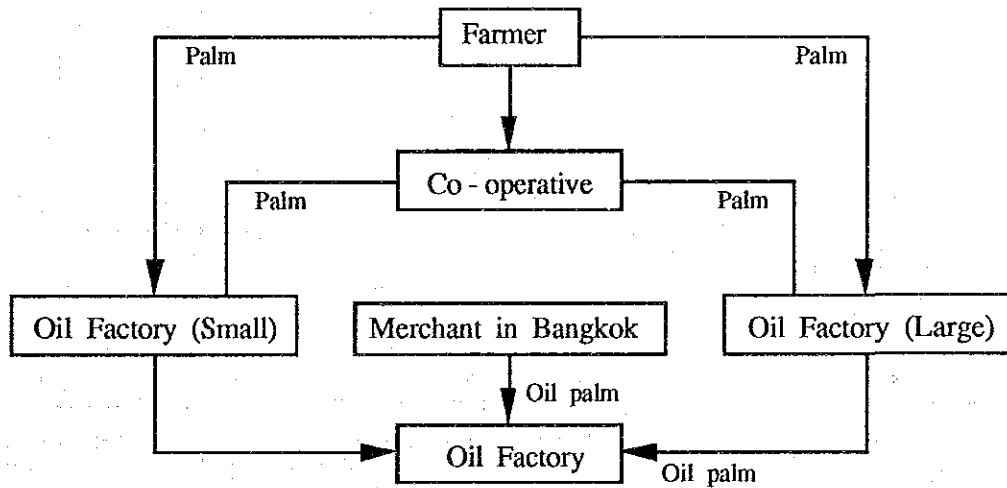


FIGURE H - 3

MARKETING FLOW CHART OF PARA RUBBER

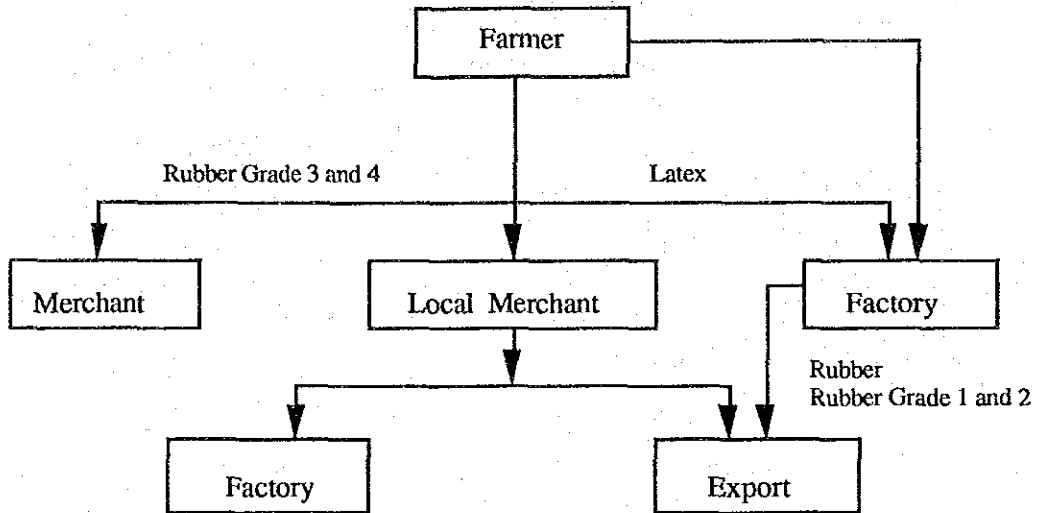
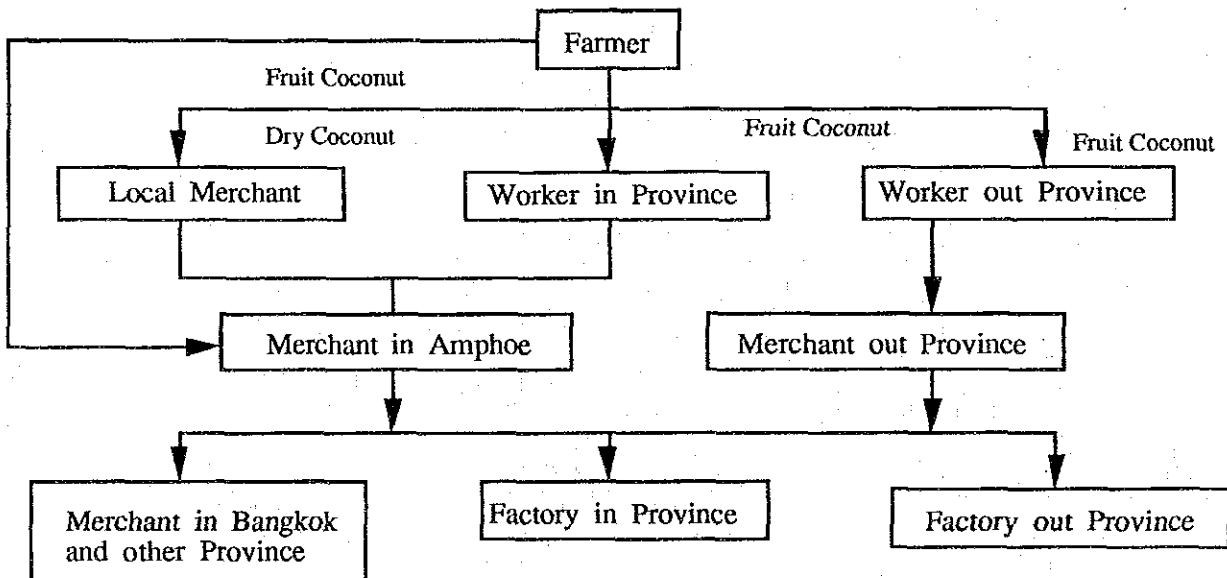


FIGURE H - 4

MARKETING FLOW CHART OF COCONUT



(Source : Commercial Office of Province Chumphon)

(5) Non-Agricultural Production

The non-agricultural production is consisted of mining, industries, construction, electricity, transportation, wholesale and retail, services and government administration. Since the last decade it was found that the value of non-agricultural GDP has gradually increased every year. The average of increasing rate was about 9.00 per annum which was rather high due to the expansion of all kinds of business in this province. The value of the non-agricultural GDP was 2,109.9 million Baht in 1981, then it has increased every year later. In 1985 it was 3,118.4 million of Baht of which the value of wholesale and retail was 1,052.9 million Baht, and the value of services was 459.6 million Baht.

Regarding industries in province Chumphon which are mostly agro-based industries and mainly concentrated in Amphoe Muang.

In Nong Yai area, off-farm activities are mainly concentrated in labor works, especially for Tambon Na Thung which has many inhabitants working in the town for official and private jobs.

(6) Agro-Industry

Almost industries in province Chumphon as well as the Study Area are agro-based industries which most of these industries are found concentrated in Amphoe Muang Chumphon.

The situation of agro-industry in the Study-Area is notified in the following TABLE H - 9.

From these figures, most agro-industrial units are rice mills, coconut/palm oil factories, fish meals, noodle-plants, cold storage and factories of marine products (shrimp, crab and molluses) with limited investments and hired employees.

The development of agro industries related to the main agricultural production, therefore, is considered important for this province.

In Nong Yai area only some small rice-mills and coconut-processing places are considered as agro-industries.

TABLE H - 9 : AGRO-INDUSTRY IN THE STUDY AREA (MUANG, THA SAE, PATHIU)

Industry	Location (Amphoe)	Number	Investment (Million Baht)	Capacity/Year	Employee (Person)
(1) Processing of Shrimps, Crab and Molluses	Muang	2	9.5	945 ton	194
(2) Shrimps, Dried	Muang	2	0.668	32 ton	22
(3) Coconut/Palm Oil	Muang	6	26.940	15,640 ton	78
	Tha Sae	1	6.8	2,343 ton	35
(4) Rice Mill	Muang	55	6.462	41,055 ton	81
	Tha Sae	16	1.864	15,560 ton	27
	Pathiu	19	1.785	9,300 ton	36
(5) Bean Mill	Pathiu	1	0.095	9 ton	1
(6) Dried Ginger, Ginger Preserves	Tha Sae	1	2.3	1,500 ton	8
(7) Noodle	Muang	4	1.7	225 ton	11
(8) Coconut Fiber	Tha Sae	1	1.2	90 ton	23
(9) Instant Coffee	Muang	1	0.26	5 ton	3
(10) Fish Square	Muang	1	2.1	50 million litre	20
	Pathiu	1	0.4	0.04 million litre	1
(11) Fish Meal	Muang	5	14.251	11,700 ton	130
(12) Cold Storage	Muang	5	45.4	61,642 ton	240

(Source: Office of Provincial Industry, Chumphon, 1990)

(7) Other Industries

Industry in Chumphon has fairly expanded. Various types of industries were established scatterly in every Amphoe. Major industries in this province are cold storages, ice cream plants, sawing mills, shrimp, crab and fish cans, coconut oils and rice mills. In 1985, there were 404 factories however, all of them are in small scale.

In Nong Yai area, there are only some small rice-mills and coconut processing places. Main industries in province Chumphon are shown in TABLE H - 10.

TABLE H - 10.: INDUSTRIES IN CHUMPHON PROVINCE (UP TO 1985)

Type	Factories
1. Uncoating crop grain	8
2. Rock grinding	5
3. Beef ball	3
4. Ice cream	1
5. Shrimp, crab, fish can	2
6. Dry shrimp	3
7. Oil (coconut, palm)	13
8. Rice mill	198
9. Bread cake	6
10. Noodle	7
11. Instant coffee	1
12. Fish sauce	1
13. Ice	16
14. Fish powder	10
15. Whisky	1
16. Silk tread	1
17. Fiber	2
18. Sawing	8
19. Wood processing	3
20. Wooden door and window	6
21. Wooden chip (for sugar fermentation)	4
22. Wooden box	4
23. furniture	7
24. Printing	2
25. Tire repairing	7
26. Rubber sheet smoked	4
27. Plastic bar	1
28. White lime	1
29. Brick	4
30. Iron door and window	1
31. Mortar and repairing	46
32. Boat building and repairing	6
33. Car roof making	2
34. Motorcycle repairing	3
35. Frozen warehouse	5
36. Car repairing	10
37. Drinking water	1
38. Cooking gas	1
39. Car part repairing	1

(Source: Chumphon Land Use Plan, DLD, 1986)

H-2 PROJECT EVALUATION

H-2-1 Basic Premises

The Chumphon basin formed by 4 watersheds, namely Thasae, Rap Ro, Tha Taphao and Chumphon, covers a total area of 2,625 sq.km is composed largely of 2 Amphoe, Muang Chumphon and Thasae, but partly of 2 other Amphoe, Pathiu and Bansaphan Noi in which only the latter is belonged to province Prachuap Khiri Khan of the Central Region.

In term of river-system, 3 watersheds of Thasae, Rap Ro and Tha Taphao would be considered in one system due to the conjunction of rivers Thasae and Rap Ro as 2 upstreams joining the Tha Taphao river as a downstream. Meanwhile, Chumphon river is an independent river-system.

In fact, both river-systems are subjected to flow down into Amphoe Muang Chumphon, the main administrative unit and the most densely part of the province, causing a flooding area in this Amphoe during some period(s) in the rainy season and occasionally during heavy storms/and typhoons over this basin.

The project which is entitled as "The Feasibility Study on the Integrated Agriculture and Water Resources Development Project of the Menam Chumphon Basin" is basically aimed at flood control and integrated agricultural development in this Chumphon basin.

For the purpose of flood control in the Study Area, the serious flooding area is particularly limited in the lowland portion of Amphoe Muang, especially on the upper part of the flooding area made up by the river-system of Thasae, Rap Ro and Tha Taphao. The lower part of this flooding area made up by the Chumphon river-system is considered of lesser affect by floods due to the lower run-offs of Chumphon river and the medium lowland type in this part.

This total flooding area is estimated at more than 30,000 ha covering almost paddy fields in this Amphoe, which is also the main place for rice production in the Study Area.

Other parts of Amphoe Muang and other Amphoe in the Study Area, however, are not subjected to floods except some portions of low valleys and nearby riversides in Amphoe Thasae.

Another occasional factor of floods is typhoons and cyclonic storms which have been occurred from times to times causing flooding in whole area of Chumphon Basin. Province Chumphon, therefore, has experienced so many disasters of this natural catastrophe such as in 1970, 1980 and 1989 (Gay) which the latter had destroyed all economic crops, especially fruit trees and tree crops, innumerable social infrastructures and many human lives as afore mentioned in concerned chapters.. Such catastrophes are subjected to ravage this area again in the years to come.

These annual and occasional floods, therefore, have constantly caused damages to the agricultural production and social economic activities in this area, causing an instability in living and production conditions.

Regarding the aspect of water resources development for agricultural development on the other hand, there is an insufficiency in application of irrigation in the Study Area, especially for paddy fields and fruit crops in Amphoe Muang Chumphon as well as Amphoe Thasae which agricultural system is mainly based on large plantations of oil palm, para-rubber and coffee ; meanwhile paddy fields and other cash crops are grown only on limited areas.

The priority project area of Nong Yai located in the northeast of Amphoe Muang Chumphon is partly covered in this lowland basin of Tha Tapao river embracing an agricultural land of 1840 ha and more than 1,200 farming households. This area is subjected to flood damages, preventing its agricultural production development. Despite of its adjacency to the provincial headquarters, Nong Yai area has performed a typical agriculture of the South with a high density of farming households. Besides the area is subjected to annual floods, causing damages to its agricultural production and the daily life of local inhabitants.

As a matter of fact, the priority project is aimed at the ultimate purpose of flood control and integrated agriculture for making better living conditions for local people in Nong Yai area with proper applications. Besides, corresponding aspects on environment will be evaluated accordingly.

H-2-2 Project Components

Project components of Nong Yai area are considered in 4 parts as follows.

(1) Water Resources Development

- Construction of water reservoirs
- Construction of installations for irrigation and domestic water supply
- Rehabilitation of swamp for irrigation and fisheries
- Construction of floodways
- Improvement of river and canal

(2) Agricultural Development

- Increase in yields and crop intensities
- Irrigated agriculture
- Improvement of rainfed agriculture
- Livestock development
- Inland fisheries development
- Agricultural extension services

(3) Irrigation Development

- Construction of irrigation and drainage systems

- Development of on-farm facilities
- Water management

(4) Rural Road Development

H-2-3 Evaluation Methodology

In order to proceed the project-evaluation, the economic evaluation, the farm budget analysis as the financial evaluation and the environmental evaluation are firstly applied for concluding an overall justification of the project by combining all these evaluation-results at the final stage.

(1) Economic Evaluation

The Economic evaluation judges the project viability in terms of direct contribution to the national economy. In general, there are 3 methods for judging the project's viability for development: benefit-cost ratio (B/C ratio), net present value(NPV) and economic internal rate to return(EIRR). In this economic evaluation, the EIRR is mainly applied, but other methods are considered also.

The benefits to be used in the economic evaluation are those of flood control and integrated agriculture development. Benefits for integrated agriculture development are limited in the Nong Yai area; meanwhile the benefit of flood control covers the whole basin of Chumphon including the municipality. Besides, benefits for integrated agriculture development will be calculated from crops and livestock. The benefit from inland fisheries is too small for taking into account.

Besides, the sensitivity-analysis applied for this project to evaluate the possible risks is carried out on the basis of 3 assumptions;

1. Reduction of project-benefits.....at 10 %
2. Increase of project-costsat 10 %
3. Delay of project-benefits..... for 2 years

(2) Farm Budget Analysis

In this project, the income-generation for farmers is a main objective. Therefore, the farm budget analysis, is carried out on the basis of typical farm models in Nong Yai area for the analysis of revenues and expenditures of these typical farms.

(3) Evaluation on Environmental Impacts

The evaluation on environmental impacts is based on predicted changes on natural, living and production conditions due to project-implementation for judging the effects caused by these changes.

Environmental materials submitted by RID are notified for reference.

(4) Overall Evaluation

The overall evaluation of the project is carried out on the basis of combining corresponding results of economic evaluation, farm budget analysis and evaluation on environmental impacts for a final justification of the Project.

H-2-4 Economic Evaluation

The project period set for economic evaluation is 30 years starting from the year of 1992 until 2021. The project construction period is 5 years, 1992~1996.

From the annual disbursement of project costs and benefits, firstly the Economic Internal Rate of Return (EIRR) in these basic premises is obtained at 17.12 %. This basically proves that the Project is economically feasible.

For the sensitivity analysis, the EIRRs in three cases are as follows:

(1) Reduction of Project-Benefit at 10 percent EIRR : 15.53 %

(2) Increase of Project-Cost at 10 percent EIRR : 15.68 %

(3) Delay of Project Benefit for two years EIRR : 13.31 %

In the sensitivity analysis of these 3 cases, the EIRRs show a declination in which the lowest (13.31 %) is for the risk case (3) of Delay of Project-Benefit for two years.

In these 3 cases of risks, however, the Project proves that the feasibility of the Project is basically sustainable for its implementation.

The economic indicators of the Project are as follows;

Economic Indicators of Project

Alternative	Present Value (: 10 % of discount rate)		Net Present Value	Benefit Cost Ratio	Economic Internal rate of Return (EIRR)
	Benefit	Cost			
1. Basis Case	1890 mB	1118 mB	772 mB	1.60	17.12 %
2. 10 % Reduction in benefit	1701	1118	583	1.52	15.53
3. 10 % Increase in project cost	1890	12430	660	1.54	15.68
4. Two-year delay in benefit	1527	1118	409	1.37	13.31
5. Combination of 2 and 3	1701	1230	471	1.38	14.17
6. Combination of 2 and 4	1374	1118	256	1.23	12.15
7. Combination of 3 and 4	1527	1230	297	1.24	12.26
8. Combination of 2, 3 and 4	1374	1250	144	1.12	11.14
9. For Agricultural Development	192	202	-10	0.95	9.46
10. For Flood Control	1698	916	782	1.85	18.69

(Note : Discount rate of 10%)

The EIRR (9.46 %) for agricultural development, is relatively low. However, agriculture is the main industry in Thailand in spite of its low productivity. The implementation of the Project will pay the effectively utilization of available natural and human resources, and

an important role in correcting the differentials in production and living standards among regions of the country.

H-2-5 Farm Budget Analysis

(1) Present Situation or Without Project

Results from the farm-survey and collected agricultural data imply that Nong Yai area of the Study Area belongs to the category of family farming. This is the case of most development countries in Asia.

Specific characteristics of this category of family - farming are in this case along with the small farm size of average 9 rai in the farm-survey at Nong Yai area, the agricultural production is mainly based on 2 family labor-forces, applying common farming practices with limited capital for production-investment of approximately 15,000 Baht per annum, and marketing of the produces within short distances from farms and only in case of needs to sell.

As a result of these basic production-conditions and a low market pricing of agricultural products at now, the farm income is considered inferior which generally can not cover the whole family-expenditure consisting of farming expenses and household expenses. Especially, in the surveyed area at Nong Yai area, the average of household expenses per farm is about 4 times of the farming expenditure and about 3 times of the on-farm income. A summary of the related values for Nong Yai area is notified as follows;

Farm Survey Results :

Annual on farm income	:	16,192 Baht
Annual off-farm income	:	67,367 "
Annual total income	:	83,559 Baht
<hr/>		
Annual farming expenses	:	12,067 Baht
Annual household expenses	:	42,675 "
Annual total expenses	:	54,741 Baht

From the above, the net profit from farming is low, approximately 4,000 Baht at average. This cannot cover the whole household expenditure of approximately 43,000 Baht at now.

Off-farm activities of mainly labor works in town (s), therefore, are now made up the principal income source for solving the high household expenditure in the rural areas; especially for the Nong Yai area due to its adjacency to the town of Chumphon.

In Thailand, with the regional development and economic growth, the household expenditure has been gradually increasing; meanwhile the margin from net farm profit has been considered stagnant due to aforementioned conditions and recently higher prices of agricultural inputs, making the agricultural sector and people living upon agriculture inferior to other sectors in the whole frame of national economy.

Off-farm incomes, therefore, are now considered as an indispensable application in this kind of agricultural system for balancing the farm-budget of most farming households.

On another hand, supposing off-farm incomes are not sufficiently available or people would be mainly employed in the agricultural sector only, a proper model of agriculture, therefore, is subjected to be elaborated in order to increase sufficiently the on-farm income for covering the whole farm-budget in this case, which is considered very important for many developing countries with agricultural base at the present time.

Upon the farm survey, there are 2 kinds of typical farms in Nong Yai area which are Paddy-Growing Farms and Mixed Orchard-Growing Farms, considered as 2 types of Farm Models : Model 1 (Paddy Farm) and Model 2 (Mixed Orchard Farm). The ratio of farming households for these two Farm Models surveyed in Nong Yai area is almost 1 : 1.

In Model 1, the main crop is paddy (approx. 50 %); meanwhile other minor crops (approx. 50 %) are mixed orchards with mainly coconut (approx. 75 %) and other mixed orchards (approx. 25%). This type of farm is largely found in Tambon Bang Luk which is relatively far from the town with available soil and water for paddy cultivation.

In Model 2, the main crops are mixed orchards (approx. 100 %) consisting of mainly coconut and other fruit trees with vegetables. The proportion of these crops is considered similar to the above. This type of farm is largely found in Tambon Na Thung adjacent to the town of Chumphon.

The kinds of fruit trees and vegetables are found very similar in both Models despite of a variable in percentages of these crops such as Mangosteen, Durian, etc. obtained from the recent data of agriculture in Nong Yai area;

In the budget calculation for these Model Farms the following calculation will be applied for these crops.

1. Mangosteen	30 %
2. Durian	30 %
3. Others	40 %
Total	100 %

(Pineapple will be substitutively used as others in the calculation)

Besides, the farm survey revealed that only approximately 80 % of the planted areas can be harvested. This means that 20 % of farm land are idle land in both Models, offering no farm incomes at now.

The crops benefits from these 2 Model Farms, therefore, are calculated as approx. 6,800 Baht (Model 1) and 11,600 Baht (Model 2), respectively.

Regarding livestock benefit, the present situation implies a small scale of livestock raising in both Models which the average animal-heads are collected by the farm survey are as follows;

1. Cattle : Approx. 1.3 Heads per Farm
2. Swine : Approx. 2 Heads per Farm
3. Poultry, Duck etc. : Approx. 5 Units per Farm

For calculation, the numbers of 1.5 cattle-heads (covering poultry, duck etc.) and 2 swine-heads are used for simplifying calculation-purpose. The net livestock benefit is approximately, 2,300 Baht for both Model Farms.

CROP BENEFIT (Without Project) :

Model 1 (Without Project)

	Harvested Area (Rai)	Unit Revenue (B/Rai)	Revenue (B)	Unit Cost (B/Rai)	Cost	NPV
1. Paddy	3.60	960	3,456	990	3,564	-108
2. Coconut	2.70	1,247	3,367	820	2,214	1,153
3. Mixed Orchards (0.90)						
(1) Mangosteen	0.30	2,874	863	3,100	930	-67
(2) Durian	0.27	12,488	3,372	3,500	945	2,427
(3) Others	0.33	11,500	3,795	1,210	400	3,395
Total	7.20		14,853		7,983	6,800
						↓ 6,800

Model 2 (Without Project)

	Harvested Area (Rai)	Unit Revenue (B/Rai)	Revenue (B)	Unit Cost (B/Rai)	Cost	NPV
1. Coconut	5.80	1,247	7,233	820	4,756	2,477
2. Orchards	(1.40)					
(1) Mangosteen	0.45	7,600	1,520	3,000	600	920
(2) Durian	0.45	11,740	2,935	3,100	775	2,160
(3) Others	0.50	35,323	6,005	3,500	595	5,410
Total	7.20		19,896		8,331	11,565
						↓ 11,600

LIVESTOCK BENEFITS (Without Project) :

Both Model 1 and 2 ; (Without Project)

Cattle-Heads : 1.3

Swine-Heads : 2

(Poultry : 5)

* Annual Average Revenue : 4,000 B

* Annual Average Cost : 1,700

* Annual Average Net Benefit : 2,300 B

(* Data from Farm Survey)

FARM-NET INCOME (With Project) :

	Model 1	Model 2
CROP BENEFIT	6,800 B	11,600 B
LIVESTOCK BENEFIT	2,300	2,300
FARM NET INCOME	9,100	13,900 B

The average household expenditure survey in Nong Yai area for these both Model Farms is approximately 42,500 B per annum. This means a deficit in the budget of farming households being occurred presently to be calculated as follows.

	Model 1	Model 2
NET FARM INCOME	9,100 B	13,500 B
HOUSEHOLD EXPENDITURE	43,000	43,000
ANNUAL DEPICIT	-33,900	-29,100 B

In order to solve these annual benefit deficits in both Model Farms, average 30,000 Baht per annum, farmers should be engaged in off-farm activities at now. In Nong Yai area, labor-works in town(s) are presently their main off-farm activities which are however very fluctuated every year.

This situation is presently occurred in almost rural areas in Thailand where off-farm activities are related to labor-works in other places, nearby or far from their own farms, which however cannot always provide a stable source of incomes for solving the remarkable deficits by household expenditure.

The issue of sufficiently or largely increasing farm-incomes, therefore, is a vital and indispensable solution to this important matter.

(2) Proposed Plan or "With Project"

The basic objective of the proposed plan, therefore, is to maximize the on-farm incomes for covering the whole expenditure of farming and household expenses so that off-farm activities in towns could be neglected or reduced with the projected-implementation.

Basically the two types of Farm-Model in Nong Yai area will be remained but following changes will be applied as guidelines;

1. The harvested area will be 100 percent of the planted area supposed to be 9 rai for both Models 1 and 2.
2. The area for paddy-cultivation in Model 1 will be the same, half of the agricultural land, but 5 percent of the area will be used for paddy cultivation in dry-season.

3. The area for mixed orchards in Model 2 will be the whole area of 9 rai for the agricultural land of farm.
4. For the proportion of coconut versus other fruit trees and vegetables in the area for mixed orchards in both Models, 60 percent of the area will be used for coconut and its 40 percent will be planted with fruit trees and vegetables, changed from the ratio of 80:20 at now.
5. For the area for coconut in both proposed Models, 70 percent will be remained by local varieties but 30 percent will be changed for the variety of Young Coconut (Palmyra Palm) for higher income purpose, changed from 100 percent of the local variety at now.
6. For the proportion of fruit trees and vegetables in both Models, the proposed percentage is as follows;

Pomelo	30%
Mangosteen	30%
Durian	30%
Cashew Nut	7%
<u>Vegetagble</u>	<u>3%</u>
Total	100%

7. The above distribution of crops is based on the proposed plan of crops.
8. The average livestocks proposed per farm are 2 cattle-heads and 4 swine-heads for both Models.

The crop benefits of both Models 1 and 2, therefore are estimated at 30,500 Baht and 53,500 Baht, respectively.

The calculation is summarized as follows :

CROP BENEFITS (With Project) :

Model 1 (With Project)

	Harvested Area (Rai)	Unit Revenue (B/Rai)	Revenue (B)	Unit Cost (B/Rai)	Cost (B)	NPV
1. Paddy (Wet S.)	4.5	1,845	8,302	1,140	5,130	3,172
2. Paddy (Dry S.)	0.4	2,398.5	960	1,390	556	404
3. Mixed Orchards (4.5)						
(1) Coconut	1.9	2,580	4,902	1,035	1,967	2,935
(2) Young coconut	0.8	7,770	6,216	1,225	980	5,236
(3) Durian	0.5	21,408	10,704	4,320	2,160	8,544
(4) Pomelo	0.5	14,250	7,125	3,820	1,910	5,215
(5) Mangosteen	0.5	7,799.5	3,900	3,900	1,950	1,950
(6) Cashew Nut	0.2	9,100	1,820	1,910	382	1,438
(7) Vegetable	0.1	14,950	1,495	1,430	143	1,352
Total			45,425		15,178	30,246
						↓ 30,500

Model 2 (With Project)

	Harvested Area (Rai)	Unit Revenue (B/Rai)	Revenue (B)	Unit Cost (B/Rai)	Cost (B)	NPV
1. Coconut	3.8	2,580	9,804	1,035	3,933	5,871
2. Young coconut	1.6	7,770	12,440	1,250	2,000	10,440
3. Durian	1.0	21,408	21,408	4,320	4,320	17,088
4. Pomelo	1.0	14,250	14,250	3,820	3,820	10,430
5. Mangosteen	1.0	7,799.5	7,800	3,900	3,900	3,900
6. Cashew Nut	0.4	9,100	3,640	1,910	764	2,876
7. Vegetable	0.2	14,950	2,990	1,430	286	2,704
Total	9.0		72,322		19,323	53,309
						↓ 53,500

For livestock-benefits, the proposed animals per farm are estimated at averaged of 2 cattle-heads and 4 swine-heads. This is based on farmers' intention to increase livestock raising but to be centralized on raising swine and on small scale at household-basis.

Moreover, except for some farms with larger size sufficiently producing feeds, the average farm in Nong Yai area can raise 2 cattle-heads in average. The net livestock-benefit for both Models 1 and 2, therefore, is approximately 9,000 Baht per annum, summarized as follows.

LIVESTOCK BENEFIT (With Project) :

Both Models 1 and 2 ; (With Project)

Cattle-Heads	:	2
Swine-Heads	:	4
** Annual Average Revenue	:	16,000 B
** Annual Average Cost	:	7,000
** Annual Average Net Benefit	:	<u>9,000 B</u>

(** Data from MOAC)

<u>Cattle</u>	:	Cost Per Head	:	2,600 B/year
		Revenue Per Head	:	6,100
		Net Benefit Per Head	:	3,500
<u>Swine</u>	:	Cost Per Head	:	450
		Revenue Per Head	:	950
		Net Benefit Per Head	:	400

The net farm benefits in both Model 1 and 2, therefore, would be estimated at approximately 39,500 Baht and 62,500 Baht, respectively, which calculation is as follows.

FARM-NET INCOME (With Project) :

	Model 1	Model 2
NET CROP BENEFITS	30,500 B	53,500 B
NET LIVESTOCK BENEFITS	9,000 B	9,000 B
TOTAL	39,500 B	62,500 B

(3) Solvency of Farm Budgets:

The solvency of farm budgets, therefore, will be made by a conventional calculation, instead of a complicated methodology.

In case of "with project" the net farm benefits are estimated at 39,500 Baht for Model 1 and 62,500 Baht for Model 2, making a significant increase in net farm benefits as follows.

NET FARM BENEFIT	Model 1	Model 2
Without Project	9,100 B	13,900 B
With Project	39,500 B	62,500 B
Increase	30,400 B	48,600 B

On another hand, the net farm benefits of "With Project" as mentioned above would cope with the present household expenditure of approximately 43,000 Baht: a full cover in Model 2, but a remaining insufficient cover in Model 1.

In order to solve the slightly insufficient remain in Model 1, there are 2 possible solutions which would be a slight application of off-farm works or increasing livestock-raising.

The increase of animal heads in livestock raising is recommended for large-sized farms, especially in Tambon Bang Luk where most farms are in Model 1. The number of swine-heads would be increased twice of three times from the number of 4 swine-heads for this case.

For the solution of a slight application of off-farm works, an annual off-farm income of 19,500 Baht, or one-half of the present average off-farm income (38,900 Baht), is recommended accordingly.

With this slight application of off-farm works, the solvency in farm budgets can be estimated as follows;

Farm-Budget Items	(Unit : Baht)	
	Model 1	Model 2
Net Farm Incomes	39,500 B	62,500 B
Off-Farm Incomes	19,500 B	19,500 B
Total Incomes	59,000 B	82,000 B
Household Expenditure	43,000 B	43,000 B
Income-Surplus	16,000 B	39,000 B

The situation, therefore, proves that both Model Farms can earn a disposal income, approx. 16,000 Baht for Model 1 and approx. 39,000 Baht for Model 2, offering farmers successive investment-opportunities and loan -payments, considered indispensable for this case of high investments for agricultural production in this project.

A summarized description of farm budgets for both representative farms of Model 1 and 2 is shown as follows.

**Cost Estimates in Farm Budgeting for Representative Farms (Models 1 & 2)
"Without Project" and "With Project"**

Items	Without Project		With Project	
	Model 1	Model 2	Model 1	Model 2
*Farm holding Area (rai)	9.0	9.0	9.0	9.0
*Harvested Area	7.2(80 %)	7.2(80 %)	9.4(105 %)	9.4(105 %)
(1) Crop Benefit (B/Farm)	14,850	19,800	45,500	72,500
(2) Livestock Benefit (B/Farm)	4,000	4,000	9,000	9,000
Total Farm Reviews (B/farm)	18,850	23,800	54,500	81,500
(3) Fixed Costs				
1. Land Caring Cost	2,000	2,000	2,000	2,000
2. Farming Tools	1,000	1,000	3,000	3,000
3. Livestock Barn	500	500	1,500	1,500
4. Purchased Animals	1,000	1,000	2,500	2,500
5. Loan Interest	1,200	1,200	3,600	4,800
	(12 % for 10,000 B)	(12 % for 10,000 B)	(12 % for 30,000 B)	(12 % for 40,000 B)
(4) Variable Cost				
1. Seeds, Fertilizers, Chemicals, Machinery and Labor	8,000	8,400	16,000	19,500
2. Livestock Feeds etc.	500	500	4,000	4,000
3. Marketing Costs	0	0	3,000	5,000
Annual Total Investments (B/Farm)	14,200	14,600	35,600	42,300
Net Farm Revenue (B / Farm)	4,650	9,200	18,900	39,200

Results from the above are summarized as follows;

1. The above estimation which is based on fixed costs and variable costs, therefore, shows corresponding net farm revenues of Models 1 and 2 lower than their net farm benefits calculated without some items of fixed costs and variable costs as mentioned previously.
2. The situation of annual investment is as follows;

Description	Without Project		With Project	
	Model 1	Model 2	Model 1	Model 2
Annual Investment	14,500	14,500	35,000	42,500

3. For the implementation of "With Project", BAAC credits therefore, are recommended to be provided to farmers on the following basis:
 - Model 1 : max. 30,000 Baht per annum (9 rai)
 - Model 2 : max. 40,000 Baht per annum (9 rai)
 The scheme for this credit-application is considered for 8 years, 1996-2003, where farmers can obtain full benefit from this project.
4. The credit-amount offered to each farm could be changed with the applied farm-size and development-items, but considered higher than the normal BAAC credit of average 2,000 Baht per rai applied at now.
5. Supposing almost 1,200 farming households in Nong Yai area to be engaged in this project, a credit volume of approximately 50 million Baht is subjected to this credit-scheme at first.

Evaluation of Economic Crop in Chumphon Basin Project

(Unit : B/Rai)

	Without Project		With Project	
	Financial	Economic	Financial	Economic
1. Paddy (Wet Season)				
(1) Revenue Per Rai	960	1,034	1,845	1,987.50
(2) Cost Per Rai	990	919.5	1,140	1057.5
(3) Net Benefit Per Rai	-30	114.5	705	930
2. Paddy (Dry Season)				
(1) Revenue Per Rai	1,144	1,232.5	2,398.5	2,584
(2) Cost Per Rai	1,290	1,195.50	1,390	1,287.5
(3) Net Benefit Per Rai	-146	37	1,008.5	1,296.5
3. Coconut				
(1) Revenue Per Rai	1,247	1,334	2,580	2,760
(2) Cost Per Rai	820	800	1,035	1,000
(3) Net Benefit Per Rai	427	534	1,545	1,760
4. Young Coconut				
(1) Revenue Per Rai	2,146	2,320	7,770	8,400
(2) Cost Per Rai	1,010	1,000	1,225	1,200
(3) Net Benefit Per Rai	1,136	1,320	6,545	7,200
5. Durian				
(1) Revenue Per Rai	12,488	12,796	21,408	21,936
(2) Cost Per Rai	3,500	3,328	4,320	4,082.5
(3) Net Benefit Per Rai	8,988	9,468	17,088	17,853.5
6. Mangosteen				
(1) Revenue Per Rai	2,873.5	2,971.5	7,799.5	8,065.5
(2) Cost Per Rai	3,100	2,960	3,900	3,622.5
(3) Net Benefit Per Rai	-226.5	11.5	3,899.5	4,443
7. Pomelo				
(1) Revenue Per Rai	7,600	8,000	14,250	15,000
(2) Cost Per Rai	3,000	2,868	3,820	3,622
(3) Net Benefit Per Rai	4,600	5,132	10,430	11,378
8. Cashew Nut				
(1) Revenue Per Rai	5,850	6,300	9,100	9,800
(2) Cost Per Rai	1,580	1,530	1,910	1,830
(3) Net Benefit Per Rai	4,270	4,770	7,190	7,970
9. Chilli				
(1) Revenue Per Rai	4,440	4,800	6,512	7,040
(2) Cost Per Rai	1,880	1,746	2,590	2,344
(3) Net Benefit Per Rai	2,560	3,054	3,922	4,696
10. Pine Apple				
(1) Revenue Per Rai	11,500	12,500	14,950	16,250
(2) Cost Per Rai	1,210	1,140	1,430	1,340
(3) Net Benefit Per Rai	10,290	11,360	13,520	14,910

Crop Budget Analysis
1. Crop : Paddy (Wet Season)

	Without Project		With Project	
	Financial	Economic	Financial	Economic
1. Yield (kg/rai)	260	260	500	500
2. Farm Gate Price	3.69	3.975	3.69	3.975
3. Gross Production Value (B / rai)	960	1,034	1,845	1,987.50
4. Cost of Production				
(1) Seeds	40	45.5	40	45.5
(2) Fertilizers	200	184	250	230
(3) Chemicals	100	92	150	138
(4) Machinery	350	322	400	368
(5) Labour	300	276	300	276
Total Cost	990	919.5	1,140	1057.5
5. Net Benefit (B / rai)	-30	114.5	705	930

Crop Budget Analysis
2. Crop : Paddy (Dry Season)

	Without Project		With Project	
	Financial	Economic	Financial	Economic
1. Yield (kg/rai)	310	310	650	650
2. Farm Gate Price	3.69	3.975	3.69	3.975
3. Gross Production Value (B / rai)	1,144	1,232.5	2,398.5	2,584
4. Cost of Production				
(1) Seeds	40	45.5	40	45.5
(2) Fertilizers	250	230	300	276
(3) Chemicals	200	184	250	230
(4) Machinery	450	414	450	414
(5) Labour	350	322	350	322
Total Cost	1,290	1,195.50	1,390	1,287.5
5. Net Benefit (B / rai)	- 146	37	1,008.5	1,296.5

Crop Budget Analysis

3. Crop : Coconut

	Without Project		With Project (Non-irrigated)	
	Financial	Economic	Financial	Economic
1. Yield (fruit/rai)	580	580	1,200	1,200
2. Farm Gate Price (B / fruit)	2.15	2.3	2.15	2.3
3. Gross Production Value (B / rai)	1,247	1,334	2,580	2,760
4. Cost of Production				
(1) Seeds	200	220	200	220
(2) Fertilizers	150	140	250	230
(3) Chemicals	105	100	150	140
(4) Machinery	150	140	160	150
(5) Labour	215	200	275	260
Total Cost	820	800	1,035	1,000
5. Net Benefit (B / rai)	427	534	1,545	1,760

Crop Budget Analysis

4. Crop : Young Coconut

	Without Project		With Project (Irrigated)	
	Financial	Economic	Financial	Economic
1. Yield (fruit/rai)	580	580	2,100	2,100
2. Farm Gate Price (B / fruit)	3.7	4.0	3.7	4.0
3. Gross Production Value (B / rai)	2,146	2,320	7,770	8,400
4. Cost of Production				
(1) Seeds	390	420	390	420
(2) Fertilizers	150	140	300	280
(3) Chemicals	105	100	100	95
(4) Machinery	150	140	150	140
(5) Labour	215	200	285	265
Total Cost	1,010	1,000	1,225	1,200
5. Net Benefit (B / rai)	1,136	1,320	6,545	7,200

Crop Budget Analysis

5. Crop : DURIAN

	Without Project		With Project	
	Financial	Economic	Financial	Economic
1. Yield (kg/rai)	700	700	1,200	1,200
2. Farm Gate Price	17.84	18.28	17.84	18.28
3. Gross Production Value (B / rai)	12,488	12,796	21,408	21,936
4. Cost of Production				
(1) Seeds	500	568	500	568
(2) Fertilizers	250	230	420	386.5
(3) Chemicals	250	230	400	368
(4) Machinery	1,000	920	1,000	920
(5) Labour etc.	1,500	1,380	2,000	1,840
Total Cost	3,500	3,328	4,320	4,082.5
5. Net Benefit (B / rai)	8,988	9,468	17,088	17,853.5

Crop Budget Analysis

6. Crop : MANGOSTEEN

	Without Project		With Project	
	Financial	Economic	Financial	Economic
1. Yield (kg/rai)	350	350	950	950
2. Farm Gate Price	8.21	8.49	8.21	8.49
3. Gross Production Value (B / rai)	2,873.5	2,971.5	7,799.5	8,065.5
4. Cost of Production				
(1) Seeds	500	568	500	568
(2) Fertilizers	300	276	450	414
(3) Chemicals	300	276	450	414
(4) Machinery	1,000	920	1,000	920
(5) Labour etc.	1,000	920	1,420	1,306.5
Total Cost	3,100	2,960	3,820	3,622.5
5. Net Benefit (B / rai)	-226.5	11.5	3,979.5	4,443

Crop Budget Analysis

7. Crop : Pomelo

	Without Project		With Project	
	Financial	Economic	Financial	Economic
1. Yield (fruit/rai)	800	800	1,500	1,500
2. Farm Gate Price (B / fruit)	9.5	10	9.5	10
3. Gross Production Value (B / rai)	7,600	8,000	14,250	15,000
4. Cost of Production				
(1) Seeds	500	566	550	610
(2) Fertilizers	300	276	350	322
(3) Chemicals	300	276	400	370
(4) Machinery	900	830	1,000	920
(5) Labour	1,000	920	1,520	1,400
Total Cost	3,000	2,868	3,820	3,622
5. Net Benefit (B / rai)	4,600	5,132	10,430	11,378

Crop Budget Analysis

8. Crop : Cashew Nut

	Without Project		With Project	
	Financial	Economic	Financial	Economic
1. Yield (kg/rai)	180	180	280	280
2. Farm Gate Price (B / kg)	32.5	35	32.5	35
3. Gross Production Value (B / rai)	5,850	6,300	9,100	9,800
4. Cost of Production				
(1) Seeds	400	435	400	435
(2) Fertilizers	200	190	220	202
(3) Chemicals	150	140	150	140
(4) Machinery	230	210	230	210
(5) Labour	600	555	910	842
Total Cost	1,580	1,530	1,910	1,830
5. Net Benefit (B / rai)	4,270	4,770	7,190	7,970

Crop Budget Analysis

9. Crop : Chilli

	Without Project		With Project	
	Financial	Economic	Financial	Economic
1. Yield (fruit/rai)	240	240	352	352
2. Farm Gate Price (B / fruit)	18.5	20	18.5	20
3. Gross Production Value (B / rai)	4,440	4,800	6,512	7,040
4. Cost of Production				
(1) Seeds	80	90	80	90
(2) Fertilizers	400	368	500	460
(3) Chemicals	100	92	150	138
(4) Machinery	500	460	660	608
(5) Labour	800	736	1,200	1,048
Total Cost	1,880	1,746	2,590	2,344
5. Net Benefit (B / rai)	2,560	3,054	3,922	4,696

Crop Budget Analysis

10. Crop : Pineapple

	Without Project		With Project	
	Financial	Economic	Financial	Economic
1. Yield (fruit/rai)	5,000	5,000	6,500	6,500
2. Farm Gate Price (B / fruit)	2.3	2.5	2.3	2.5
3. Gross Production Value (B / rai)	11,500	12,500	14,950	16,250
4. Cost of Production				
(1) Seeds	100	115	100	115
(2) Fertilizers	200	185	250	230
(3) Chemicals	150	140	150	140
(4) Machinery	260	240	260	240
(5) Labour	500	460	670	615
Total Cost	1,210	1,140	1,430	1,340
5. Net Benefit (B / rai)	10,290	11,360	13,520	14,910

H-2-6 Environmental Impact

(1) Topo-Geology

Please refer to APPENDIX A "Topography and Geology".

(2) Problem Soils

Please refer to APPENDIX B "Soil and Land Use"

(3) Water Sources

Please refer to APPENDIX C "Hydro and Meteorology" and related Materials from RID.

(4) Forestry

Due to its adjacency to the municipality of Chumphon, Nong Yai area has no considerable land for forestry but gradually converting to residential land, especially areas linking to this municipality, Some parts of upland such as the northeastern side of Nong Yai swamp, however, have been planted with tree-crops i.e. para rubber of more than 2-3 years, forming a kind of small forests.

The irrigation of these parts for changing to other tree-crops or fruit trees with higher cash values can maintain the similar environment by a gradual change of these crops.

In the Nong Yai area, at the present time, about 50 percents of the area are planted with coconuts. The change of coconut-trees for fruit-trees for higher cash value would be applied with a similar procedure.

The number of trees in Nong Yai area, therefore, is subject to be increased; accordingly.

The formation of pasture-land is also a subject of the Project to develop livestock raising in the area.

(5) Bio-system

As the storage of the fresh water as well as the maintaining of this fresh water-quality in natural conditions of Tha Tapao river and Nong Yai Swamp are mainly subjected to the project, the bio-sphere of aqua-system will not be affected in this aspect. Besides, the inland fishery program planning to release more fish fries in these water bodies is subject to maintain this bio-sphere.

Apart from the aqua-system, the wildlife sanctuary is not included in Nong Yai area which is a small portion of land linking to the municipality of Chumphon.

(6) Irrigation and Drainage

Please refer to APPENDIX D "Irrigation and Drainage"

(7) Flood Control

Please refer to APPENDIX E " Flood Control"

(8) Agriculture

The traditional rainfed agriculture will be converted to irrigation agriculture. This, therefore, makes a proper cropping calendar with more valuable cash crops could be applied.

Without annual floods, fruit trees and vegetables can be grown. Up to now flood damages have prevented these crop in flooded lowlands.

The livestock development plan will substantially increase the number of animals in Nong Yai area, offering the basis of organic agriculture in the region .

The strengthened supporting system for agriculture development, on another hand, will make the development plan to be implemented for sake of local farmers.

(9) Communications

A new rural road network made by the embankment road around Nong Yai swamp to connect to other present rural roads in Nong Yai area will contribute to a better connection to remote villages in the area around Nong Yai swamp.

This new rural road network will be added to the present road network based on the provincial road No. 3180 for forming a better communication system in Nong Yai area.

With this better communication-system, the market distribution system of agricultural products will be improved accordingly.

(10) Marketing Distribution Network

The installation of Na Cha Ang Tambon market will contribute to the distribution of agricultural products and necessary goods in Nong Yai area.

This Tambon market will serve as the base for the distribution network of agricultural products from Tambon to Amphoe market and from Amphoe market to Provincial central market.

(11) Cultural Heritage

The detailed study on construction of floodway and improvement works of Tha Tapao river and Sam Kaeo canal is subjected to prevent damages to cultural heritages such Wat, Mosque, historical or archaeological places etc.

In Nong Yai area, some places of cultural heritages are notified in attached RID Materials.

(12) Environmental Evaluation in Overall

From the environmental evaluation on three aspects of natural conditions, production and quality of life, there are no serious problems posed to the environmental evaluation to be subjected for recommending further studies at the moment.

The implementation of the Project, however should be concerned about following points;

1. Cultural heritages in the area should be prevented from damages by the project-implementation.
2. Construction of the floodway and river improvement-works should be assured on following safeties:
 - a. Safe communication and schooling in the area.
 - b. No flood-damage to local inhabitants at the floodway terminal.
 - c. Proper compensation and rehabilitation of families affected by the construction of floodways and river improvement-works
3. The application of agricultural inputs such as pesticides etc. should not cause environmental problems affected to water sources and soil in the area.

Apart from these above points, the Project has no significant impacts at sight. The Project, therefore, does not require an EIA statement to be prepared.

H-2-7 Overall evaluation

The economic evaluation of the Project proves that the Project is quite viable with highly economic feasibility by its basic EIRR of 17.12 %.

The sensitivity analysis of 3 cases of possible risks, reduction of project-benefits at 10 %, increase of project-costs at 10 % and delay of project-benefit for 2 years, proved also that the Project is economically feasible with corresponding EIRRs of 15.33 %, 15.68 % and 13.31 %, respectively.

Regarding social impacts by this project, the stability in daily life, free from flood damages, is assured for a 10-year return period which offers the fundamental conditions for the regional development, an urgent issue for Chumphon province at now.

Besides, the farm budget analysis proved that local farmers can generate their agricultural incomes by the application of integrated agricultural development through mentioned typical farm models for balancing their family expenses which have been largely shared by labor works in nearby districts as indispensable off-farm activities up to now.

Finally, the evaluation on environmental impacts shows no negative impacts to the project for making future environmental studies, except some concerns about the prevention of damages to cultural and historical places in the area as well as proper compensation and resettlement for families affected by the floodway construction and river-improvement works subjected to the Project.

TABLE H-11 FARM HOUSEHOLD STRUCTURE (FARM SURVEY)

Amphoe/Tambon/ Villages	Sample's Farm Household	No. of Members		Household Size (person/hh.)	Farm Worker (%)	
		Male	Female		Active Labor	Inactive Labor
P R I O R I T Y P R O J E C T						
A. MUANG CHUMPHON						
T. NA CHA ANG						
Khan Saen -M1	8.0	21.0	18.0	39.0	69.23	30.77
Na Cha Ang -M2	8.0	15.0	23.0	38.0	44.74	55.26
Noen Kiri -M7	4.0	6.0	11.0	17.0	17.65	82.35
Sub-total	20.0	42.0	52.0	94.0	50.00	50.00
T. BANG LUK						
Fai Tha -M3	4.0	7.0	9.0	16.0	68.75	31.25
Sala Loi -M8	8.0	16.0	23.0	39.0	58.97	41.03
Khao rat -M12	8.0	16.0	17.0	33.0	57.58	42.42
Sub-total	20.0	39.0	49.0	88.0	60.23	39.77
T. NA THUNG						
Na Thung -M1	4.0	7.0	6.0	13.0	38.46	61.54
Thap Tanot -M4	5.0	14.0	13.0	27.0	48.15	51.85
Tha Tapao Nua-M5	8.0	12.0	15.0	27.0	40.74	59.26
Nai Sang -M6	7.0	15.0	16.0	31.0	51.61	48.39
Thung Jik -M8	8.0	20.0	15.0	35.0	60.00	40.00
Nong Phak -M9	8.0	18.0	17.0	35.0	17.14	82.86
Sub-Total	40.0	86.0	82.0	168.0	42.86	57.14
T O T A L	80.0	167.0	183.0	350.0	49.14	50.86
M A S T E R P L A N						
A. Tha-Sae	144.0	323.0	312.0	635.0	64.09	35.91
A. Pathil	8.0	18.0	17.0	35.0	68.57	31.43
A. Muang	56.0	133.0	121.0	254.0	62.99	37.01
T O T A L	208.0	474.0	450.0	924.0	63.96	36.04

TABLE H-12 ANNUAL GROSS INCOME PER FARM (FARM SURVEY)

Amphoe/Tambon/ Villages	Crop (1)	On-farm Income Livestock (2)	Off-farm Income Employee (4)	Off-farm Income Others (5)	Total Income (6)	Gross Income (7)	Farm Expend. (8)	Household Expend. (9)	Gross Expend. (10)	Net Family Income (11)
		(1)+(2)			(4)+(5)	(3)+(6)			(8)+(9)	(6)-(10)
P R I O R I T Y P R O J E C T										
A. MUANG CHUMPHON										
I. NA CHA ANG										
Khan Saen -M1	26498.	6084.	47504.	1998.	49502.	82083.	21410.	48595.	70004.	12079.
Na Cha Ang -M2	10275.	2241.	72710.	7363.	80073.	92598.	12771.	35068.	47839.	44749.
Noen Kiri -M7	3260.	1000.	29275.	7013.	36288.	40548.	4091.	30508.	34598.	5949.
Sub-total	15361.	3530.	53941.	5147.	59087.	77978.	14490.	39567.	54057.	23921.
I. BANG LUK										
Fai Iha -M3	34829.	1523.	13155.	1522.	14677.	51028.	22871.	36174.	59045.	-8017.
Sala Loi -M8	9483.	13908.	15713.	4067.	19779.	32687.	20387.	26539.	46926.	-14239.
Khao rat -M12	11577.	18344.	18175.	15050.	33225.	51569.	13025.	28875.	41900.	9668.
Sub-total	15390.	19771.	16186.	7951.	24137.	43908.	17939.	29400.	47939.	-3431.
I. NA THUNG										
Na Thung -M1	13070.	14570.	107100.	1800.	108900.	123470.	11739.	49424.	61162.	62308.
Ihap Ianot -M4	15760.	20763.	30200.	4700.	34900.	55663.	15486.	31491.	46977.	8686.
The Tapao Nua -M5	6488.	9938.	78026.	12658.	90684.	100621.	4742.	42580.	47322.	53299.
Nai Sang -M6	14196.	11448.	60317.	23960.	84277.	109921.	11408.	70564.	81972.	27949.
Thung Jik -M8	7996.	9199.	65445.	5988.	71433.	80631.	7873.	48650.	56523.	24108.
Nong Phak -M9	1788.	1643.	128268.	25224.	153491.	156921.	1449.	56962.	58411.	98511.
Sub-Total	9016.	13053.	79388.	13734.	93123.	106176.	7919.	50866.	58785.	47391.
I O T A L	12195.	16192.	57236.	10142.	67367.	83559.	12067.	42675.	54741.	28818.
M A S T E R P L A N										
A. Tha-Sae	28592.	5014.	11071.	5894.	16966.	50572.	42526.	26032.	68558.	-17986.
A. Pathil	24941.	6480.	9375.	4631.	14006.	45427.	28706.	41653.	70361.	-24934.
A. Muang	24184.	4850.	29188.	8692.	37879.	66913.	24439.	36407.	60846.	6067.
I O T A L	27265.	9291.	15984.	6599.	23482.	54773.	37125.	29426.	66551.	-11777.

TABLE H - 13 LAND TENURE (FARM SURVEY)

Amphoe/Tambon/Villages	Own		Rent		Other		Total	
	% of total area	Area per farm (rai)	% of total area	Area per farm (rai)	% of total area	Area per farm (rai)	% of total area	Area per farm (rai)
PRIORITY PROJECT								
A. MUANGCHUMPHON								
T. NA CHA ANG								
Khan Saen -M1	38.83	7.06	46.74	8.50	14.43	2.63	100.00	18.10
Na Cha Ang -M2	88.20	20.56	3.22	0.75	8.58	2.00	100.00	23.30
Noen Kiri -M7	100.00	3.69	0.00	0.00	0.00	0.00	100.00	3.60
Sub-total	67.99	11.79	21.34	3.70	10.67	1.85	100.00	17.30
T. BANG LUK								
Fai Tha -M3	92.92	13.13	0.00	0.00	7.08	1.00	100.00	14.10
Sala Loi -M8	86.44	19.13	0.00	0.00	13.56	3.00	100.00	22.10
Khao rat -M12	100.00	29.63	0.00	0.00	0.00	0.00	100.00	29.60
Sub-total	94.05	22.13	0.00	0.00	5.95	1.40	100.00	23.50
T. NA THUNG								
Na Thung -M1	91.49	10.75	0.00	0.00	8.51	1.00	100.00	11.75
Thap Tanot -M4	90.52	21.00	9.48	2.20	0.00	0.00	100.00	23.20
Tha Tapao Nua -M5	100.00	5.09	0.00	0.00	0.00	0.00	100.00	5.09
Nai Sang -M6	100.00	10.18	0.00	0.00	0.00	0.00	100.00	10.18
Thung Jik -M8	82.86	5.44	15.24	1.00	1.90	0.13	100.00	6.56
Nong Phak -M9	100.00	2.22	0.00	0.00	0.00	0.00	100.00	2.22
Sub-total	93.05	8.03	5.50	0.47	1.45	0.13	100.00	8.63
TOTAL	85.98	12.49	8.00	1.16	6.02	0.88	100.00	14.53
M A S T E R P L A N								
A. Tha-Sae	88.72	24.14	1.48	0.40	9.81	2.67	100.00	27.20
A. Phthil	98.71	16.94	1.29	0.22	0.00	0.00	100.00	17.10
A. Muang	69.59	13.75	24.37	4.82	6.04	1.19	100.00	19.76
TOTAL	84.93	21.06	6.35	1.58	8.72	2.16	100.00	24.79

TABLE H-14 LAND UTILIZATION (FARM SURVEY).

DESCRIPTION	% OF FARM HAVING	AVE. PLOT PER FARM	AREA IN RAI PER FARM	% OF TOTAL AREA	PRICE IN BAHT PER RAI	TAX IN BAHT PER FARM	AVE. DISTANCE FROM HOUSE (Kms.)
Arable land							
Cultivated land :							
- Paddy	53.75	0.74	4.32	30.24	77840.81	17.74	1.02
- Upland	1.25	0.01	0.05	0.36	3000.00	0.00	0.00
- Vegetables	8.75	0.11	0.42	2.99	59611.94	2.16	0.36
- Tree crop	6.25	0.06	0.38	2.71	302302.63	1.34	0.50
- Fruits	53.75	0.61	3.93	28.05	217634.06	20.60	0.54
Sub-total	91.25	1.45	9.10	64.94	146340.28	41.85	1.00
Fallow land	33.75	0.43	3.12	22.29	107378.38	16.22	0.51
Non-clearing	1.25	0.01	0.25	1.78	3000.00	0.00	0.00
Sub-Total	93.75	1.75	12.48	89.11	133776.30	58.07	1.06
Pasture	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fish culture	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Productive land	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Homestead	100.00	1.60	1.53	10.59	180718.03	0.80	0.00
Non-cultiv. land	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Others	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Farm Area	100.00	2.75	14.01	100.00	138890.39	58.87	1.00
Cropping intensity (%)							
Wet Season							
Dry Season							
TOTAL							

TABLE H - 15 PLANTED AND HARVESTED AREA (FARM SURVEY)

KIND OF CROP	PLANTED AREA (RAI)	HARVESTED AREA (RAI)	% OF PLANTED	YIELD PER RAI BY:	
				PLANTED (KGS)	HARVESTED (KGS)
R I C E					
Transplanted	4.34	3.74	86.04	287.	334.
HYV	0.05	0.05	100.00	750.	750.
LIV	0.81	0.66	81.54	308.	377.
LY	5.43	3.03	56.89	276.	317.
Non-glutinous.	4.34	3.74	86.04	287.	334.
All types	4.34	3.74	86.04	287.	334.
UPLAND CROPS					
Maize	0.05	0.05	100.00	80.	80.
Sub-total	0.05	0.05	100.00	80.	80.
VEGETABLES					
Bird Pepper	0.04	0.04	100.00	340.	340.
Cucumbers -big	0.04	0.04	100.00	6667.	6667.
Stringbeans	0.01	0.01	100.00	1000.	1000.
Sub-total	0.09	0.09	100.00	3146.	3145.
TREE CROPS					
Coffee	0.09	0.09	100.00	20.	20.
Para Rubber -New	0.11	0.00	0.00	0.	0.
Betal-nut	0.05	0.00	0.00	0.	0.
Nipa leaf	11.00	11.00	100.00	1309.	1309.
Sub-total	30.40	17.90	58.83	478.	612.
FRUITS					
Coconuts -Dry	1.78	1.02	57.45	359.	625.
Cashew-nuts	0.85	0.05	5.54	5.	88.
Mangosteen	0.69	0.32	46.32	108.	235.
Lancet Fruit	0.03	0.01	20.83	21.	100.
Rambutan	0.00	0.00	0.00	0.	0.
Jack Fruit	0.03	0.00	0.00	0.	0.
Pomeio	0.34	0.02	5.55	59.	1067.
Taneh Banana	0.19	0.00	0.00	0.	0.
Naraha Banana	0.01	0.01	100.00	1440.	1440.
Figure Banana	0.01	0.01	100.00	960.	950.
Sub-total	5.94	1.45	36.70	195.	531.
T O T A L	6.80	5.55	63.00	0.	0.

REMARKS: PRODUCT UNIT: BANANA = HANDS/ CORN = EARS/CASSAVA = TON.

TABLE H-16 EXPENSES AND INCOME OF LIVESTOCK (FARM SURVEY)

I T E M S	SOLD		CONSUMED		PURCHASED		IN./DECRE. VALUE		PRODUCT- ION COST		INCOME IN BAHT
	NO. OF HEADS	VALUE BAHT	NO. OF HEADS	VALUE BAHT	NO. OF HEADS	VALUE BAHT	BAHT	BAHT	IN BAHT	IN BAHT	
BUFFALOES											
Less than 2 yrs.	0.025	125.	0.000	0.	0.000	0.	525.	0.	0.	0.	650.
Over 2 years	0.100	661.	0.000	0.	0.038	150.	-409.	0.	0.	0.	323.
Sub-total	0.125	1006.	0.000	0.	0.038	150.	116.	0.	0.	0.	973.
CATTLES											
Less than 2 yrs.	0.025	194.	0.000	0.	0.038	200.	969.	0.	0.	0.	963.
Over 2 years	0.112	943.	0.000	0.	0.025	163.	-175.	1.	1.	0.	609.
Sub-total	0.138	1141.	0.000	0.	0.063	363.	794.	1.	1.	0.	1571.
Swine	1.200	1492.	0.000	0.	0.287	198.	-121.	763.	763.	0.	410.
Young pig	0.300	696.	0.000	0.	0.150	93.	-65.	325.	325.	0.	213.
Chicken	3.003	240.	1.175	49.	0.875	15.	165.	431.	431.	0.	13.
Ducks	0.750	20.	0.000	0.	0.875	11.	10.	208.	208.	0.	-188.
Eggs	567.625	645.	99.513	159.	0.000	0.	0.	0.	0.	0.	1004.
T O T A L	573.200	5445.	100.488	209.	2.287	630.	899.	1728.	3997.		

TABLE H - 17 CREDIT OBTAINED OUTSTANDING DEBTS (FARM SURVEY)

Amphoe/Tambon /Villages	% of farm having	Principal (by average)	Interest rate(%)	Interest (baht)	Payment amount	End outst. debts
P R I O R I T Y P R O J E C T						
A.MUANG CHUMPHON						
T.NA CHA ANG						
Khan Saen -M1	12.50	3750.	9.00	338.	338.	3750.
Na Cha Ang -M2	12.50	250.	15.00	38.	38.	250.
Noen Kiri -M7	25.00	7500.	12.50	938.	2400.	6038.
Sub-total	15.00	3100.	12.17	338.	630.	2808.
T.BANG LUK						
Fai Tha -M3	0.00	0.	0.00	0.	0.	0.
Sala Loi -M8	0.00	0.	0.00	0.	0.	0.
Khao rat -M12	0.00	0.	0.00	0.	0.	0.
Sub-total	0.00	0.	0.00	0.	0.	0.
T.NA THUNG						
Na Thung -M1	25.00	26000.	6.00	1560.	12000.	14000.
Thap Tanot -M4	40.00	5800.	15.50	944.	1400.	5340.
Tha Tapao Nua-M5	12.50	8750.	8.00	700.	3375.	6075.
Nai Sang -M6	28.57	30000.	12.75	5114.	5000.	30114.
Thung Jik -M8	0.00	0.	0.00	0.	0.	0.
Nong Phak -M9	12.50	25000.	8.00	4000.	0.	29000.
Sub-Total	17.50	15325.	11.21	2109.	2925.	14353.
T O T A L	12.50	8438.	11.50	1139.	1620.	7878.
M A S T E R P L A N						
A.Tha-Sae	32.64	15109.	10.02	2206.	1807.	15491.
A.Pathil	37.50	10750.	9.00	968.	1250.	10468.
A.Muang	7.14	4286.	10.88	510.	1196.	3332.
T O T A L	25.96	12028.	10.03	1701.	1621.	12024.

TABLE H - 18 CROPPING AREAS OF "WITHOUT PROJECT" AND "WITH PROJECT"

Items	WITHOUT PROJECT AREA(HA)	WITH PROJECT AREA	INCREASED AREA (HA)	IRRIGATED AREA	NON-IRRIGATED AREA
Paddy					
Wet Season	565	630	+65	630	0
Dry Season	30	60	+30	60	0
Sub-Total(a)	(595)	(690)	(+95)	(690)	(0)
Tree Crops					
Coconut	749	728	-21	0	728
Young Coco(Palmyra Palm)	100	170	+70	58	112
Sub Total (b)	(849)	(898)	(+49)	(58)	(840)
Fruit Trees					
Mangosteen	54	135	+81	135	0
Cashew Nut	32	60	+28	60	0
Durian	30	135	+105	135	0
Pomelo	20	110	+90	110	0
Pineapple	16	32	+16	32	0
Sub Total (c)	(152)	(472)	(+320)	(472)	(0)
Vegetables	40	40	+0	40	0
Pasture	0	38	+38	0	38
Sub Total (d)	(40)	(78)	(+38)	(40)	(38)
Total	1,636	2,138	+502	1,260	878
Agricultural Land	2,019	2,078	+59	1,200	878
Cropping Intensity	81.0%	102.8%		105%	100%

TABLE H - 19 CROPPING BENEFITS OF "WITHOUT PROJECT" AND "WITH PROJECT"

Crops	Without Project (mB)	With Project (mB)	Incremental Benefit (mB)
Paddy			
Wet Season	0.42	3.68	3.26
Dry Season	0.01	0.49	0.48
Tree Crops			
Coconut	2.46	8.00	5.54
Young Coconut	0.81	2.66/2.67	4.52
Fruit Trees			
Mangosteen	0.01	5.90	5.89
Cashew Nut	0.97	2.99	2.02
Durian	1.75	15.05	13.30
Pomelo	0.64	7.23	6.59
Pineapple	1.14	2.98	1.84
Vegetable	0.76	1.17	0.41
Total	8.97	52.82	43.85

TABLE H - 20 CROPPING COST AND REVENUE OF NONG YAI PROJECT AREA FOR ECONOMIC EVALUATION (W/O PROJECT)

Crops	Area (ha)	Gross Production Value				Production Cost		Net Production Value(mB)
		Yield (t/ha)	Production (t)	Economic Price (B/t)	Value (mB)	Unit Cost (B/ha)	Total (mB)	
(1) Paddy Wet Season	565	1.63	921	3,975	3.66	5,744	3.24	0.42
Dry Season	30	1.94	58	3,975	0.23	7,468	0.22	0.01
(2) Coconut*	749	3,600	2,696,000	+2.3	6.20	5,000	3.74	2.46
(3) Young Coconut*	100	3,600	360,000	+4.0	1.44	6,250	0.63	0.81
(4) Mangosteen	54	2.20	119	8,490	1.01	18,500	1.00	0.01
(5) Cashew Nut	32	1.13	36	35,000	1.27	9,562	0.30	0.97
(6) Durian	30	4.38	131	18,280	2.40	20,800	0.65	1.75
(7) Pomelo*	20	5,000	100	10	1.00	17,925	0.36	0.64
(8) Pineapple	16	31.25	500	2,500	1.25	7,106	0.11	1.14
(9) Vegetable (Chili)	40	1.5	60	20,000	1.20	10,912	0.44	0.76
Total	1,636**				19.66		10.69	8.97

Note : * Yield = Fruits/ha
 TP = Thousand Fruits
 Price = B/fruit

** Include idle land of paddy land and others are 131 and 262 ha respectively
 TP = Total Product
 TR = Total Revenue
 TC = Total Cost
 NPV = Net Production Value

TABLE H - 21 CROPPING COST AND REVENUE OF NONG YAI PROJECT AREA FOR ECONOMIC EVALUATION (W/ PROJECT)

Crops	Area (ha)	Gross Production Value				Production Cost		Net Production Value(mB)
		Yield (t/ha)	Production (t)	Economic Price (B/t)	Value (mB)	Unit Cost (B/ha)	Total (mB)	
(1) Paddy								
Wet Season	630	3.13	1,972	3,975	7.84	6,606	4.16	3.68
Dry Season	60	4.06	244	3,975	0.97	8,043	0.48	0.49
(2) Coconut*	728	7,500	5,460,000	2.3	12.55	6,250	4.55	8.00
(3) Young Coconut**	112**	7,500**	840,000	4.0	3.36	6,250	0.70	2.66
	58	13,400	777,200	4.0	3.11	7,500	0.44	2.67
(4) Mangosteen	135	7.80	1,054	8,490	8.95	22,637	3.05	5.90
(5) Cashew nut	60	1.75	105	35,000	3.68	11,437	0.69	2.99
(6) Durian	135	7.50	1,012	18,280	18.49	25,512	3.44	15.05
(7) Pomelo*	110	9,400	1,034	10	9.72	22,637	2.49	7.23
(8) Pineapple	32	40.60	1,299	2,500	3.25	8,356	0.27	2.98
(9) Vegetable (Chili)	40	2.2	88	20,000	1.76	14,650	0.59	1.17
Total	2,100**						20.86	52.82

Note : * Yield = Fruits/ha
 TP = Thousand Fruits
 Price = B/fruit

** Non-irrigated young coconut
 TP = Total Product
 TR = Total Revenue
 TC = Total Cost
 NPV = Net Production Value

TABLE H - 22 EIRR (1) AT BASIC CONDITIONS

No.	Year	Cost			Benefit			10% of discount			18% of discount			
		Agri.	Flood	O&M	Replacement	Total	Gross	Net	Total Cost	Benefit	Net Benefit	Total Cost	Benefit	Net Benefit
1	1992	16,331	0	0	0	16,331	0	-16,331	14,846	0	-14,846	13,840	0	-13,840
2	1993	127,867	0	0	0	127,867	0	-127,867	105,675	0	-105,675	91,832	0	-91,832
3	1994	375,261	0	0	0	375,261	0	-375,261	281,939	0	-281,939	228,395	0	-228,395
4	1995	558,339	0	0	0	558,339	0	-558,339	381,353	0	-381,353	287,985	0	-287,985
5	1996	393,014	11,127	0	0	404,141	0	-404,141	250,940	0	-250,940	176,654	0	-176,654
6	1997	0	14,422	0	0	14,422	307,460	293,038	8,141	173,553	165,412	5,342	113,893	108,551
7	1998	0	14,422	0	0	14,422	313,610	299,188	7,401	160,932	153,531	4,527	98,450	93,923
8	1999	0	14,422	0	0	14,422	319,760	305,338	6,728	149,170	142,442	3,837	85,068	81,232
9	2000	0	14,422	0	0	14,422	325,920	311,498	6,116	138,222	132,106	3,252	73,481	70,229
10	2001	0	14,422	0	0	14,422	332,100	317,678	5,560	128,039	122,479	2,756	63,453	60,697
11	2002	0	14,422	0	0	14,422	335,840	321,418	5,055	117,710	112,655	2,335	54,379	52,044
12	2003	0	14,422	0	0	14,422	339,750	325,328	4,595	108,255	103,660	1,979	46,620	44,641
13	2004	0	14,422	0	0	14,422	343,530	329,108	4,178	99,508	95,331	1,677	39,948	38,271
14	2005	0	14,422	0	0	14,422	347,310	332,888	3,798	91,458	87,660	1,421	34,227	32,806
15	2006	0	14,422	0	0	14,422	351,030	336,608	3,453	84,034	80,581	1,204	29,317	28,112
16	2007	0	14,422	0	0	14,422	351,030	336,608	3,139	76,394	73,256	1,021	24,845	23,824
17	2008	0	14,422	0	0	14,422	351,030	336,608	2,853	69,449	66,596	865	21,055	20,190
18	2009	0	14,422	0	0	14,422	351,030	336,608	2,594	63,136	60,542	733	17,843	17,110
19	2010	0	14,422	0	0	14,422	351,030	336,608	2,358	57,396	55,038	621	15,121	14,500
20	2011	0	14,422	0	0	14,422	351,030	336,608	2,144	52,178	50,035	526	12,815	12,288
21	2012	0	14,422	0	0	14,422	351,030	336,608	1,949	47,435	45,486	446	10,860	10,414
22	2013	0	14,422	0	0	14,422	351,030	336,608	1,772	43,123	41,351	378	9,203	8,825
23	2014	0	31,828	0	0	31,828	351,030	319,202	3,554	39,202	35,648	707	7,799	7,092
24	2015	0	16,492	0	0	16,492	351,030	334,538	1,674	35,639	33,964	311	6,610	6,299
25	2016	0	14,422	0	0	14,422	351,030	336,608	1,331	32,399	31,068	230	5,601	5,371
26	2017	0	14,422	0	0	14,422	351,030	336,608	1,210	29,453	28,243	195	4,747	4,552
27	2018	0	14,422	0	0	14,422	351,030	336,608	1,100	26,776	25,676	165	4,023	3,858
28	2019	0	14,422	0	0	14,422	351,030	336,608	1,000	24,342	23,342	140	3,409	3,269
29	2020	0	14,422	0	0	14,422	351,030	336,608	909	22,129	21,220	119	2,889	2,770
30	2021	0	14,422	0	0	14,422	351,030	336,608	827	20,117	19,291	101	2,448	2,348
Total		1,470,812	391,153	0	0	1,861,965	8,581,760	6,719,795	1,118,192	1,890,048	771,856	833,595	788,104	-45,492

Unit : Thousand Baht

NPV = 10% 771,856 18%
 B/C Ratio = 10% 1.69 18%
 EIRR = 17.12%

TABLE H - 23 EIRR (2) AT REDUCTION OF BENEFIT (10%)

No.	Year	Cost			Benefit			10% of discount			16% of discount		
		Agri.	Flood	Total	Gross	Net	Total Cost	Benefit	Net Benefit	Total Cost	Benefit	Net Benefit	
1	1992	16,331	0	16,331	0	-16,331	14,846	0	-14,846	14,078	0	-14,078	
2	1993	127,867	0	127,867	0	-127,867	105,675	0	-105,675	95,026	0	-95,026	
3	1994	375,261	0	375,261	0	-375,261	281,939	0	-281,939	240,414	0	-240,414	
4	1995	558,339	0	558,339	0	-558,339	381,353	0	-381,353	308,366	0	-308,366	
5	1996	393,014	11,127	404,141	0	-404,141	250,940	0	-250,940	192,417	0	-192,417	
6	1997	0	14,422	14,422	276,714	262,292	8,141	156,198	148,057	5,919	113,575	107,656	
7	1998	0	14,422	14,422	282,249	267,827	7,401	144,838	137,438	5,103	99,868	94,765	
8	1999	0	14,422	14,422	287,784	273,362	6,728	134,253	127,525	4,399	87,781	83,382	
9	2000	0	14,422	14,422	293,328	278,906	6,116	124,400	118,283	3,792	77,131	73,339	
10	2001	0	14,422	14,422	298,890	284,468	5,560	115,235	109,675	3,269	67,753	64,484	
11	2002	0	14,422	14,422	302,256	287,834	5,055	105,939	100,884	2,818	59,066	56,248	
12	2003	0	14,422	14,422	305,775	291,353	4,595	97,429	92,834	2,430	51,512	49,082	
13	2004	0	14,422	14,422	309,177	294,755	4,178	89,558	85,380	2,094	44,901	42,806	
14	2005	0	14,422	14,422	312,579	298,157	3,798	82,312	78,514	1,806	39,133	37,328	
15	2006	0	14,422	14,422	315,927	301,505	3,453	75,630	72,178	1,557	34,097	32,541	
16	2007	0	14,422	14,422	315,927	301,505	3,139	68,755	65,616	1,342	29,394	28,052	
17	2008	0	14,422	14,422	315,927	301,505	2,853	62,504	59,651	1,157	25,340	24,183	
18	2009	0	14,422	14,422	315,927	301,505	2,594	56,822	54,228	997	21,845	20,847	
19	2010	0	14,422	14,422	315,927	301,505	2,358	51,657	49,298	860	18,832	17,972	
20	2011	0	14,422	14,422	315,927	301,505	2,144	46,961	44,817	741	16,234	15,493	
21	2012	0	14,422	14,422	315,927	301,505	1,949	42,691	40,743	639	13,995	13,356	
22	2013	0	14,422	14,422	315,927	301,505	1,772	38,810	37,039	551	12,065	11,514	
23	2014	0	31,828	31,828	315,927	284,099	3,554	35,282	31,728	1,048	10,400	9,353	
24	2015	0	16,492	16,492	315,927	299,435	1,674	32,075	30,400	468	8,966	8,498	
25	2016	0	14,422	14,422	315,927	301,505	1,331	29,159	27,828	353	7,729	7,376	
26	2017	0	14,422	14,422	315,927	301,505	1,210	26,508	25,298	304	6,663	6,359	
27	2018	0	14,422	14,422	315,927	301,505	1,100	24,098	22,998	262	5,744	5,482	
28	2019	0	14,422	14,422	315,927	301,505	1,000	21,907	20,907	226	4,952	4,726	
29	2020	0	14,422	14,422	315,927	301,505	909	19,916	19,007	195	4,269	4,074	
30	2021	0	14,422	14,422	315,927	301,505	827	18,105	17,279	168	3,680	3,512	
Total		1,470,812	391,153	1,861,965	7,723,584	5,861,619	1,118,192	1,701,043	582,851	892,798	864,925	-27,873	
NPV	=	10%		582,851		16%							
B/C Ratio	=	10%		1.52		16%							
EIRR	=	15.53%											

TABLE H - 24 EIRR (3) AT INCREASE OF PROJECT-COSTS (10%)

Unit : Thousand Baht

No.	Year	Cost			Benefit			10% of discount			16% of discount		
		Agri. Flood	O&M	Replacement	Total	Gross	Net	Total Cost	Benefit	Net Benefit	Total Cost	Benefit	Net Benefit
1	1992	17,964	0	0	17,964	0	-17,964	16,331	0	-16,331	15,486	0	-15,486
2	1993	140,654	0	0	140,654	0	-140,654	116,243	0	-116,243	104,529	0	-104,529
3	1994	412,787	0	0	412,787	0	-412,787	310,133	0	-310,133	264,455	0	-264,455
4	1995	614,173	0	0	614,173	0	-614,173	419,488	0	-419,488	339,202	0	-339,202
5	1996	432,315	12,240	0	444,555	0	-444,555	276,034	0	-276,034	211,658	0	-211,658
6	1997	0	15,864	0	15,864	307,460	291,596	8,955	173,533	164,598	6,511	126,195	119,683
7	1998	0	15,864	0	15,864	313,610	297,746	8,141	160,932	152,791	5,613	110,964	105,351
8	1999	0	15,864	0	15,864	319,760	303,896	7,401	149,170	141,494	4,839	97,535	92,696
9	2000	0	15,864	0	15,864	325,920	310,056	6,728	138,222	131,494	4,172	85,702	81,530
10	2001	0	15,864	0	15,864	332,100	316,236	6,116	128,039	121,923	3,596	75,282	71,685
11	2002	0	15,864	0	15,864	335,840	319,976	5,560	117,710	112,150	3,100	65,629	62,529
12	2003	0	15,864	0	15,864	339,750	323,886	5,055	108,255	103,200	2,673	57,235	54,563
13	2004	0	15,864	0	15,864	343,530	327,666	4,595	99,508	94,913	2,304	49,890	47,586
14	2005	0	15,864	0	15,864	347,310	331,446	4,178	91,458	87,280	1,986	43,482	41,495
15	2006	0	15,864	0	15,864	351,030	335,166	3,798	84,034	80,236	1,712	37,886	36,173
16	2007	0	15,864	0	15,864	351,030	335,166	3,453	76,394	72,942	1,476	32,660	31,184
17	2008	0	15,864	0	15,864	351,030	335,166	3,139	69,449	66,311	1,272	28,155	26,883
18	2009	0	15,864	0	15,864	351,030	335,166	2,853	63,136	60,283	1,097	24,272	23,175
19	2010	0	15,864	0	15,864	351,030	335,166	2,594	57,396	54,802	946	20,924	19,978
20	2011	0	15,864	0	15,864	351,030	335,166	2,358	52,178	49,820	815	18,038	17,223
21	2012	0	15,864	0	15,864	351,030	335,166	2,144	47,435	45,291	703	15,550	14,847
22	2013	0	15,864	0	15,864	351,030	335,166	1,949	43,123	41,174	606	13,405	12,799
23	2014	0	35,011	0	35,011	351,030	316,019	3,910	39,202	35,292	1,153	11,556	10,404
24	2015	0	18,141	0	18,141	351,030	332,889	1,842	35,639	33,797	515	9,962	9,447
25	2016	0	15,864	0	15,864	351,030	335,166	1,464	32,399	30,934	388	8,588	8,200
26	2017	0	15,864	0	15,864	351,030	335,166	1,331	29,453	28,122	335	7,403	7,069
27	2018	0	15,864	0	15,864	351,030	335,166	1,210	26,776	25,566	288	6,382	6,094
28	2019	0	15,864	0	15,864	351,030	335,166	1,100	24,342	23,242	249	5,502	5,253
29	2020	0	15,864	0	15,864	351,030	335,166	1,000	22,129	21,129	214	4,743	4,529
30	2021	0	15,864	0	15,864	351,030	335,166	909	20,117	19,208	185	4,089	3,904
Total		1,617,893	430,268	0	2,048,162	8,581,760	6,533,599	1,230,011	1,890,048	660,037	982,078	961,028	-21,050
NPV	=	10%	660,037	16%	-21,050								
B/C Ratio	=	10%	1.54	16%	0.98								
EIRR	=	15.68%											

TABLE H - 25 EIRR (4) AT DELAY OF BENEFITS (2 YEARS)

Unit : Thousand Baht

No.	Year	Cost			Benefit		10% of discount			14% of discount				
		Agr.	Flood	O&M	Replacement	Total	Gross	Net	Total Cost	Benefit	Net Benefit	Total Cost	Benefit	Net Benefit
1	1992	16,331	0	0	0	16,331	0	-16,331	14,846	0	-14,846	14,325	0	-14,325
2	1993	127,867	0	0	0	127,867	0	-127,867	105,675	0	-105,675	98,390	0	-98,390
3	1994	375,261	0	0	0	375,261	0	-375,261	281,939	0	-281,939	253,290	0	-253,290
4	1995	558,339	0	0	0	558,339	0	-558,339	381,353	0	-381,353	330,582	0	-330,582
5	1996	393,014	11,127	0	0	404,141	0	-404,141	250,940	0	-250,940	209,898	0	-209,898
6	1997	0	14,422	0	0	14,422	0	-14,422	8,141	0	-8,141	6,570	0	-6,570
7	1998	0	14,422	0	0	14,422	0	-14,422	7,401	0	-7,401	5,764	0	-5,764
8	1999	0	14,422	0	0	14,422	307,460	293,038	6,728	143,432	136,704	5,056	107,783	102,727
9	2000	0	14,422	0	0	14,422	313,610	299,188	6,116	133,001	126,885	4,435	96,438	92,003
10	2001	0	14,422	0	0	14,422	319,760	305,338	5,560	123,281	117,721	3,890	86,253	82,363
11	2002	0	14,422	0	0	14,422	325,920	311,498	5,055	114,233	109,178	3,412	77,118	73,706
12	2003	0	14,422	0	0	14,422	332,100	317,678	4,595	105,817	101,222	2,993	68,930	65,937
13	2004	0	14,422	0	0	14,422	335,840	321,418	4,178	97,281	93,103	2,626	61,146	58,520
14	2005	0	14,422	0	0	14,422	339,750	325,328	3,798	89,467	85,669	2,303	54,261	51,958
15	2006	0	14,422	0	0	14,422	343,530	329,108	3,453	82,238	78,786	2,020	48,127	46,107
16	2007	0	14,422	0	0	14,422	347,310	332,888	3,139	75,585	72,446	1,772	42,681	40,909
17	2008	0	14,422	0	0	14,422	351,030	336,608	2,853	69,449	66,596	1,555	37,841	36,286
18	2009	0	14,422	0	0	14,422	351,030	336,608	2,594	63,136	60,542	1,364	33,194	31,830
19	2010	0	14,422	0	0	14,422	351,030	336,608	2,358	57,396	55,038	1,196	29,117	27,921
20	2011	0	14,422	0	0	14,422	351,030	336,608	2,144	52,178	50,035	1,049	25,542	24,492
21	2012	0	14,422	0	0	14,422	351,030	336,608	1,949	47,435	45,486	920	22,405	21,484
22	2013	0	14,422	0	0	14,422	351,030	336,608	1,772	43,123	41,351	807	19,653	18,846
23	2014	0	31,828	0	0	31,828	351,030	319,202	3,554	39,202	35,648	1,563	17,240	15,677
24	2015	0	16,492	0	0	16,492	351,030	334,538	1,674	35,639	33,964	710	15,123	14,412
25	2016	0	14,422	0	0	14,422	351,030	336,608	1,331	32,399	31,068	545	13,265	12,720
26	2017	0	14,422	0	0	14,422	351,030	336,608	1,210	29,453	28,243	478	11,636	11,158
27	2018	0	14,422	0	0	14,422	351,030	336,608	1,100	26,776	25,676	419	10,207	9,788
28	2019	0	14,422	0	0	14,422	351,030	336,608	1,000	24,342	23,342	368	8,954	8,586
29	2020	0	14,422	0	0	14,422	351,030	336,608	909	22,129	21,220	323	7,854	7,532
30	2021	0	14,422	0	0	14,422	351,030	336,608	827	20,117	19,291	283	6,890	6,607
Total		1,470,812	391,153	0	0	1,861,965	7,879,700	6,017,735	1,118,192	1,527,109	408,918	958,910	901,660	-57,249

NPV = 408,918
 B/C Ratio = 1.37
 EIRR = 13.31%

TABLE H - 26 EIRR (5) AT REDUCTION OF BENEFIT (10%) AND INCREASE OF COSTS (10%)

Unit : Thousand Baht

No.	Year	Cost			Benefit			10% of discount			15% of discount		
		Agri.	Flood	O&M	Total	Gross	Net	Total Cost	Benefit	Net Benefit	Total Cost	Benefit	Net Benefit
1	1992	17,964	0	0	17,964	0	-17,964	16,331	0	-16,331	15,621	0	-15,621
2	1993	140,654	0	0	140,654	0	-140,654	116,243	0	-116,243	106,354	0	-106,354
3	1994	412,787	0	0	412,787	0	-412,787	310,133	0	-310,133	271,414	0	-271,414
4	1995	614,173	0	0	614,173	0	-614,173	419,488	0	-419,488	351,155	0	-351,155
5	1996	432,315	12,240	0	444,555	0	-444,555	276,034	0	-276,034	221,022	0	-221,022
6	1997	0	15,864	0	15,864	276,714	260,850	8,955	156,198	147,243	6,859	119,631	112,773
7	1998	0	15,864	0	15,864	282,249	266,385	8,141	144,838	136,698	5,964	106,108	100,144
8	1999	0	15,864	0	15,864	287,784	271,920	7,401	134,253	126,853	5,186	94,077	88,891
9	2000	0	15,864	0	15,864	293,328	277,464	6,728	124,400	117,672	4,510	83,382	78,873
10	2001	0	15,864	0	15,864	298,890	283,026	6,116	115,235	109,119	3,921	73,881	69,960
11	2002	0	15,864	0	15,864	302,256	286,392	5,560	105,939	100,379	3,410	64,968	61,558
12	2003	0	15,864	0	15,864	305,775	289,911	5,055	97,429	92,375	2,965	57,152	54,186
13	2004	0	15,864	0	15,864	309,177	293,313	4,595	89,558	84,962	2,578	50,250	47,672
14	2005	0	15,864	0	15,864	312,579	296,715	4,178	82,312	78,134	2,242	44,176	41,934
15	2006	0	15,864	0	15,864	315,927	300,063	3,798	75,630	71,833	1,950	38,826	36,876
16	2007	0	15,864	0	15,864	315,927	300,063	3,453	68,755	65,302	1,695	33,761	32,066
17	2008	0	15,864	0	15,864	315,927	300,063	3,139	62,504	59,366	1,474	29,358	27,884
18	2009	0	15,864	0	15,864	315,927	300,063	2,853	56,822	53,969	1,282	25,529	24,247
19	2010	0	15,864	0	15,864	315,927	300,063	2,594	51,657	49,063	1,115	22,199	21,084
20	2011	0	15,864	0	15,864	315,927	300,063	2,358	46,961	44,602	969	19,303	18,334
21	2012	0	15,864	0	15,864	315,927	300,063	2,144	42,691	40,548	843	16,785	15,943
22	2013	0	15,864	0	15,864	315,927	300,063	1,949	38,810	36,862	733	14,596	13,863
23	2014	0	35,011	0	35,011	315,927	280,916	3,910	35,282	31,372	1,407	12,692	11,286
24	2015	0	18,141	0	18,141	315,927	297,786	1,842	32,075	30,233	634	11,037	10,403
25	2016	0	15,864	0	15,864	315,927	300,063	1,464	29,159	27,695	482	9,597	9,115
26	2017	0	15,864	0	15,864	315,927	300,063	1,331	26,508	25,177	419	8,345	7,926
27	2018	0	15,864	0	15,864	315,927	300,063	1,210	24,098	22,888	364	7,257	6,892
28	2019	0	15,864	0	15,864	315,927	300,063	1,100	21,907	20,807	317	6,310	5,993
29	2020	0	15,864	0	15,864	315,927	300,063	1,000	19,916	18,916	276	5,487	5,212
30	2021	0	15,864	0	15,864	315,927	300,063	909	18,105	17,196	240	4,771	4,532
Total		1,617,893	430,268	0	2,048,162	7,723,584	5,675,423	1,230,011	1,701,043	471,032	1,017,401	959,479	-57,922

NPV = 10% 471,032 15%
 B/C Ratio = 10% 1.38
 EIRR = 14.17%

TABLE H - 27 EIRR (6) AT REDUCTION OF BENEFIT (10%) AND DELAY OF BENEFIT (2 YEARS)

Unit : Thousand Baht

No.	Year	Cost			Benefit			10% of discount			13% of discount		
		Agri. Flood	O&M	Replacement	Total	Gross	Net	Total Cost	Benefit	Net Benefit	Total Cost	Benefit	Net Benefit
1	1992	16,331	0	0	16,331	0	-16,331	14,846	0	-14,846	14,452	0	-14,452
2	1993	127,867	0	0	127,867	0	-127,867	105,675	0	-105,675	100,139	0	-100,139
3	1994	375,261	0	0	375,261	0	-375,261	281,939	0	-281,939	260,075	0	-260,075
4	1995	558,339	0	0	558,339	0	-558,339	381,353	0	-381,353	342,440	0	-342,440
5	1996	393,014	11,127	0	404,141	0	-404,141	250,940	0	-250,940	219,352	0	-219,352
6	1997	0	14,422	0	14,422	0	-14,422	8,141	0	-8,141	6,927	0	-6,927
7	1998	0	14,422	0	14,422	0	-14,422	7,401	0	-7,401	6,130	0	-6,130
8	1999	0	14,422	0	14,422	276,714	262,292	6,728	129,089	122,361	5,425	104,089	98,664
9	2000	0	14,422	0	14,422	282,249	267,827	6,116	119,701	113,585	4,801	93,956	89,156
10	2001	0	14,422	0	14,422	287,784	273,362	5,560	110,953	105,393	4,249	84,778	80,529
11	2002	0	14,422	0	14,422	293,328	278,906	5,055	102,810	97,755	3,760	76,470	72,710
12	2003	0	14,422	0	14,422	298,890	284,468	4,595	95,236	90,640	3,327	68,956	65,628
13	2004	0	14,422	0	14,422	302,256	287,834	4,178	87,553	83,375	2,944	61,710	58,765
14	2005	0	14,422	0	14,422	305,775	291,353	3,798	80,520	76,722	2,606	55,246	52,641
15	2006	0	14,422	0	14,422	309,177	294,755	3,453	74,015	70,562	2,306	49,435	47,129
16	2007	0	14,422	0	14,422	312,579	298,157	3,139	68,026	64,888	2,041	44,229	42,188
17	2008	0	14,422	0	14,422	315,927	301,505	2,853	62,504	59,651	1,806	39,560	37,754
18	2009	0	14,422	0	14,422	315,927	301,505	2,594	56,822	54,228	1,598	35,009	33,410
19	2010	0	14,422	0	14,422	315,927	301,505	2,358	51,657	49,298	1,414	30,981	29,567
20	2011	0	14,422	0	14,422	315,927	301,505	2,144	46,961	44,817	1,252	27,417	26,165
21	2012	0	14,422	0	14,422	315,927	301,505	1,949	42,691	40,743	1,108	24,263	23,155
22	2013	0	14,422	0	14,422	315,927	301,505	1,772	38,810	37,039	980	21,471	20,491
23	2014	0	31,828	0	31,828	315,927	284,099	3,554	35,282	31,728	1,914	19,001	17,087
24	2015	0	16,492	0	16,492	315,927	299,435	1,674	32,075	30,400	878	16,815	15,937
25	2016	0	14,422	0	14,422	315,927	301,505	1,331	29,159	27,828	679	14,881	14,201
26	2017	0	14,422	0	14,422	315,927	301,505	1,210	26,508	25,298	601	13,169	12,568
27	2018	0	14,422	0	14,422	315,927	301,505	1,100	24,098	22,998	532	11,654	11,122
28	2019	0	14,422	0	14,422	315,927	301,505	1,000	21,907	20,907	471	10,313	9,842
29	2020	0	14,422	0	14,422	315,927	301,505	909	19,916	19,007	417	9,127	8,710
30	2021	0	14,422	0	14,422	315,927	301,505	827	18,105	17,279	369	8,077	7,768
Total		1,470,812	391,153	0	1,861,965	7,091,730	5,229,765	1,118,192	1,374,398	256,207	994,991	920,605	-74,386
NPV		=	10%	256,207				13%					
B/C Ratio		=	10%	1.23				13%					
EIRR		=	12.15%										

TABLE H - 28 EIRR (7) AT INCREASE OF COST (10%) AND DELAY OF BENEFIT (2 YEARS)

No.	Year	Cost			Benefit		10% of discount			13% of discount			
		Agri.	Flood	O&M	Total	Gross	Net	Total Cost	Benefit	Net Benefit	Total Cost	Benefit	Net Benefit
1	1992	17,964	0	0	17,964	0	-17,964	16,331	0	-16,331	15,897	0	-15,897
2	1993	140,654	0	0	140,654	0	-140,654	116,243	0	-116,243	110,152	0	-110,152
3	1994	412,787	0	0	412,787	0	-412,787	310,133	0	-310,133	286,082	0	-286,082
4	1995	614,173	0	0	614,173	0	-614,173	419,488	0	-419,488	376,684	0	-376,684
5	1996	432,315	12,240	0	444,555	0	-444,555	276,034	0	-276,034	241,287	0	-241,287
6	1997	0	15,864	0	15,864	0	-15,864	8,955	0	-8,955	7,620	0	-7,620
7	1998	0	15,864	0	15,864	0	-15,864	8,141	0	-8,141	6,743	0	-6,743
8	1999	0	15,864	0	15,864	307,460	291,596	7,401	143,432	136,032	5,967	115,654	109,687
9	2000	0	15,864	0	15,864	313,610	297,746	6,728	133,001	126,273	5,281	104,396	99,115
10	2001	0	15,864	0	15,864	319,760	303,896	6,116	123,281	117,165	4,673	94,198	89,524
11	2002	0	15,864	0	15,864	325,920	310,056	5,560	114,233	108,673	4,136	84,967	80,831
12	2003	0	15,864	0	15,864	332,100	316,236	5,055	105,817	100,762	3,660	76,617	72,957
13	2004	0	15,864	0	15,864	335,840	319,976	4,595	97,281	92,686	3,239	68,567	65,328
14	2005	0	15,864	0	15,864	339,750	323,886	4,178	89,467	85,289	2,866	61,385	58,519
15	2006	0	15,864	0	15,864	343,530	327,666	3,798	82,238	78,441	2,537	54,927	52,391
16	2007	0	15,864	0	15,864	347,310	331,446	3,453	75,585	72,132	2,245	49,143	46,898
17	2008	0	15,864	0	15,864	351,030	335,166	3,139	69,449	66,311	1,986	43,955	41,969
18	2009	0	15,864	0	15,864	351,030	335,166	2,853	63,136	60,283	1,758	38,898	37,140
19	2010	0	15,864	0	15,864	351,030	335,166	2,594	57,396	54,802	1,556	34,423	32,868
20	2011	0	15,864	0	15,864	351,030	335,166	2,358	52,178	49,820	1,377	30,463	29,086
21	2012	0	15,864	0	15,864	351,030	335,166	2,144	47,435	45,291	1,218	26,959	25,740
22	2013	0	15,864	0	15,864	351,030	335,166	1,949	43,123	41,174	1,078	23,857	22,779
23	2014	0	35,011	0	35,011	351,030	316,019	3,910	39,202	35,292	2,106	21,113	19,007
24	2015	0	18,141	0	18,141	351,030	332,889	1,842	35,639	33,797	966	18,684	17,718
25	2016	0	15,864	0	15,864	351,030	335,166	1,464	32,399	30,934	747	16,534	15,787
26	2017	0	15,864	0	15,864	351,030	335,166	1,331	29,453	28,122	661	14,632	13,971
27	2018	0	15,864	0	15,864	351,030	335,166	1,210	26,776	25,566	585	12,949	12,364
28	2019	0	15,864	0	15,864	351,030	335,166	1,100	24,342	23,242	518	11,459	10,941
29	2020	0	15,864	0	15,864	351,030	335,166	1,000	22,129	21,129	458	10,141	9,682
30	2021	0	15,864	0	15,864	351,030	335,166	909	20,117	19,208	406	8,974	8,569
Total		1,617,893	430,268	0	2,048,162	7,879,700	5,831,539	1,230,011	1,527,109	297,098	1,094,490	1,022,894	-71,595
NPV		10%	297,098	13%	-71,595								
B/C Ratio		10%	1.24	13%	0.93								
EIRR													12.26%

Unit : Thousand Baht

TABLE H - 29 EIRR (8) AT REDUCTION OF BENEFIT (10%), INCREASE OF COSTS (10%) AND DELAY OF BENEFIT (2 YEARS)

Unit : Thousand Baht

No.	Year	Cost			Benefit		10% of discount			12% of discount			
		Agn. Flood	O&M	Replacement	Total	Gross	Net	Total Cost	Benefit	Net Benefit	Total Cost	Benefit	Net Benefit
1	1992	17,964	0	0	17,964	0	-17,964	16,331	0	-16,331	16,039	0	-16,039
2	1993	140,654	0	0	140,654	0	-140,654	116,243	0	-116,243	112,128	0	-112,128
3	1994	412,787	0	0	412,787	0	-412,787	310,133	0	-310,133	293,814	0	-293,814
4	1995	614,173	0	0	614,173	0	-614,173	419,488	0	-419,488	390,318	0	-390,318
5	1996	432,315	12,240	0	444,555	0	-444,555	276,034	0	-276,034	252,253	0	-252,253
6	1997	0	15,864	0	15,864	0	-15,864	8,955	0	-8,955	8,037	0	-8,037
7	1998	0	15,864	0	15,864	0	-15,864	8,141	0	-8,141	7,176	0	-7,176
8	1999	0	15,864	0	15,864	276,714	260,850	7,401	129,089	121,688	6,407	111,760	105,353
9	2000	0	15,864	0	15,864	282,249	266,385	6,728	119,701	112,973	5,721	101,782	96,061
10	2001	0	15,864	0	15,864	287,784	271,920	6,116	110,953	104,837	5,108	92,659	87,551
11	2002	0	15,864	0	15,864	293,328	277,464	5,560	102,810	97,249	4,561	84,325	79,764
12	2003	0	15,864	0	15,864	298,890	283,026	5,055	95,236	90,181	4,072	76,718	72,646
13	2004	0	15,864	0	15,864	302,256	286,392	4,595	87,553	82,958	3,636	69,269	65,634
14	2005	0	15,864	0	15,864	305,775	289,911	4,178	80,520	76,343	3,246	62,568	59,321
15	2006	0	15,864	0	15,864	309,177	293,313	3,798	74,015	70,217	2,898	56,485	53,587
16	2007	0	15,864	0	15,864	312,579	296,715	3,453	68,026	64,574	2,588	50,988	48,401
17	2008	0	15,864	0	15,864	315,927	300,063	3,139	62,504	59,366	2,311	46,013	43,702
18	2009	0	15,864	0	15,864	315,927	300,063	2,853	56,822	53,969	2,063	41,083	39,020
19	2010	0	15,864	0	15,864	315,927	300,063	2,594	51,657	49,063	1,842	36,681	34,839
20	2011	0	15,864	0	15,864	315,927	300,063	2,358	46,961	44,602	1,645	32,751	31,107
21	2012	0	15,864	0	15,864	315,927	300,063	2,144	42,691	40,548	1,468	29,242	27,774
22	2013	0	15,864	0	15,864	315,927	300,063	1,949	38,810	36,862	1,311	26,109	24,798
23	2014	0	35,011	0	35,011	315,927	280,916	3,910	35,282	31,372	2,583	23,312	20,728
24	2015	0	18,141	0	18,141	315,927	297,786	1,842	32,075	30,233	1,195	20,814	19,619
25	2016	0	15,864	0	15,864	315,927	300,063	1,464	29,159	27,695	933	18,584	17,651
26	2017	0	15,864	0	15,864	315,927	300,063	1,331	26,508	25,177	833	16,593	15,760
27	2018	0	15,864	0	15,864	315,927	300,063	1,210	24,098	22,888	744	14,815	14,071
28	2019	0	15,864	0	15,864	315,927	300,063	1,100	21,907	20,807	664	13,228	12,563
29	2020	0	15,864	0	15,864	315,927	300,063	1,000	19,916	18,916	593	11,810	11,217
30	2021	0	15,864	0	15,864	315,927	300,063	909	18,105	17,196	530	10,545	10,015
Total		1,617,893	430,268	0	2,048,162	7,091,730	5,043,569	1,230,011	1,374,398	144,387	1,136,717	1,048,133	-88,583
NPV	=	10%						144,387			12%		
B/C Ratio	=	10%						1.12			12%		
FIRR	=	11.14%											

TABLE H - 30 EIRR (9) FOR AGRICULTURAL DEVELOPMENT ONLY

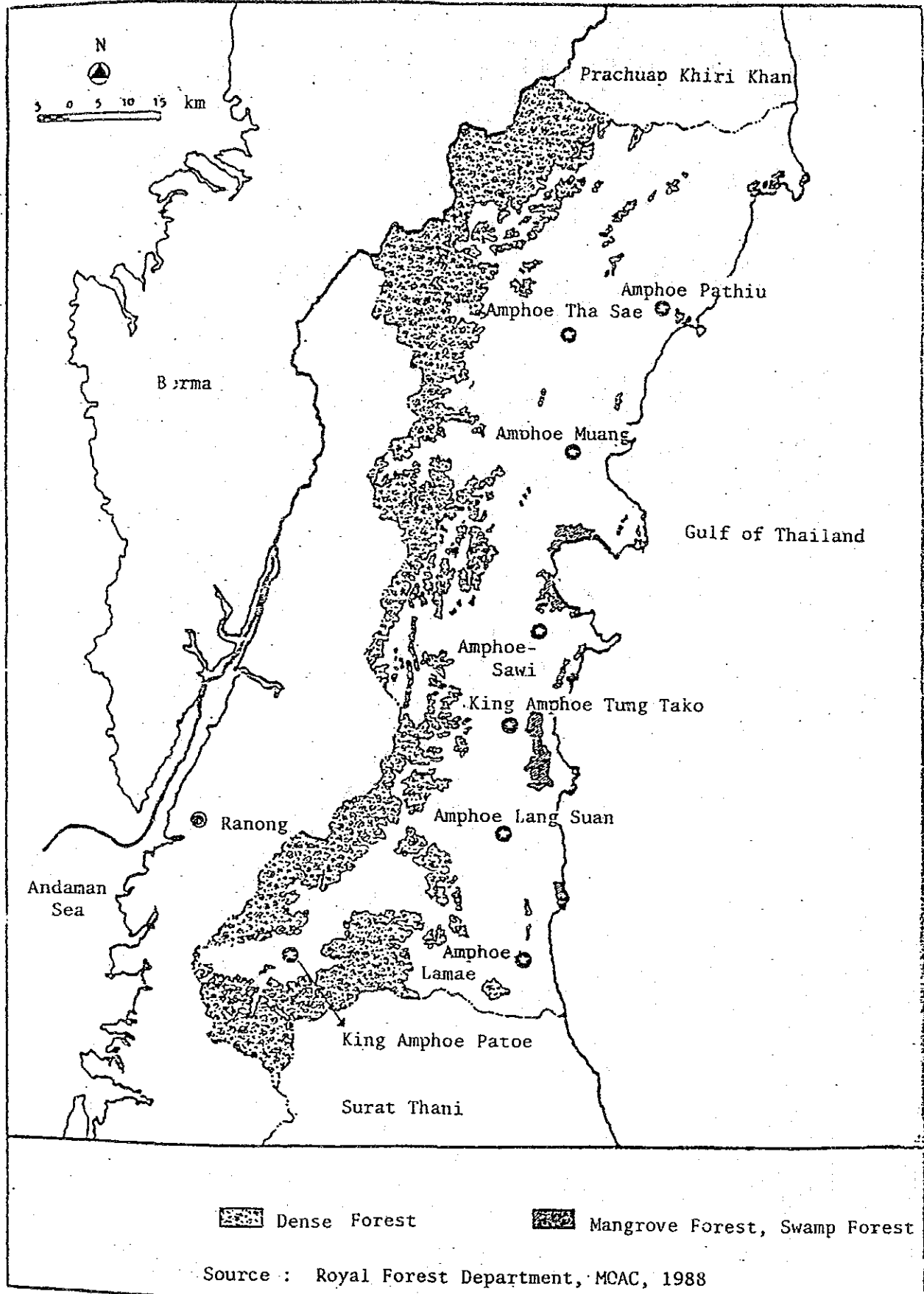
No.	Year	Cost				Benefit			9% of discount			10% of discount			Unit : Thousand Baht
		Agri	O&M	Replacement	Total	Gross	Net	Total Cost	Benefit	Net Benefit	Total Cost	Benefit	Net Benefit		
1	1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1993	9,213	0	0	9,213	0	-9,213	7,754	0	-7,754	7,614	0	-7,614	0	-7,614
3	1994	57,773	0	0	57,773	0	-57,773	44,611	0	-44,611	43,406	0	-43,406	0	-43,406
4	1995	112,769	0	0	112,769	0	-112,769	79,888	0	-79,888	77,023	0	-77,023	0	-77,023
5	1996	70,202	1,550	0	71,752	0	-71,752	46,634	0	-46,634	44,552	0	-44,552	0	-44,552
6	1997	0	4,845	0	4,845	6,160	1,315	2,889	3,673	784	2,755	3,477	742	3,477	742
7	1998	0	4,845	0	4,845	12,310	7,465	2,650	6,734	4,084	2,486	6,317	3,831	6,317	3,831
8	1999	0	4,845	0	4,845	18,460	13,615	2,432	9,264	6,833	2,260	8,612	6,351	8,612	6,351
9	2000	0	4,845	0	4,845	24,620	19,775	2,231	11,336	9,105	2,055	10,441	8,387	10,441	8,387
10	2001	0	4,845	0	4,845	30,800	25,955	2,047	13,010	10,964	1,868	11,875	10,007	11,875	10,007
11	2002	0	4,845	0	4,845	34,540	29,695	1,878	13,385	11,508	1,698	12,106	10,408	12,106	10,408
12	2003	0	4,845	0	4,845	38,450	33,605	1,723	13,670	11,948	1,544	12,251	10,708	12,251	10,708
13	2004	0	4,845	0	4,845	42,230	37,385	1,580	13,775	12,194	1,403	12,233	10,829	12,233	10,829
14	2005	0	4,845	0	4,845	46,010	41,165	1,450	13,768	12,318	1,276	12,116	10,840	12,116	10,840
15	2006	0	4,845	0	4,845	49,730	44,885	1,330	13,653	12,323	1,160	11,905	10,745	11,905	10,745
16	2007	0	4,845	0	4,845	49,730	44,885	1,220	12,525	11,305	1,054	10,823	9,768	10,823	9,768
17	2008	0	4,845	0	4,845	49,730	44,885	1,120	11,491	10,372	959	9,839	8,880	9,839	8,880
18	2009	0	4,845	0	4,845	49,730	44,885	1,027	10,542	9,515	871	8,944	8,073	8,944	8,073
19	2010	0	4,845	0	4,845	49,730	44,885	942	9,672	8,730	792	8,131	7,339	8,131	7,339
20	2011	0	4,845	0	4,845	49,730	44,885	864	8,873	8,009	720	7,392	6,672	7,392	6,672
21	2012	0	4,845	0	4,845	49,730	44,885	793	8,141	7,348	655	6,720	6,065	6,720	6,065
22	2013	0	4,845	0	4,845	49,730	44,885	728	7,469	6,741	595	6,109	5,514	6,109	5,514
23	2014	0	22,251	0	22,251	49,730	27,479	3,066	6,852	3,786	2,485	5,554	3,069	5,554	3,069
24	2015	0	6,915	0	6,915	49,730	42,815	874	6,286	5,412	702	5,049	4,347	5,049	4,347
25	2016	0	4,845	0	4,845	49,730	44,885	562	5,767	5,205	447	4,590	4,143	4,590	4,143
26	2017	0	4,845	0	4,845	49,730	44,885	515	5,291	4,775	407	4,173	3,766	4,173	3,766
27	2018	0	4,845	0	4,845	49,730	44,885	473	4,854	4,381	370	3,793	3,424	3,793	3,424
28	2019	0	4,845	0	4,845	49,730	44,885	434	4,453	4,019	336	3,448	3,112	3,448	3,112
29	2020	0	4,845	0	4,845	49,730	44,885	398	4,086	3,688	305	3,135	2,830	3,135	2,830
30	2021	0	4,845	0	4,845	49,730	44,885	365	3,748	3,383	278	2,850	2,572	2,850	2,572
Total		249,957	142,151		392,108	1,049,260	657,152	212,478	222,320	9,841	202,056	191,883	-10,173		-10,173
NPV			9%	9,841				10%							
B/C Ratio			9%	1.05				10%							
EIRR			9.46%												

TABLE H - 31 EIRR (10) FOR FLOOD CONTROL ONLY

Unit : Thousand Baht

No.	Year	Cost			Benefit			10% of discount			19% of discount		
		Flood Con.	O&M	Replacement	Total	Gross	Net	Total Cost	Benefit	Net Benefit	Total Cost	Benefit	Net Benefit
1	1992	16,331	0	0	16,331	0	-16,331	14,846	0	-14,846	13,724	0	-13,724
2	1993	118,654	0	0	118,654	0	-118,654	98,061	0	-98,061	83,789	0	-83,789
3	1994	317,488	0	0	317,488	0	-317,488	238,533	0	-238,533	188,402	0	-188,402
4	1995	445,570	0	0	445,570	0	-445,570	304,330	0	-304,330	222,192	0	-222,192
5	1996	322,812	9,577	0	332,389	0	-332,389	206,387	0	-206,387	139,287	0	-139,287
6	1997	0	9,577	0	9,577	301,300	291,723	5,406	170,076	164,670	3,372	106,100	102,728
7	1998	0	9,577	0	9,577	301,300	291,723	4,915	154,615	149,700	2,834	89,160	86,326
8	1999	0	9,577	0	9,577	301,300	291,723	4,468	140,559	136,091	2,382	74,924	72,543
9	2000	0	9,577	0	9,577	301,300	291,723	4,062	127,781	123,719	2,001	62,962	60,960
10	2001	0	9,577	0	9,577	301,300	291,723	3,692	116,164	112,472	1,682	52,909	51,227
11	2002	0	9,577	0	9,577	301,300	291,723	3,357	105,604	102,247	1,413	44,461	43,048
12	2003	0	9,577	0	9,577	301,300	291,723	3,052	96,003	92,952	1,188	37,362	36,175
13	2004	0	9,577	0	9,577	301,300	291,723	2,774	87,276	84,502	998	31,397	30,399
14	2005	0	9,577	0	9,577	301,300	291,723	2,522	79,342	76,820	839	26,384	25,545
15	2006	0	9,577	0	9,577	301,300	291,723	2,293	72,129	69,836	705	22,171	21,467
16	2007	0	9,577	0	9,577	301,300	291,723	2,084	65,572	63,487	592	18,631	18,039
17	2008	0	9,577	0	9,577	301,300	291,723	1,895	59,611	57,716	498	15,657	15,159
18	2009	0	9,577	0	9,577	301,300	291,723	1,723	54,191	52,469	418	13,157	12,739
19	2010	0	9,577	0	9,577	301,300	291,723	1,566	49,265	47,699	351	11,056	10,705
20	2011	0	9,577	0	9,577	301,300	291,723	1,424	44,786	43,363	295	9,291	8,996
21	2012	0	9,577	0	9,577	301,300	291,723	1,294	40,715	39,421	248	7,808	7,559
22	2013	0	9,577	0	9,577	301,300	291,723	1,176	37,013	35,837	209	6,561	6,352
23	2014	0	9,577	0	9,577	301,300	291,723	1,070	33,649	32,579	175	5,513	5,338
24	2015	0	9,577	0	9,577	301,300	291,723	972	30,590	29,617	147	4,633	4,486
25	2016	0	9,577	0	9,577	301,300	291,723	884	27,809	26,925	124	3,893	3,770
26	2017	0	9,577	0	9,577	301,300	291,723	804	25,281	24,477	104	3,272	3,168
27	2018	0	9,577	0	9,577	301,300	291,723	731	22,982	22,252	87	2,749	2,662
28	2019	0	9,577	0	9,577	301,300	291,723	664	20,893	20,229	73	2,310	2,237
29	2020	0	9,577	0	9,577	301,300	291,723	604	18,994	18,390	62	1,941	1,880
30	2021	0	9,577	0	9,577	301,300	291,723	549	17,267	16,718	52	1,632	1,580
Total		1,220,855	249,002	0	1,469,857	7,532,500	6,062,643	916,136	1,698,165	782,029	668,244	655,937	-12,307
NPV		=		10%	782,029	19%		-12,307					
B/C Ratio		=		10%	1.85	19%		0.98					
EIRR		=		18.69%									

FIGURE H - 5 FOREST AREA IN CHUMPHON AREA



RID MATERIALS ON ENVIRONMENT

- (1) Environmental Overview
- (2) Probable Significant Area of Environmental Impacts
- (3) Pictures of Prehistoric Remains

(1). ENVIRONMENTAL OVERVIEW

Being flanked by the Tenasserim and the Gulf the province of Chumphon (CP) abounds in natural resources both in land and on sea. The area is subject to both Northeast and Southwest monsoon which bring in a considerable amount of rainfall through a year and among these main components the air temperature of CP has been maintained in a comfortable/narrow range of 25 - 29°C.

CP river basin located in the 3 northernmost districts of 2,880 sq.km, namely Tasae, Pathieu and Muang districts. Despite annual flood on low-lying area of Muang district and occasional heavy storm/flood over the whole basin, CP community has been existed in this peninsular long before 1490. Although there were some indications of the existence of CP community long before in the nearby areas of the present provincial seat, surface evidence/ancient site were hardly found. Natural catastrophes and wars were, perhaps, the 2 main destructive mechanisms.

Based on natural resources people of the 3 districts of about 210,000 individuals enjoy varieties of occupation, for instance, horticulture of coconut, coffee, oil palm, rubber and fruits, fishery/aquaculture and its related enterprises. In former days CP was an important source of terrestrial forest and mangrove.

	1975	early 1989
Forest (sq.km)	2,090	1,420
Mangrove (sq.km)	46,250	9,570

It should be noted that the size of a forest area often raises argument and to this point of November 1989, 600 sq.km, is of an argument. The heavy storm of November 1989 (Typhoon Gay) destructed the terrestrial bionics immensely.

CP watershed of about 80 × 15 sq.km covers a part of the Tenasserim range and its drainage pattern is a dendritic form flowing N - S and W - E later on before passing the provincial seat some 10 km downstream from the confluence of Rubroh and Tasae tributaries. Natural runoff usually caused 2 peak periods during August and November. Overbanking / annual flood in low-lying area, the provincial seat in particular, and drought during January - May are common

phenomenas of the basin. However shortage of water for rural domestic is gradually become crucial problems.

Generally those areas of hilly / mountainous features are regarded as natural protection areas under various degree of conservation ranging from natural forest reserve, watershed classification zones to wildlife sanctuary.

Sedimentary rock of Silurium - Devonian age predominate the basin geologic formation. It was learnt that crustal activities during ancient periods resulted in granitic intrusions to the area which are generally responsible for tin deposits. This acknowledgement is confirmed by 60 mining concessions permitted in CP area in which 10 mines ha been undertaking and among these 9 mines are of tin minings.

As to seismicity, the CP area has been learnt as being far from the earthquake epicenter, but fault zone in certain area is indicated.

Downstream area of provincial seat, where natural runoff join the sea, proliferation of aquatic production is strongly indicated in form of multi-related fishery activities / structures which contribute to a large part of provincial earning. Thousands of people join those activities. It has been also reported that CP coastal area is a significant nursery area of *Rastrelliger brachsoma*, one of the most precious species both in term of economic and nutrition.

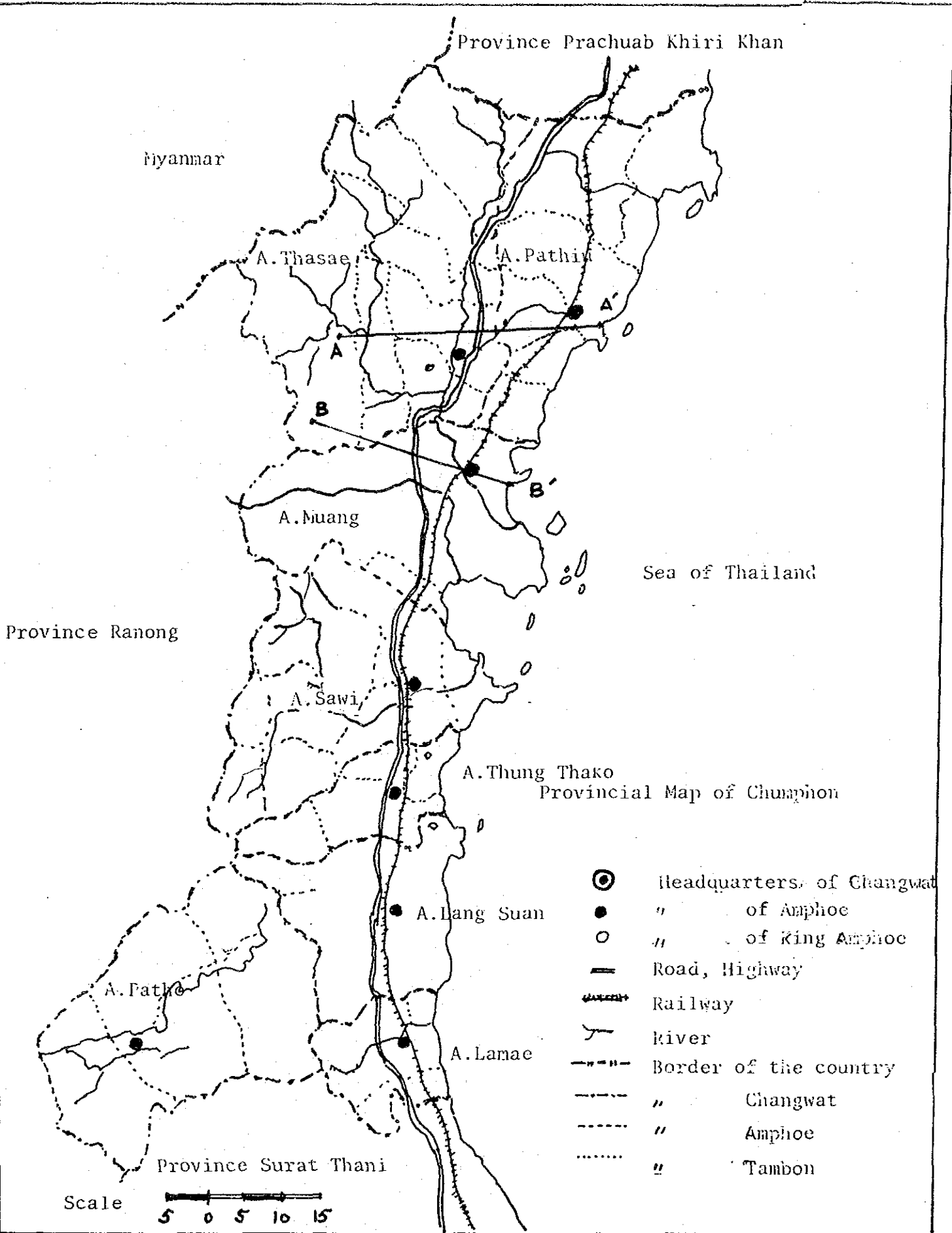
CP basin during these days is a transform period from the catastrophic condition in 1989 to a more man - made condition stemming from multi-project plannings for resource utilizations, including land use, land allocation, reforestation, air port, industry, environmental enhancement, tourism, irrigation and water resources development.

Water resources development, in principle, caused a wide range of effects on the environment both positive and negative, short and long term effects. While the CP basin shown diversified environmental resources with large areas of development, environmental issues now a day draw a spectrum of concerned groups / institutes/interests. The Environmental Impact Assessment (EIA) of a project is thus normally required a wide spectrum of study.

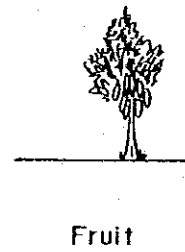
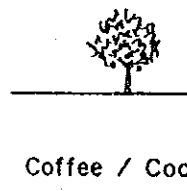
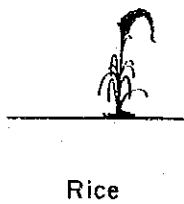
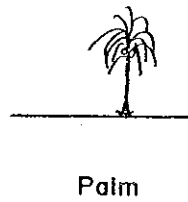
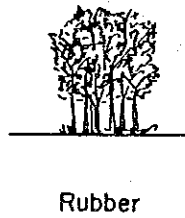
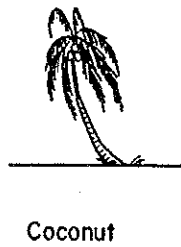
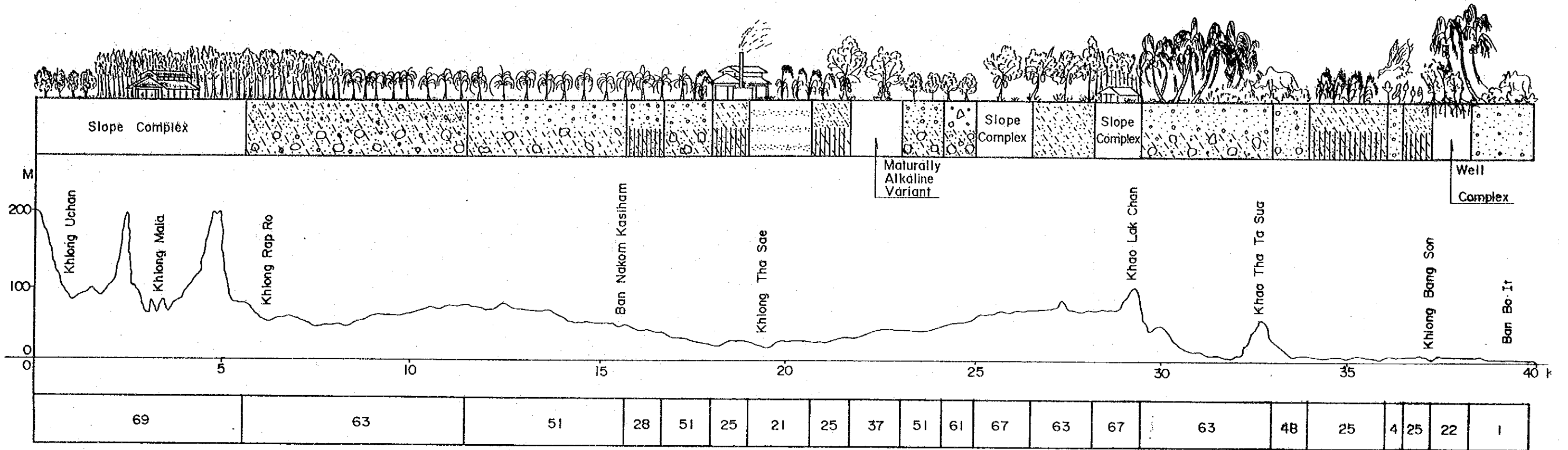
Following the Environmental Quality Enhancement Act as of 1975 the National Environment Board (NEB) issued a Guidelines for preparation of EIA in 1979. Enforcement was undertaken by a proclamation of Ministerial regulation of the Sciences and Technology Ministry (1981) specifying project category in term of types and sizes which are obliged to prepare the EIA for project approval. A dam / reservoir, irrigation project of not less than 100 MCM in capacity (or, 15 sq.km inundated area) and 12,800 ha respectively are regarded as under the regulation. OECF of Japan also issued the Environmental Guidelines of various development projects, including hydropower and irrigation projects. The first version is of October 1989. The 2 guidelines require wide range of EIA which include the identification of mitigation measures, but OECF also expresses her concerned of those environmental NGOs.

SALIENT ENVIRONMENTAL ASPECTS

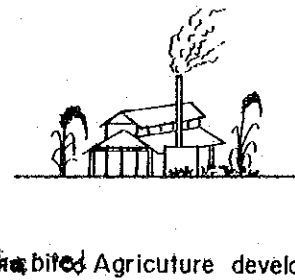
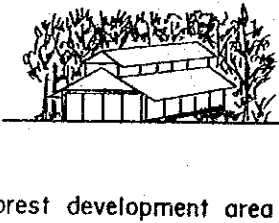
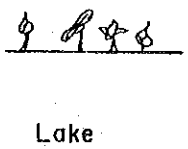
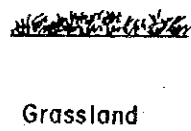
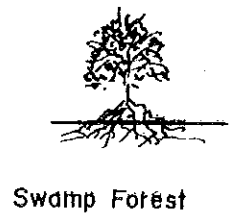
Aspect Scheme	Reservoir	Irrigation	Shortcut
Flood / Drought / Regulated flow	○	○	○
Soil degradation		○	
Fault / Limestone / Quarry / Tunneling	○		
Water table / Water logging	○	○	
Salinity intrusion	○		○
Water quality	○	○	
Erosion / Sedimentation	○	○	
Nutrient budget to the estuary	○	○	○
Nursery area	○	○	○
Reservoir ecosystem	○		
Watershed / Forestry / Wildlife	○		
Pest control / Agri. pattern		○	
Aquaculture / Fishery	○	○	○
Water supply	○	○	
Industry / Related development	○	○	
Mineral development	○		
Landuse	○	○	○
Socio - economic	○	○	
Compensation / Resettlement	○		
Historical / Archaeological			○
Public health	○	○	



Section A - A'



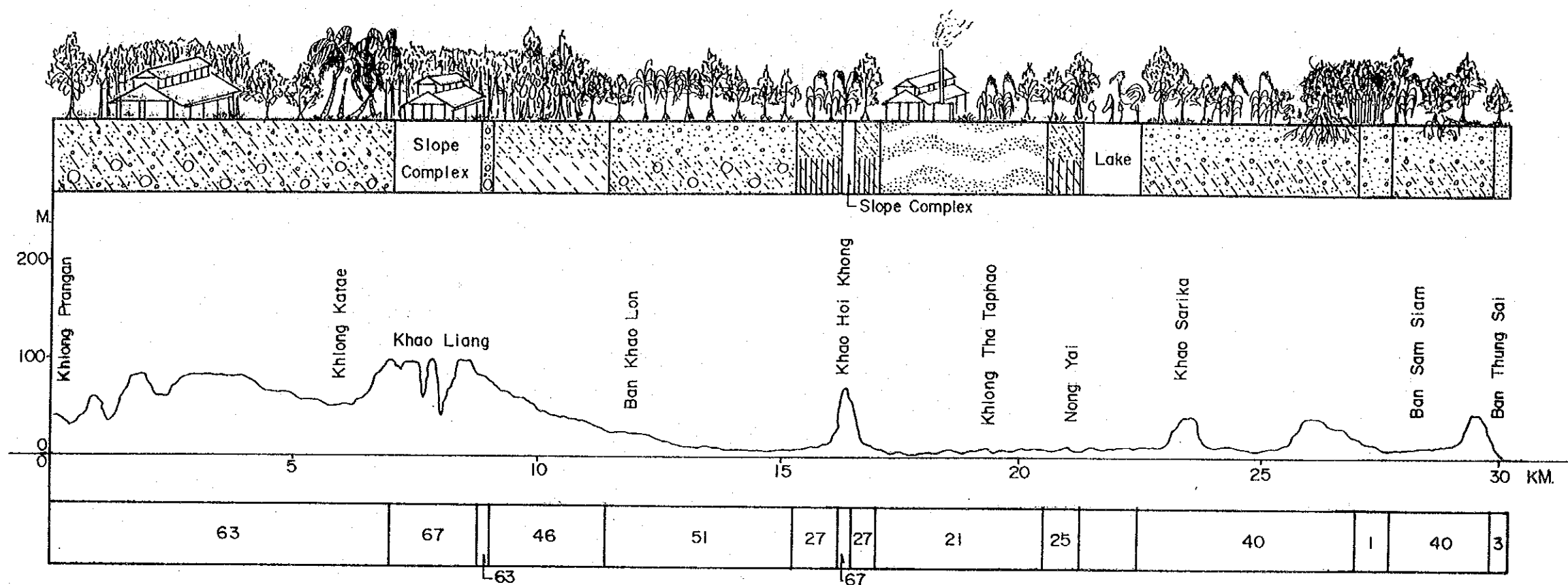
- Silt
- Clay
- Loam
- Sand
- Gravel
-



Japan International Cooperation Agency

The Integrated Agriculture and Water Resources Development Project of The Mendum Chumphon Basin

Section B - B'



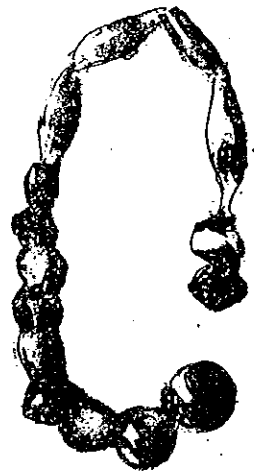
Source of Data

1. Reconnaissance soil map. (DLD. 1972)
2. Landuse planning for affected area after heavy storm. (Gay) (DLD. 1990)
3. 1: 50,000 Topographic map. (Dept of Army - survey 1968)
4. Field survey. (Aug. 1990 and Nov. 1991)

(2) Probable Significant Areas of Environmental Impacts

1. Existing utilization of the Nong Yai lake, particularly for fishery, water uses and lake ecology.
2. Probable impact on the twin estuary-ecology, particularly the Nutrient budget, hydro/sediment regime as well as the impact of salt water intrusion in water channel and nursery ground on Chumphon coastal area.
3. Transfer of flood zone from the provincial seat to the upper area is probably affected the existing landuse, residential, aquaculture, communication, public health as well as the ecology of a plot of Mangrove forest and drainage of lowlying areas.
4. Recommendation should be made on long term monitoring for the equality and watertable of groundwater in the vicinity as well as for the provision of adequate Drainage on the proposed irrigated areas.
5. Investigation should be made over the two deserted mines in Tasae District. Those are of Tim and Antimony mines, for further monitoring on water quality, during implementation phase.
6. Local inhabitants along the canal route as made are of directed effects. Plan/ process/ criteria for mitigation should be addressed, probably in terms of compensation and rehabilitation.
7. During 1980 a number of archaeological evidence were found, in the proposed project area, There are 3 metal drums, bead strings and bracelet. These kinds of cultural values should prevented from destruction by any project scheme, particularly the excavation activities.

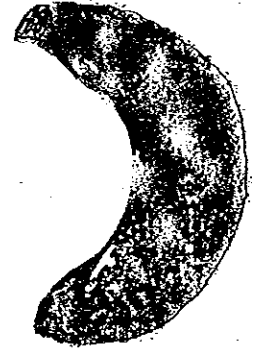
(3) Pictures of Prehistoric Remians



- Prehistoric remains found at Same Kaew hill

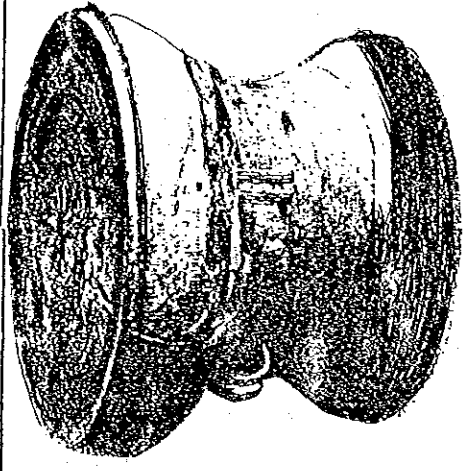
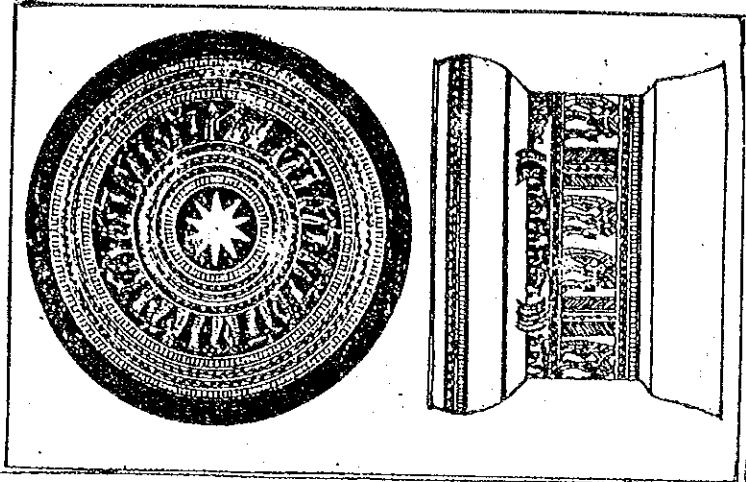
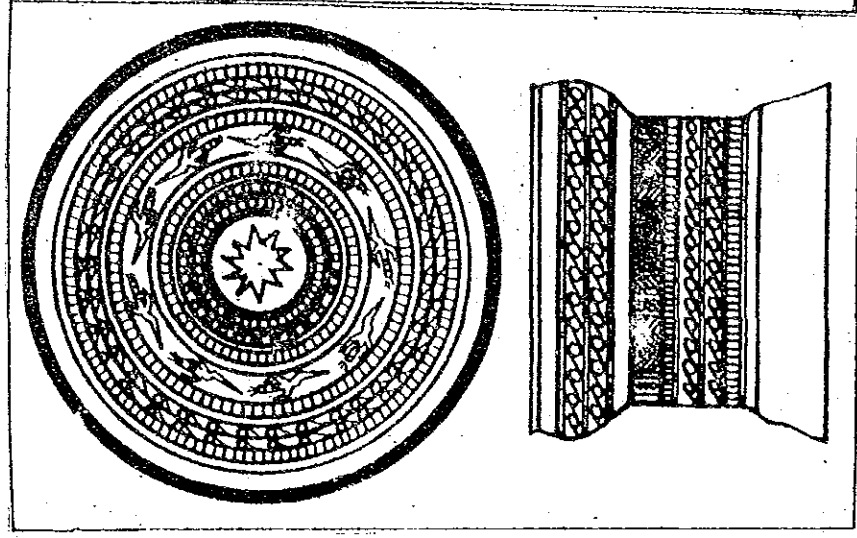


- Head strings



Bracelet

Metal drums found at Sam Kaew hill



APPENDIX I. DRAWINGS

CONTENTS

APPENDIX I. DRAWINGS

- I - 1 Water Resources Development Plan of The Menam Chumphon Basin
- I - 2 Administrative Map of The Study Area
- I - 3 Social Land Use Map
- I - 4 Location Map of Existing projects
- I - 5 Location Map of Meteorology and Hydrology Gauging Stations for Flood Warning Projects
- I - 6 General Plan of Nong Yai Irrigation Project
- I - 7 Administrative Map of Amphoe Muang Chumphon
- I - 8 Infrastructure Map
- I - 9 Location Map of Geological Survey
- I - 10 Geological Cross Section at Site 1, 2, 3
- I - 11 Geological Cross Section at Site 4~11
- I - 12 Geological Cross Section Along Pak Phraek Canal, Irrigation Canal
- I - 13 Geological Cross Section Along Hua Wang Phanang Tuk Canal
- I - 14 Geological Cross Section Along Sam Kaeo Canal (1/2)
- I - 15 Geological Cross Section Along Sam Kaeo Canal (2/2)
- I - 16 Profile of Dike and Road of Nong Yai Reservoir
- I - 17 Nong Yai Project Irrigation Diagram (1/2)
- I - 18 Nong Yai Project Irrigation Diagram (2/2)
- I - 19 Profile of Main Irrigation Canal Block-A, B
- I - 20 Profile of Main Irrigation Canal Block-B, E
- I - 21 Profile of Main Irrigation Canal Block-G (1/2)
- I - 22 Profile of Main Irrigation Canal Block-G (2/2)
- I - 23 Design of Pak Phraek Canal Weir and Bridge at National Road Route-4
- I - 24 Design of Upper Hua Wang Phanang Tuk Canal Weir
- I - 25 Design of Lower Hua Wang Phanang Tuk Canal Weir and Gates (1/2)
- I - 26 Design of Lower Hua Wang Phanang Tuk Canal Weir and Gates (2/2)
- I - 27 Design of Pumping Station at Nong Yai Reservoir Block-B
- I - 28 Plan of Dredging at Estuary of Tha Taphao River (Thai Harbor Dep.)
- I - 29 Plan of Livestock Model Farm
- I - 30 Plan of Nachaang Market
- I - 31 Dike and Road of Nong Yai Reservoir

WATER RESOURCES DEVELOPMENT PLAN OF THE MENAM CHUMPHON BASIN

(流域水資源開發計畫一般図)

BLAUKTUNG RANGE

MYANMAR

PHRACHUAP KHIRI KHAN
PROVINCE

CHUMPHON PROVINCE

GULF OF
THAILAND

UPPER RAP RO
RESERVOIR

RAP RO BASIN

RAP RO
RESERVOIR

NAM RON
RESERVOIR

KAPHON
RESERVOIR

UPPER KUM
RESERVOIR

THA SAE
RESERVOIR

THA SAE BASIN

THA SAE RIVER

RAP RO RIVER

PAK PHRAEK CANAL

NONG YAI PROJECT AREA

HUA WANG-PHANANG TUK CANAL

NONG YAI
SWAMP

SAM KAEO CANAL

PHANANG TUK
RIVER

THA TAPHAO RIVER

CHUMPHON RIVER

CHUMPHON BASIN

CHUMPHON
CITY

THA TAPHAO
BASIN

RIVER	D.A. (Km ²)
THA SAE	1,016
RAP RO	803
THA TAPHAO	357
CHUMPHON	449
TOTAL	2,625

LEGEND

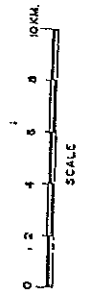
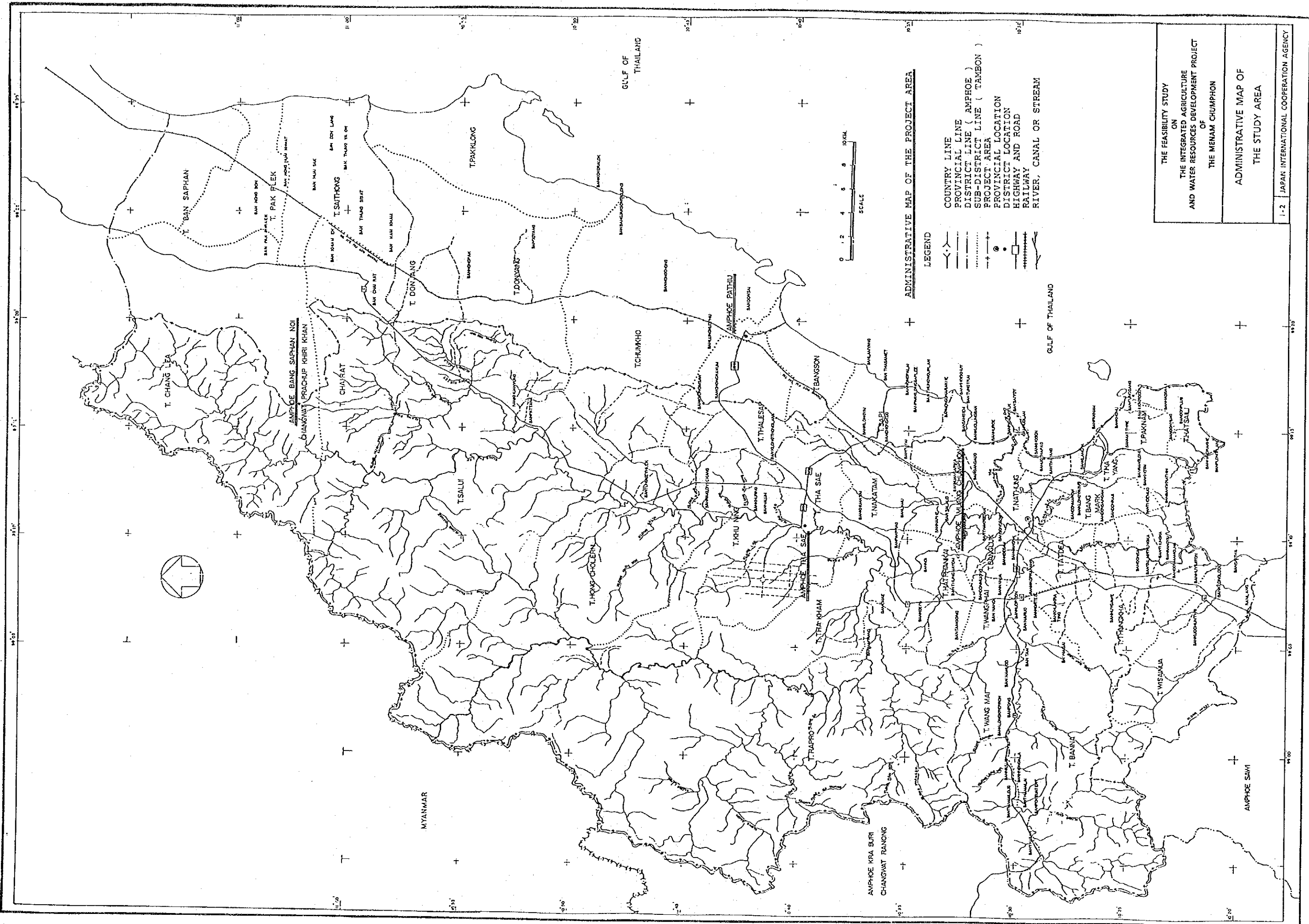
- BASIN BOUNDARY
- - - - SUB-BASIN BOUNDARY
- ==== CANAL



THE FEASIBILITY STUDY
ON
THE INTEGRATED AGRICULTURE
AND WATER RESOURCES DEVELOPMENT PROJECT
OF
THE MENAM CHUMPHON

WATER RESOURCES DEVELOPMENT PLAN
OF THE MENAM CHUMPHON BASIN

1-1 JAPAN INTERNATIONAL COOPERATION AGENCY



ADMINISTRATIVE MAP OF THE PROJECT AREA

LEGEND

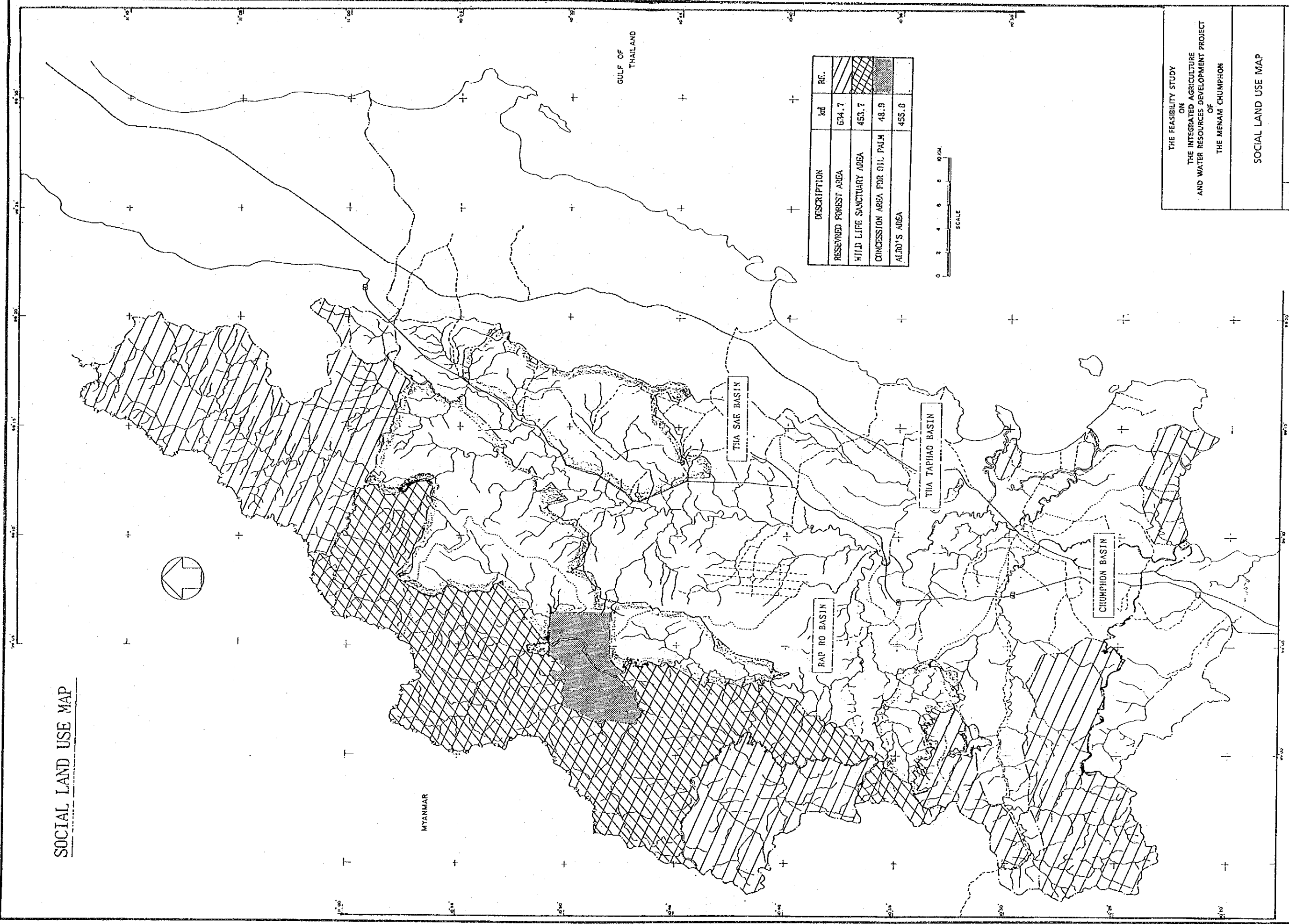
- COUNTRY LINE
- PROVINCIAL LINE
- DISTRICT LINE (AMPHOE)
- SUB-DISTRICT LINE (TAMBON)
- PROJECT AREA
- PROVINCIAL LOCATION
- DISTRICT LOCATION
- HIGHWAY AND ROAD
- RAILWAY
- RIVER, CANAL OR STREAM

THE FEASIBILITY STUDY
ON
THE INTEGRATED AGRICULTURE
AND WATER RESOURCES DEVELOPMENT PROJECT
OF
THE MENAM CHUMPHON

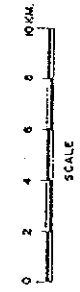
ADMINISTRATIVE MAP OF
THE STUDY AREA

1-2 JAPAN INTERNATIONAL COOPERATION AGENCY

SOCIAL LAND USE MAP



DESCRIPTION	km ²	RE.
RESERVED FOREST AREA	634.7	[Diagonal Hatching]
WILD LIFE SANCTUARY AREA	453.7	[Cross-hatching]
CONCESSION AREA FOR OIL PALM	48.9	[Solid Grey]
ALDO'S AREA	455.0	[Diagonal Hatching]



THE FEASIBILITY STUDY
ON
THE INTEGRATED AGRICULTURE
AND WATER RESOURCES DEVELOPMENT PROJECT
OF
THE MENAM CHUMPHON

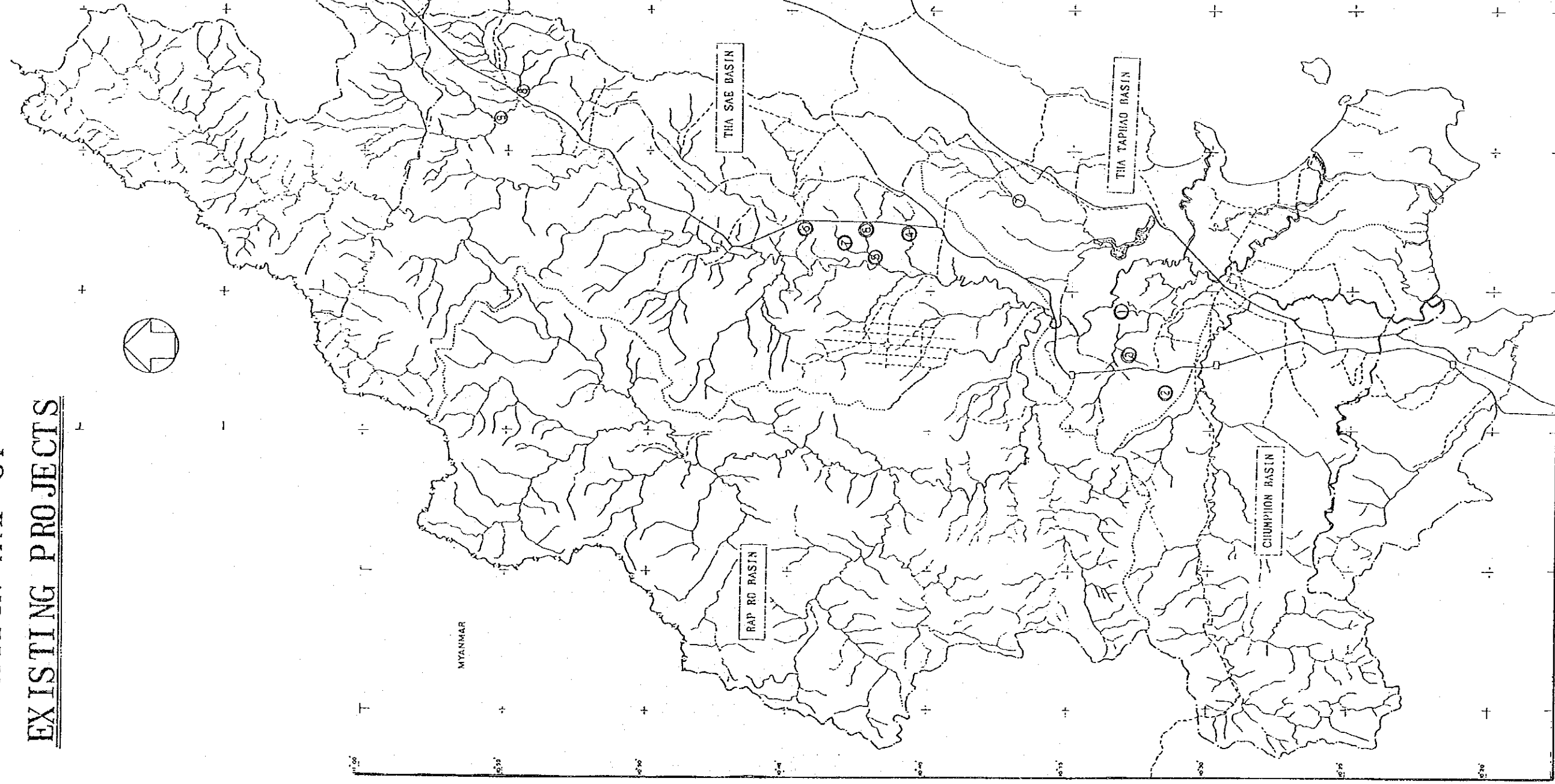
SOCIAL LAND USE MAP

1-3 JAPAN INTERNATIONAL COOPERATION AGENCY

LOCATION MAP OF EXISTING PROJECTS

LIST OF EXISTING WEIRS (KOR SOR CHOR PROJECT)

No	Amphoe	Project Name	Beneficial Area (raisi)
1	Muang	Ma Yang Weir	
2	ditto	Huai Ra Kam Weir	
3	ditto	Ban Khao Lan Weir	
4	Tha Sae	Kio, Ta Ko Weir	
5	ditto	Kio, Khuring Weir (No1)	
6	ditto	Kio, Khuring Weir (No2)	
7	ditto	Kio, Tak Weir	
8	ditto	Kio, Ka Po Weir	
9	Pathiew	Kio, Wang Chang Weir	
Total			9 projects



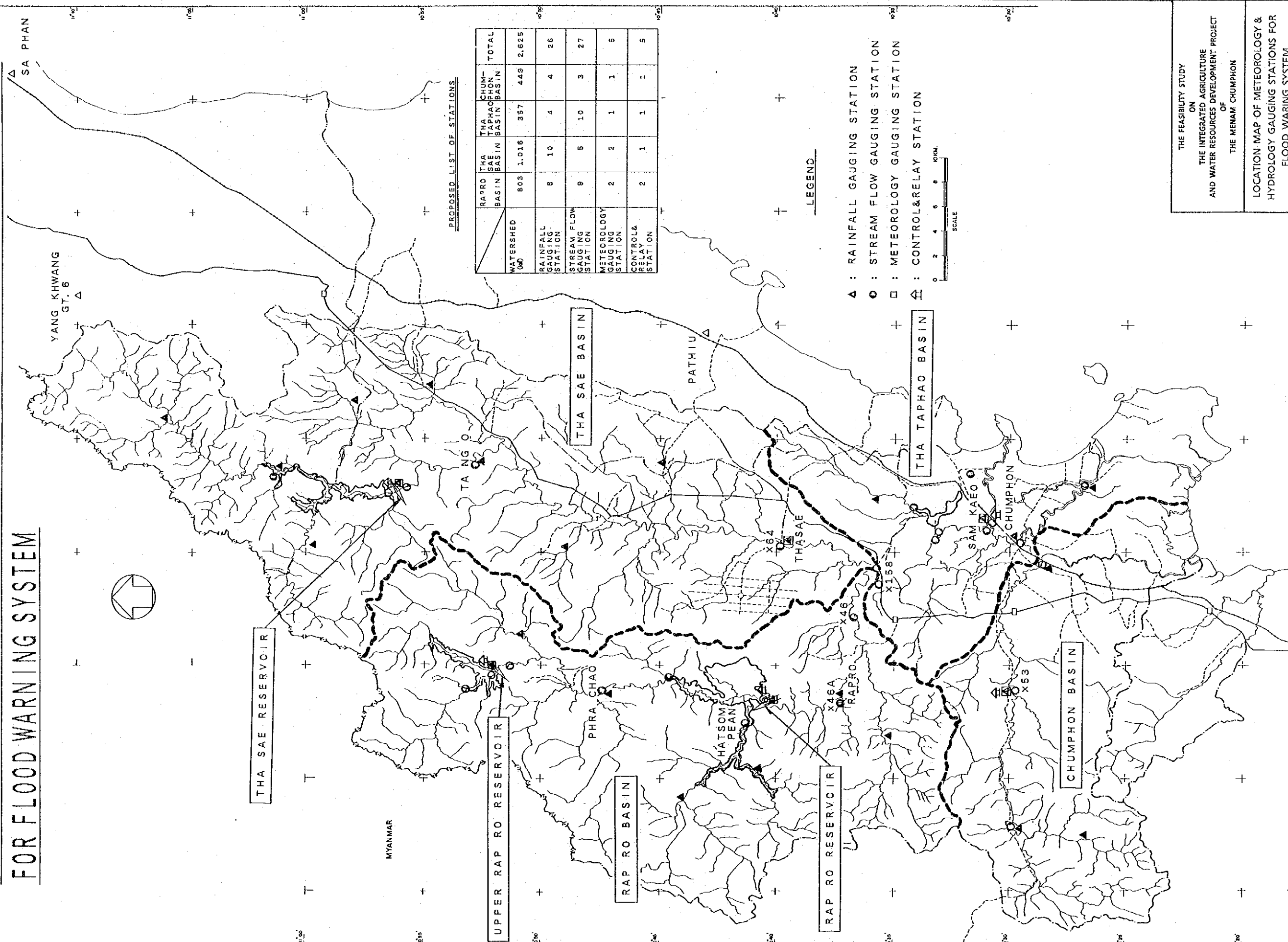
LIST OF EXISTING WATER RESOURCES FACILITIES (RID)

No	Amphoe	Project Name	Beneficial Area (raisi)
1	Muang C.	Flood Relief.	30,000
2	Muang C.	Kio, Phru Kam Weir	1,000
3	ditto	Kio, Khun Krating Weir	1,500
4	ditto	Huai Mood Re.	2,000
5	ditto	Kio, Ma Young P. Pump Station	1,000
6	Tha Sae	Kio, Krut Weir	1,300
7	ditto	Kio, Phala Weir	1,200
8	Pathiew	Kio, Bang Talai Weir	1,500
9	ditto	Kio, Sam Nae Weir	1,000
10	ditto	Kio, Kok Mha Weir	1,500
11	ditto	Kio, Pru Pliang P.	500
12	ditto	Kio, Wal Nai Re.	1,200
13	ditto	Huai Loel Weir	300
14	ditto	Kio, Poke Rang Weir	3,000
15	ditto	Kio, Toong Po Re. Weir	1,500
16	ditto	Kio, Toong Sang Weir	5,000
17	ditto		
Total			81,000

THE FEASIBILITY STUDY ON THE INTEGRATED AGRICULTURE AND WATER RESOURCES DEVELOPMENT PROJECT OF THE MENAM CHUMPHON

LOCATION MAP OF EXISTING PROJECTS

LOCATION MAP OF METEOROLOGY & HYDROLOGY GAUGING STATIONS FOR FLOOD WARNING SYSTEM

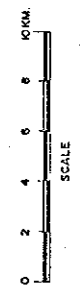


PROPOSED LIST OF STATIONS

WATERSHED	RAPRO BASIN	THA SAE BASIN	THA TAPHAC BASIN	CHUMPHON BASIN	TOTAL
	803	1,016	357	449	2,625
RAINFALL GAUGING STATION	8	10	4	4	26
STREAM FLOW GAUGING STATION	9	5	10	3	27
METEOROLOGY GAUGING STATION	2	2	1	1	6
CONTROL & RELAY STATION	2	1	1	1	5

LEGEND

- ▲ : RAINFALL GAUGING STATION
- : STREAM FLOW GAUGING STATION
- : METEOROLOGY GAUGING STATION
- ◻ : CONTROL & RELAY STATION

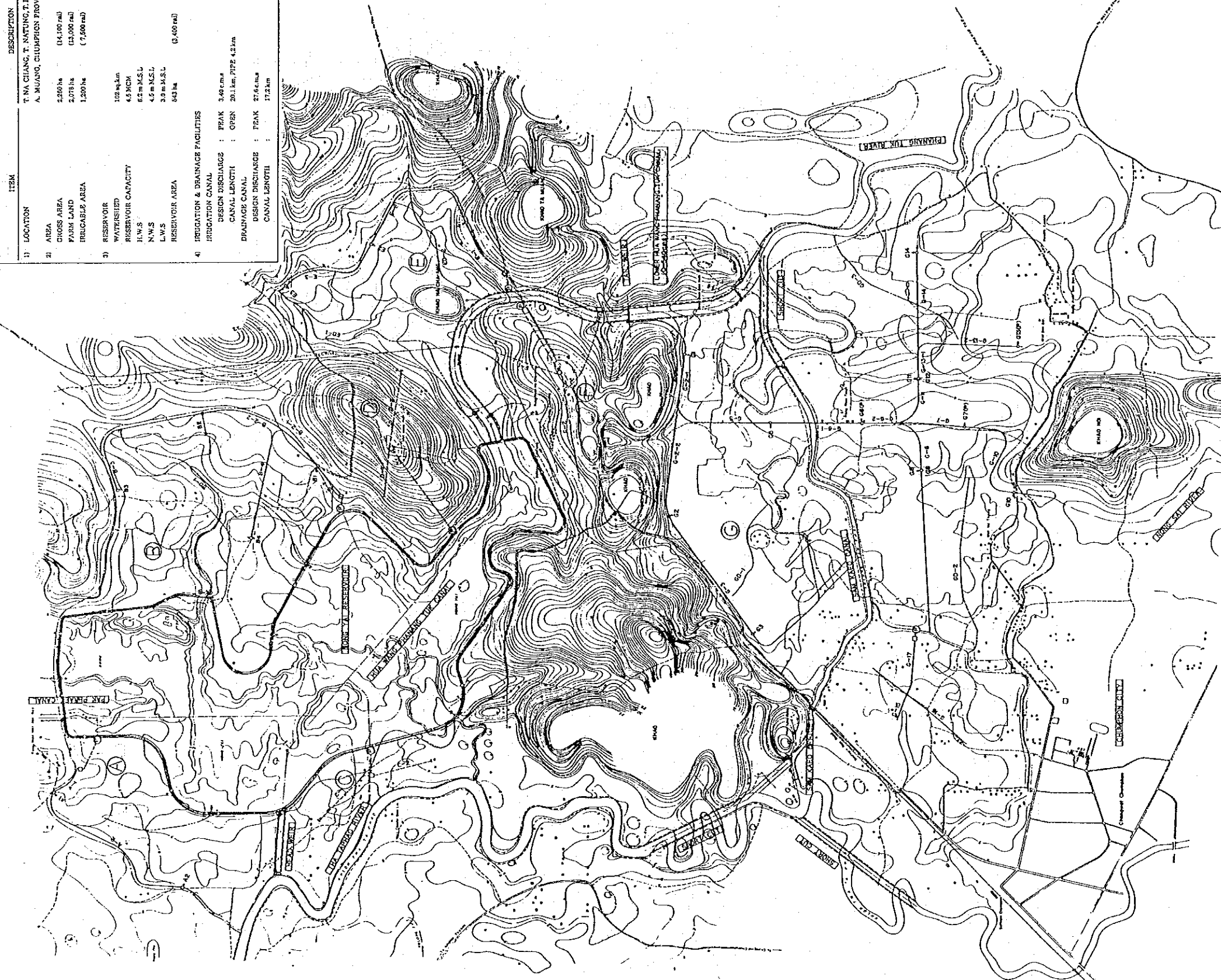


THE FEASIBILITY STUDY
ON
THE INTEGRATED AGRICULTURE
AND WATER RESOURCES DEVELOPMENT PROJECT
OF
THE MENAM CHUMPHON

LOCATION MAP OF METEOROLOGY &
HYDROLOGY GAUGING STATIONS FOR
FLOOD WARNING SYSTEM

MAJOR FEATURES OF NONG YAI IRRIGATION PROJECT

ITEM	DESCRIPTION
1) LOCATION	T. NA CHIANG, T. NATUNG, I. BIANG LUK, A. MUANG, CHUMPHON PROVINCE
2) AREA	CHOSS AREA (14,100 ha)
	FARM LAND (13,000 ha)
	IRRIGABLE AREA (7,600 ha)
3) RESERVOIR	WATERBUILT 102 ha, 1 km
	RESERVOIR CAPACITY 4.5 MCM
N.W.S.	62 m M.S.L.
	4.6 m M.S.L.
RESERVOIR AREA	3.0 m M.S.L.
	643 ha (3,400 ha)
4) IRRIGATION & DRAINAGE FACILITIES	IRRIGATION CANAL DESIGN DISCHARGE : PEAK 3,400 m ³ /s
	CANAL LENGTH : OPEN 20.1 km, PIPE 4.2 km
DRAINAGE CANAL	DESIGN DISCHARGE : PEAK 27.66 m ³ /s
	CANAL LENGTH : 17.2 km



LEGEND

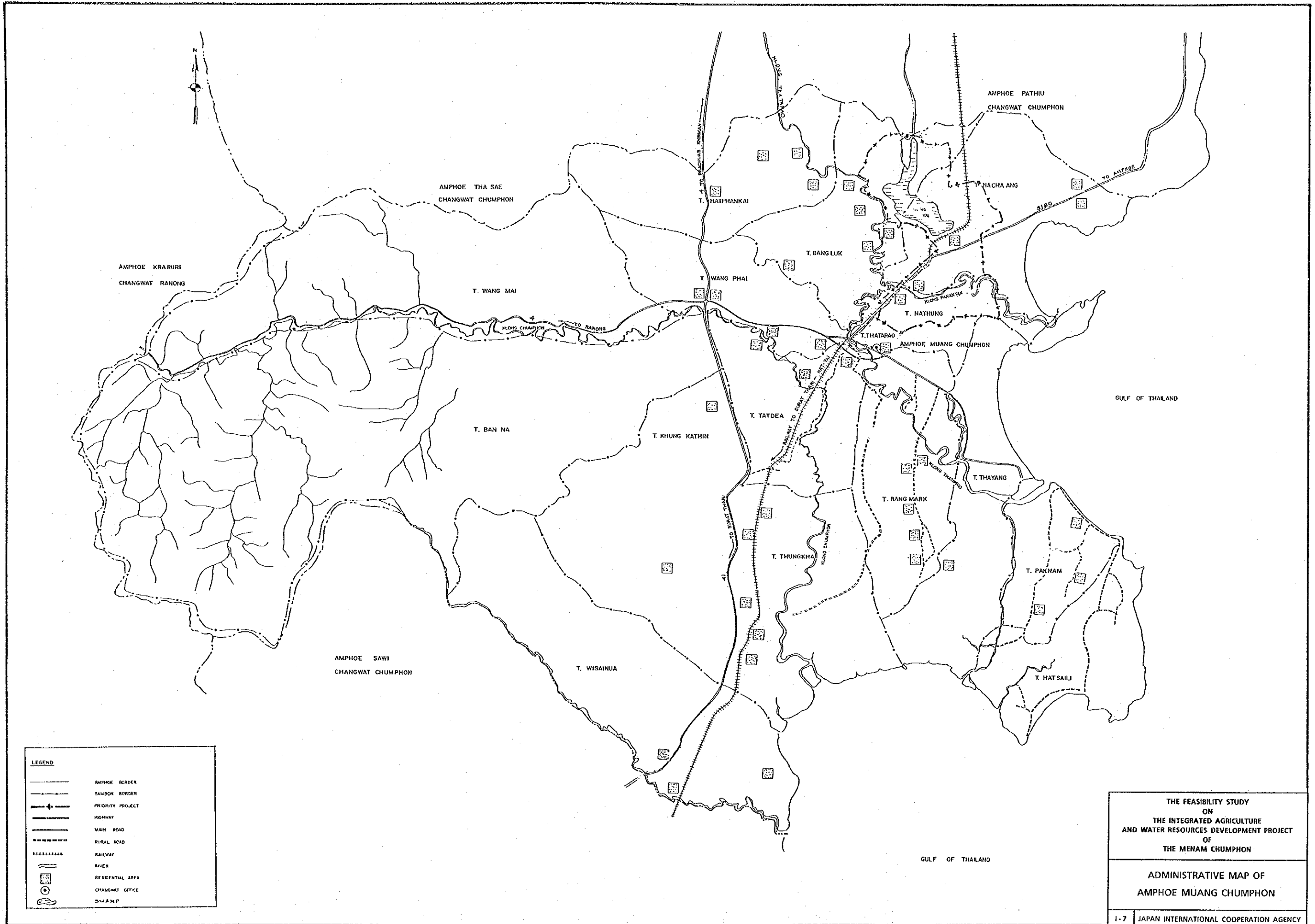
--- PROJECT BOUNDARY	⊙ PUMP STATION	▭ PADDY
--- DIKE AND ROAD	--- PIPE LINE	▨ MIXED ORCHARD
--- IRRIGATION CANAL	⊙ INTAKE FACILITY	▭ OTHER
--- DRAINAGE CANAL	□ DISCHARGE CHAMBER	⊙ IRRIGATION BLOCK
	⊙ SLUICeway	

SCALE 1:10,000

GENERAL PLAN OF NONG YAI IRRIGATION PROJECT

(ノンヤイ灌漑事業計画一般図)

THE FEASIBILITY STUDY
ON
THE INTEGRATED AGRICULTURE
AND WATER RESOURCES DEVELOPMENT PROJECT
OF
THE MENAM CHUMPHON
GENERAL PLAN OF
NONG YAI IRRIGATION PROJECT
1-6 JAPAN INTERNATIONAL COOPERATION AGENCY



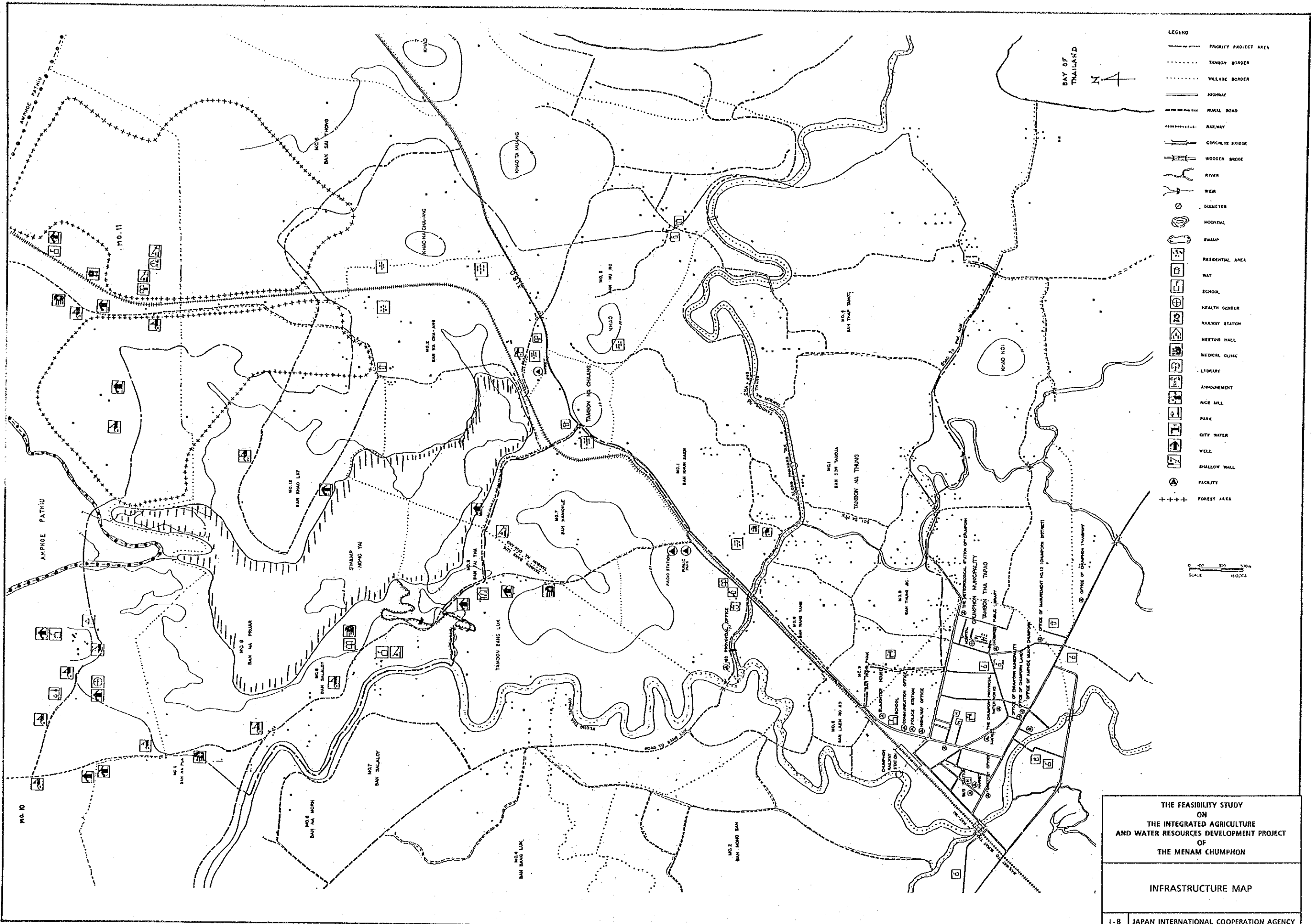
LEGEND

	AMPHOE BORDER
	TAMBOON BORDER
	PRIORITY PROJECT
	HIGHWAY
	MAIN ROAD
	RURAL ROAD
	RAILWAY
	RIVER
	RESIDENTIAL AREA
	CHANGWAT OFFICE
	DAMP

THE FEASIBILITY STUDY
ON
THE INTEGRATED AGRICULTURE
AND WATER RESOURCES DEVELOPMENT PROJECT
OF
THE MENAM CHUMPHON

ADMINISTRATIVE MAP OF
AMPHOE MUANG CHUMPHON

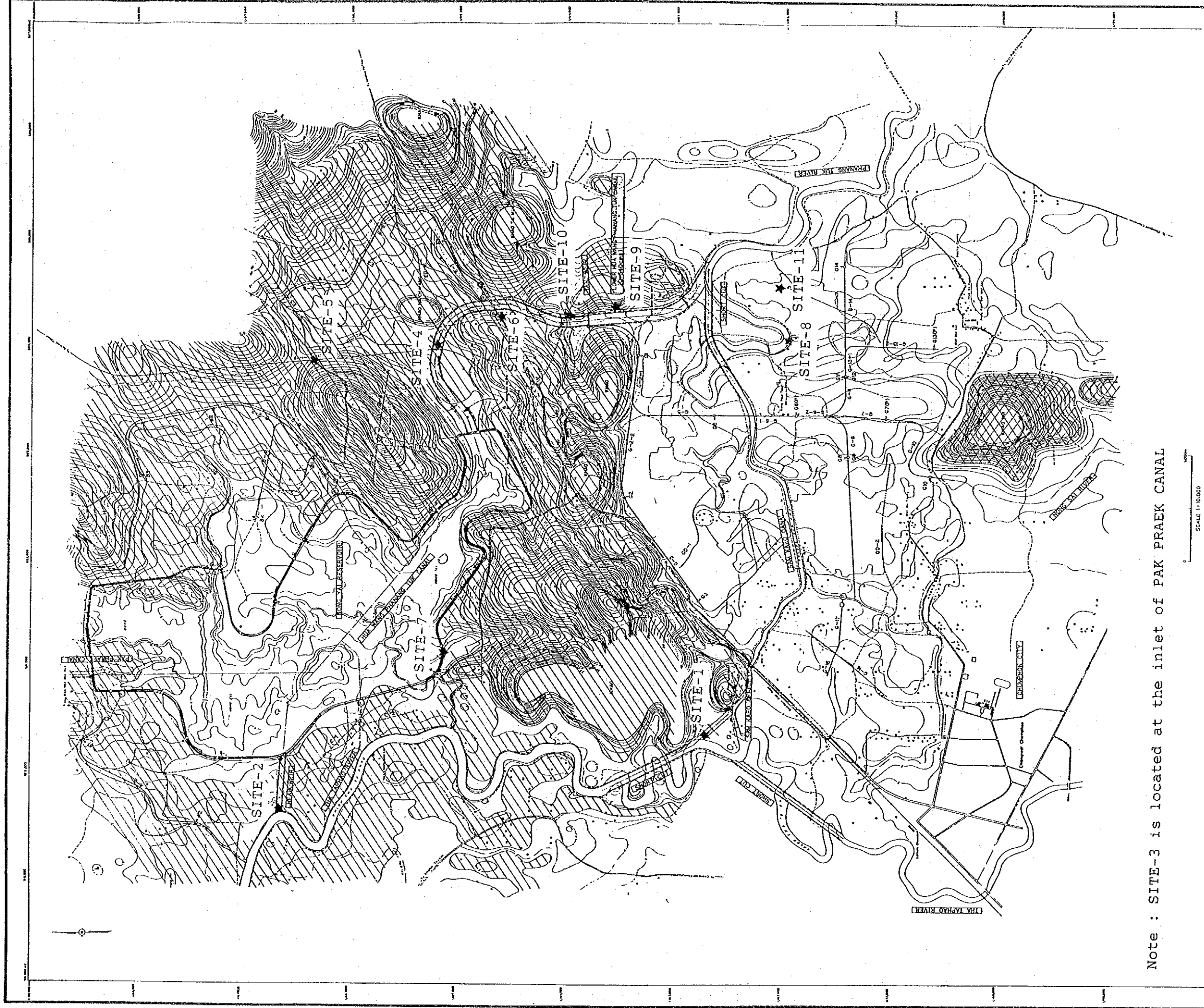
1-7 JAPAN INTERNATIONAL COOPERATION AGENCY



- LEGEND**
- PRIORITY PROJECT AREA
 - TAMBOON BORDER
 - VILLAGE BORDER
 - ==== HIGHWAY
 - RURAL ROAD
 - RAILWAY
 - CONCRETE BRIDGE
 - WOODEN BRIDGE
 - RIVER
 - WEIR
 - DIAMETER
 - MOUNTAIN
 - SWAMP
 - RESIDENTIAL AREA
 - WAT
 - SCHOOL
 - HEALTH CENTER
 - RAILWAY STATION
 - MEETING HALL
 - MEDICAL CLINIC
 - LIBRARY
 - ANNOUNCEMENT
 - RICE MILL
 - PARK
 - CITY WATER
 - WELL
 - BRICK WALL
 - FACILITY
 - +++ FOREST AREA

THE FEASIBILITY STUDY
ON
THE INTEGRATED AGRICULTURE
AND WATER RESOURCES DEVELOPMENT PROJECT
OF
THE MENAM CHUMPHON

INFRASTRUCTURE MAP



Note : SITE-3 is located at the inlet of PAK PRAEK CANAL

SCALE 1:10,000

- Alluvial fluvial, flood, coastal and marine deposits
- ▨ Diluvial terrace deposits
- ▩ Basement rocks
- Quaternary
- ▩ Carboniferous

THE FEASIBILITY STUDY
ON
THE INTEGRATED AGRICULTURE
AND WATER RESOURCES DEVELOPMENT PROJECT
OF
THE MENAM CHUMPHON

LOCATION MAP OF
GEOLOGICAL SURVEY

1-9 JAPAN INTERNATIONAL COOPERATION AGENCY