

4.5. Compensation of Submerged Area and Resettlement Programme

4.5.1. Present Situation of the Possible Area Affected

1) General Conditions

- i) This area corresponds to the middle stream area of the Mae Chang. Between Dam sites A and D, there are 10 villages (Mubans) stretched along the Mae Chang. From up to downstream, they are Ban Mae Lu, Ban Hua Sua, Ban Don Mun, Ban Huai Rai, Ban Huai Maklua, Ban Kom, Ban Mai, Ban Pong Pa Pao, Ban Thung Ton and Ban Sop Po. Of them, Ban Mae Lu is under the administration of Ban Pha Mae two Km to the east.
- ii) The right bank area is a gently sloped but rocky piedmont area, none of the villages exists in the piedmont area. The left bank area, however, is a rolling area with a width of six km and an elevation of 300 - 330 m. Many tributaries from the back mountains are eroding this area and running into the Mae Chang. There are 12 villages scattered on this bank area. Some alluvial riverine terrace lands are developed along the river, the main stream of the Mae Chang. At present, 1,775 farm families and 8,338 persons are located in 10 villages possibly affected by dam construction. (See Table 4.5-1).
- iii) Recently, socio-economic conditions surrounding this area have remarkably changed. A new high-way from Lampang through this area to Phrae was constructed two years ago. Several laterite all weather-roads were constructed lengthwise and crosswise in this area since 1978. This traffic condition not only made their living much better than ever, but also enabled them to grow sugarcane. Besides that, electric distribution lines came into the area. So far, all of the villages except for Ban Mae Lu

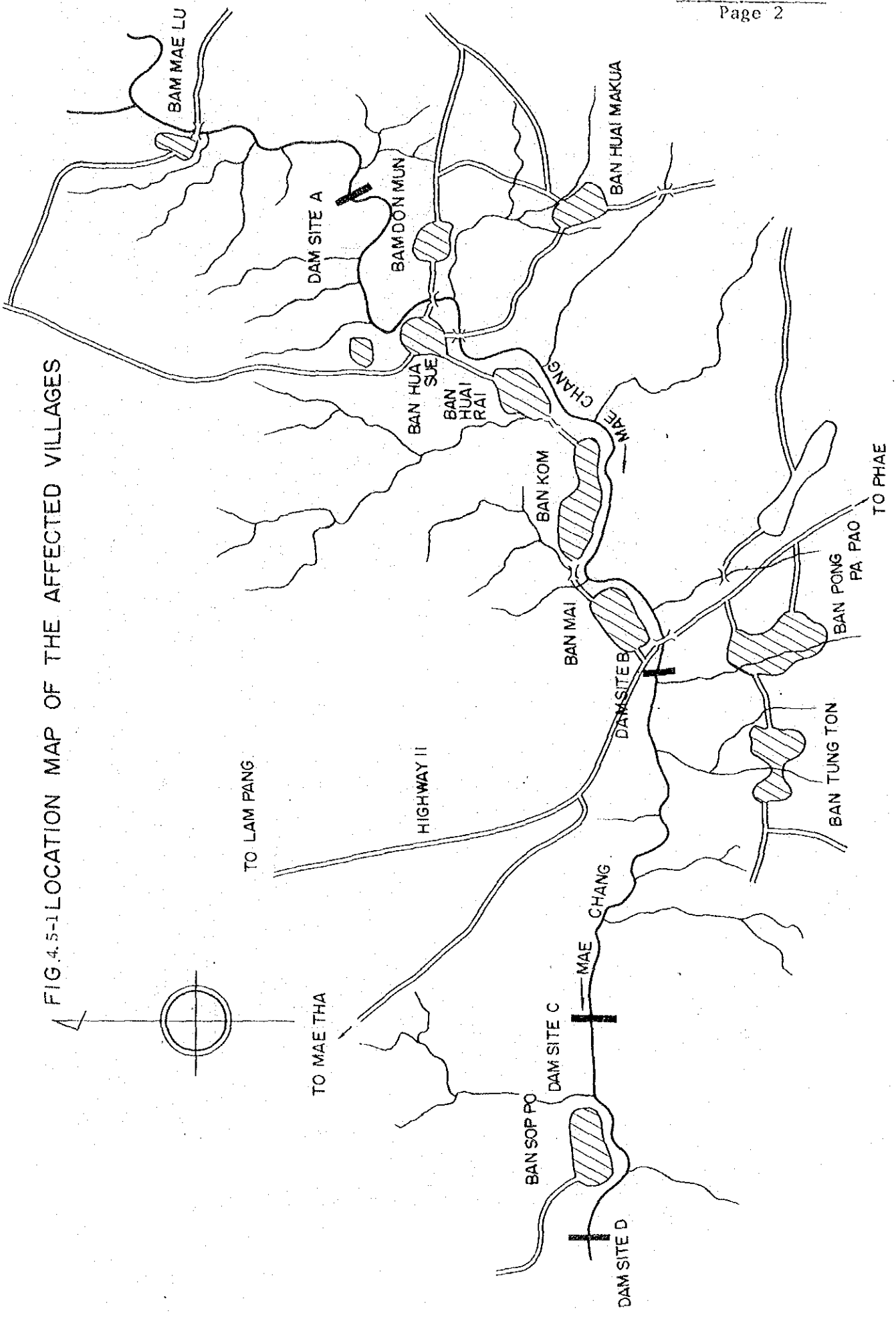


FIG. 4.5-1 LOCATION MAP OF THE AFFECTED VILLAGES

Table 4.5-1 Agriculture in the Affected Area

Mu Ban	No. of Farms	Area of (rai)			No. of Animals (head)				No. of					
		Per- Farms son	Up- Paddy land	Sugar- cane	To- bacco	Buffa- loes	Cows	Pigs	Trac- tor	Pumps	Wells	School	Elec- tricity	
Ban Mae Lu	22	100	200	10	5	50	100	-	3	1	1	1	-	X
Ban Hua Sue	450	2,214	2,926	1,800	40	300	1,000	200	50	100	30	1	1	0
Ban Don Mun	180	643	407	320	150	150	300	150	10	7	7	1	1	0
Ban Huai Rai	75	429	105	200	10	45	75	25	1	-	2	1	1	0
Ban Huai Maklua	193	834	761	535	300	100	150	150	10	10	2	1	1	0
Ban Kom	185	934	505	342	17	100	600	186	-	-	3	1	1	0
Ban Mai	280	1,281	491	267	-	80	300	200	10	-	12	1	1	0
Ban Pong Pa Pao	131	516	838	104	15	130	350	131	3	-	2	1	1	0
Ban Tung Ton	206	1,180	891	455	30	150	1,000	200	2	10	2	1	1	0
Ban Sop Po	53	207	1,500	1,000	35	10	150	16	-	-	2	1	-	X
Total	1,775	8,338	8,624	5,223	607	835	1,810	4,025	1,258	89	127	63	10	8

Note: 1) The actual area cultivated by Ban Sop Po is 300 rai of Paddy and 150 rai of Upland fields.

2) The Number of pumps owned by two tobacco curing stations is excluded.

3) Main source: Records of Mae Tha Agricultural Extension Office, supplemented by the field survey.

and Ban Sop Po, have been electrified. In the case of Ban Sop Po, the main line reached to the entrance of the village already, but was still not distributed to each family at the time of survey. In agriculture, a new irrigation technology, pumping, was introduced about six years ago. Furthermore, in addition to two tobacco curing stations placed at the hill side of this area several years ago, two new stations entered into the river side area looking for irrigation water in 1980 and 1982. They are located in Ban Kom and Ban Huai Maklua, encouraging them to grow tobacco.

2) Land Use

- i) In the proposed inundated area, there are ten schools, eight wats and one public health center. The areas occupied by these public facilities are calculated as 85 rai under the assumption that six rai is used for one school, three for one wat and one rai for one health center. Also, since one homelot is supposed to occupy 0.4 rai (640 m^2), the whole area amounts to about 710 rai. To these areas, two tobacco curing station areas of four rai each are added.
- ii) As for agricultural land, as shown in Table 4.5-1, there are paddy fields of 8,626 rai, upland fields of 5,223 rai and some orchard area.

In addition to that, 607 rai of national reserve forest are reported to be used for sugarcane growing. Forest and river bank areas surrounding cropped areas are traditionally, without any license, used for pasturing buffaloes and cows, gathering wood for fire and charcoal, gathering tree-leaves for roof-thatching and even clearing lands for sugarcane cultivation as well as planting banana in the forest.

3) Agriculture

- i) Rice is the most important crop for their subsistence. The crop is mainly grown on the alluvial soils and partly on the hill-side and valley land along the tributaries and is cropped once a year in the rainy season, usually from June to December. The per rai yield is about 500 kg and the highest yield of 900 kg appears on the alluvial land. The products are mostly consumed at home and partly sold to the neighbouring dwellers both inside and outside of the village. The annual consumption rate is 200 - 250 kg per family member. Prevailing prices of rice range from 0.60 to 3.60 Baht per kg.
- ii) Upland fields are mostly located on the hill-side. Except vegetables for domestic use, the crops mainly grown in the rainy season are groundnuts, maize and castor oil beans. The average per rai yields are about 300 kg for maize, 230 kg for groundnuts and 70 kg for castor oil beans and the prices are 2 Baht, 6 Baht and 5 - 6 Baht respectively.
- iii) Tobacco is rather a new crop starting in this area since 1980, though it has been traditionally grown for home consumption. This crop is grown in two different seasons. One is harvested from October to December mainly being rainfed and partly supplied with irrigation water by pump, the other is harvested from January to April depending on irrigation water by pumping. Tobacco is usually planted as the second crop on the paddy fields both along and near the river. The prices of land suitable to growing tobacco have gone up to 20 thousand Baht per rai, whereas it is still 10 thousand Baht for the ordinary paddy fields. Sometimes the land is rented to tobacco growers at a rent of 200 Baht per rai. The growers pick seeds, send them to a curing station for nursing seedlings, transplant them to their field, grow them and sell the harvested fresh leaves to the

station. Taking an example of the tobacco curing station at Ban Kom, the station is equipped with 18 curing houses and a warehouse and has contracts with pumps for lending free of charge, takes care of 200 nurseries for each member, sells chemical fertilizers to growers, teaches them new technology, buys leaves from farmers, cures them and sends them to the private tobacco warehouse company in Changwat Chiang Mai. The average yield per rai is about 3,000 kg and the farm gate price ranges from 0.6 to 3.0 Baht per kg.

vi) Sugarcane is also a new crop for this area. It was introduced along with the opening of the all weather-roads five years ago. This crop is grown in the national forest by clearing either with license (five Baht per rai for rent) or without it. The productivity is very low, five to seven tons per rai, due to no fertilization. The prices are now 350 Baht per ton at the factories near Muang Lampang and 70 - 90 Baht per ton must be deducted from the price for trucking. However, sugarcane production has not only raised profits to the growers, but created work opportunities for non-growers. For instance, the labourers can get at least 35 Baht per day, which comes from making 100 bundles of cane (700 - 800 kg) per day at a rate of 0.35 Baht per bundle (10 canes).

v) Apart from chickens there are 1,810 water buffaloes, 4,025 cows and 1,258 pigs. Buffaloes are reared for the purpose of cultivation, breeding and fattening, cows for both breeding and fattening and pigs only for fattening. Concerning buffaloes and cows, they are sold at the ages of three to five at a price of 4,000 Baht for male buffaloes, 3,000 Baht for male cattle and 2,000 Baht for female cattle. There is a tenure system for both buffaloes and cows, raisers of them can receive half of the selling

price. Pigs are grown, baby-pigs (600 Baht) for six months, fed with rice bran and kitchen leftovers and sold at a weight of 90 - 100 kg at the price of 1,500 Baht.

4.5.2. Possible Inundated Area

1) Affected Villages

When constructing Dam A with a high water level of 283 m, only one village Ban Mae Lu, will be submerged. However, the construction of Dams B, C and D with a high water level of 268, 266 or 263 m would affect a larger number of villages. For example, seven villages in the case of Dam B, and eight villages in Dam C and Dam D would be partly or seriously affected. Even the cases of diversion dam, four villages in the case of Diversion Dam C (255 m), five villages in DI (HWL.255 m for Diversion Dam D) and one village in DII (HWL.250 m for Diversion Dam D) would be partly affected.

The affected farm family and farm land of each village are roughly estimated in terms of percentage as shown in Table 4.5-2.

2) Expected Benefits from the Submerged Area

The expected financial and economic benefits coming from the above affected villages are calculated as shown in Table 4.5-3, for preliminary alternative studies on selection of development plan, assuming the following unit price and per rai yield as of 1990.

Unit Price

<u>Commodity</u>	<u>Unit</u>	<u>Financial</u> (฿)	<u>Economic</u> (฿)
Rice	1 kg	3.3	6.4
Maize	"	2.77	3.13
Tobbaco	"	2,5	2.83
Sugarcane	1 ton	370	420
Cows	1 head	3,000	5,000
buffaloes	"	3,500	6,000
Pigs	"	1,500	2,000

Per rai Yield

Rice	500 kg
Maize	300 "
Tobbaco	2,500 "
Sugarcane	6 ton

3) The Village, Ban Mae Lu

Among the ten villages, eight are rather old and agriculturally developed. However, the two other villages are somewhat different from them in character. Ban Sop Po located in the downstream started about 100 years ago as a logging or lumbering base to stockpile take logs and to float them downstream. Ban Mae Lu located in the upper stream is a new agricultural settlement which was started about 50 years ago. An outline of Ban Mae Lu is described as follows.

Table 4.5-2 Percentage of the Submerged Family and Land

(Unit: %)

Villages	Dam B (268)		Dam C (266)		Dam D (263)		Dam A&C(255)		Dam A&DI(255)		Dam A&DII(250)		Present Size	
	Family Land	Farm	Family Land	Farm	Family Land	Farm	Family Land	Farm	Family Land	Farm	Family Land	Farm	Family Land	Farm
Ban Mae Lu	-	-	-	-	-	-	100	100	100	100	100	100	22	410
Ban Hua Sue	100	100	90	90	20	10	0	0	0	0	0	0	450	4,766
Ban Don Mun	50	60	15	40	0	10	0	0	0	0	0	0	180	877
Ban Huai Rai	100	100	100	100	0	30	0	0	0	0	0	0	75	315
Ban Huai Maklua	0	30	0	20	0	0	0	0	0	0	0	0	193	1,596
Ban Kom	100	100	100	100	100	95	5	5	5	5	0	0	185	864
Ban Mai	80	80	100	100	100	100	50	20	50	20	0	0	280	758
Ban Pong Pa Pao	0	20	80	80	50	70	20	30	20	30	0	0	131	957
Ban Tung Ton	-	-	80	90	50	80	10	30	10	30	0	0	206	1,376
Ban Sop Po	-	-	-	-	0	100	-	-	0	90	0	10	53	2,535
Total														1,775 14,454

Note: () is the elevation of high water level.

Table 4.5-3 Expected Benefits from the Affected Villages
(unit: '000 Baht)

	Financial Benefits				Economic Benefits					
	Outputs		Inputs	Benefits	Outputs		Inputs	Benefits		
	Crops	Animals			Crops	Animals			Total	Total
Dam A	549	119	668	10	658	888	200	1,088	9	1,079
Dam B	14,966	3,512	18,478	1,454	17,024	23,025	5,861	28,886	1,277	27,609
Dam C	17,642	5,329	22,971	1,556	21,415	27,831	8,480	36,311	1,367	34,944
Dam D	12,567	3,648	16,215	1,157	15,058	19,767	5,790	25,557	1,017	24,540
Dam A&C	2,807	549	3,356	328	3,028	4,297	854	5,151	288	4,863
Dam A&D.I	6,253	654	6,907	348	6,559	10,195	1,050	11,245	306	10,939
Dam A&D.II	983	119	1,102	41	1,061	1,579	200	1,779	36	1,743

- i) This village is located in the upper Mae Chang area about 3 km from Ban Hua Sue. Administratively it belongs to Ban Pha Mae located 2 km to the east across the Mae Chang.
- ii) Ban Mae Lu consists of 22 families engaging in farming. The total population is around 100 persons. Besides them, 3 school teachers are living there. The village started about 50 years ago. The majority of the villagers came from Ban Hua Sua and some from Ban Thung. Four of the 22 families have the same family name. The new village is still increasing in members gradually.
- iii) There are 200 rai of paddy fields and 200 rai of upland fields. However, since a new access road to this village was constructed 3 years ago, sugarcane area has been expanding in the nearby forest after receiving permission from the Royal Forestry Authority. Presently 5 families are growing sugarcane. Main crops on the upland field are maize, groundnut and tobacco. Also they keep 50 water buffaloes, 100 cows and some chickens. Besides that, there are five charcoal ovens, though only one is operating at present.
- iv) The main cash income sources are sugarcane, groundnuts, maize and livestock, rice and tobacco are grown for household consumption only. Some features about living conditions are as follows:

School	1	(14 pupils)
Wat	no	
Electricity	no	
Well	1	
Motorcycle	1	
T.V.	no	
Thresher	1	
Small tractor	3	
Small pump	1	
Irrigation pond	no	

- v) Houses are rather small in size and look somewhat poor. At a glance, their living and income levels seem to be below the poverty line.

4.5.3. Counter-measures for the Submerged Areas

1) General Ideas

- i) Any compensation for immovable property in the submerged areas required by the State has been so far conducted by a method of combining resettlement with a type of compensation in kind. This seems to derive from a viewpoint of social welfare, equity and safety. In principle, almost all evacuees are relocated in the newly constructed settlement.

- ii) During the time when dam construction was first started, the Ministry of interior (MOI) has been acting as the responsible authority for resettlement. Namely, the authority concerned, e.g. RID, has paid for necessary compensation money to evacuees, and then MOI had constructed the so-called self-help resettlement and administered it at the expense of RID. Recently, however, the authority concerned is responsible to carry out such activities itself. At present, five resettlement projects of this kind had been undertaken or are on going by RID throughout the Kingdom.

Table 4.5-4 indicates 20 big dam projects in the whole Kingdom and the number of evacuees and the responsible authorities for the resettlement program of each project. Table 4.5-5 illustrates the present agricultural situation of 13 self-help resettlements calculated by using available annual reports issued from each resettlement administered by MOI is exemplified in Table 4.5-6.

- iii) Details of compensation and resettlement conducted by RID are deliberated and decided by the standing committees set up at the Changwat level. The compensation committee consists of at least five related members and, likewise, the resettlement committee is proposed to consist of 11 members. The possible membership of both committees is as follows:

Compensation Committee

- (1) Governor
- (2) Land Officer
- (3) Amphoe Officer
- (4) Division Director of Low and Land, RID
- (5) Project Engineer, RID

Resettlement Committee

- (1) Governor
- (2) Land Officer
- (3) Amphoe Officer
- (4) Representative of Royal Forestry Department
- (5) Representative of Public Welfare Department
- (6) Representative of Land Development Department
- (7) Division Director of Law and Land, RID
- (8) Project Engineer, RID
- (9) Head of Land Survey Section, RID
- (11) Head of Resettlement Section, RID

2) Examples of Resettlement nearby the Project Area

i) Kew Lom Dam Project (RID - MOI)

- a) One settlement was organized by relocating 943 families evacuated from Kew Lom Dam Reservoir. MOI is running the settlement and it is named "Self-help Resettlement Changwat Lampang". The total area is 20,104 rai, of which 14,145 rai is distributed to 943 families, 15 rai per farm including farmland of 13 rai. They moved there from 1969 to 1974 and settled in 17 new villages. The residential site is designed in a linear style.
- b) Six schools, of which two have secondary classes, and a health center are provided. An agricultural extension office and agricultural cooperatives have also been introduced. For supplying potable water, three to four wells for each village have been dug. But no electricity is provided. Although the total construction costs are not available, annual budget in fiscal year 1983, excluding salaries for 34 regular officials, amounts to 4,131 thousand Baht.

Table 4.5-4 The Social Faces of the Big Dam Project in Thailand (since 1960)

Project	River	Changwat	Object	Admin- istration	Construction		Water Storage Area (MCM)	Res- ervoir Area (km ²)	No. of Evacuees family	Charge of Reset- tlement
					Started	Completed				
1. Bhumiphol	Mae Ping	Tak	I P F	EGAT	1961	1964	13,462	300	3,302	M O I
2. Kang Krachan	Petchaburi	Petchaburi	I P F	FID	1963	1966	710	50	NA	M O I
3. Ubol Rattana	Nam Pong	U. Ratchathani	I P F	EGAT	1964	1965	2,550	410	2,023	M O I
4. Nam Pong	Nam Pong	Khon Kaen	I P	EGAT	1964	1965	150	20	1,237	M O I
5. Lam Pao	Lam Pao, Huai Yay	Karasin	I F	RID	1964	1968	2,450	380	3,304	M O I
6. Lam Takhong	Lam Takhong	N. Ratchasina	I F	RID	1964	1969	310	44	6,252	M O I
7. Lam Phra Phloeng	Lam Phra Phloeng	N. Ratchasina	I F	RID	1967	1970	320	19	NA	M O I
8. Kiu Lom	Mae Wang	Lampang	I P F	RID	1967	1972	112	16	943	M O I
9. Sirindhorn	Lam Don Noi	U. Ratchathani	I P F	EGAT	1968	1971	1,550	292	1,432	M O I
10. Sirikit	Mae Nan	Uttaradit	I P F	EGAT	1968	1973	9,000	260	3,298	M O I
11. Nam Un	Nam Un	Sakhon Nakhon	I F	RID	1968	1974	520	85	1,237	M O I
12. Chulabhorn	Mae Phrom	Chayapun	P	EGAT	1970	1972	188	12	NA	M O I
13. Pranburi	Pranburi	Prachuapkhirikhan	I F	RID	1970	1977	650	47	NA	M O I
14. Thap Salao	Sakaehrang	Uthai Thani	I	RID	1970	(1980)	198	20	210	R I D
15. Krasieo	Krasieo	Supanburi	I F	RID	1972	(1981)	240	48	313	M O I
16. Sringarind	Quae Yai	Kanchanaburi	I P F	EGAT	1974	(1979)	17,745	419	NA	M O I
17. Pattani	Pattani	Pattani	I P F	RID	1976	(1981)	1,360	57	722	R I D
18. Mae Ngat	Mae Ping	Chiang Mai	I P F	RID	1976	(1983)	325	19	550	R I D
19. Mae Kuang	Mae Ping	Chiang Mai	I F	RID	1978		363	13	427	R I D
20. Nam Mun	Mae Mun	N. Ratchasina	I F	RID	1982		416	19	1,300	R I D

Note: 1) I = Irrigation, P = Power, F = Flood Control

2) RID = Royal Irrigation Department, MOI = Ministry of Interior

3) Source: K. Miyazaki "The Big Dam Project in Thailand", supplemented by the data of RID and MOI.

Table 4.5-5 Selected Examples of the Self-Help Resettlements Derived from the Dam Projects

Resettlement	Changwat	Year	Number of		Land (rai)		Income (Baht) per Household	Major Crops
			Household	Person	Distributable	Distributed		
1. Psachuap	Kirikhan	1956	5,233	33,706	109,086	109,086	25,050	Pineapple, Cassava
2. Kham Soi	Nakhon Phanom	1956	3,214	16,070	42,096	42,096	28,647	Rice, Sugarcane
3. Bhumiphon	Tak	1963	3,302	19,812	62,900	14,272	10,846	Rice, Beans, Cows
4. Non Sang	Udonthani	1964	751	6,650	11,265	11,265	12,780	Rice, Cassava
5. Ubonsat	Khon Kaen	1964	2,023	12,585	30,345	30,345	15,225	Sugarcane, Cassava
6. Lam Pao	Karasin	1965	3,304	19,824	26,130	26,130	25,112	Cassava, Rice
7. Lam Nam Nan	Uttaradit	1966	3,298	20,136	40,000	40,000	21,191	Sugarcane, Beans, Maize
8. Lam Takhong	N. Ratchasima	1967	6,252	21,485	250,000	131,513	13,483	Silkworm, Sugarcane
9. Kiu Lom	Lampang	1969	943	4,048	14,145	14,145	17,874	Rice, Upland Crops
10. Lam Don Noi	U. Rathathani	1969	1,432	8,586	21,480	21,480	8,952	Rice, Kenaf
11. Lam Nam Un	Sakhon Nakhon	1969	1,237	10,553	14,108	14,108	18,450	Rice, Cassava
12. Ksasieo	Suphanburi	1973	313	1,252	6,260	6,260	9,485	Sugarcane, Maize
13. Huai Luang	Udonthani	1973	3,789	18,945	51,894	20,950	8,000	Rice, Cassava

Source: Ministry of Interior (1982)

Table 4.5-6 The Self-Help Resettlement in Thailand

1. Total number	58
2. Established year (44 Projects)	
1940 - 50	2
1950 - 60	19
1960 - 70	12
1970 - 80	11
Total	44

3. Location and size (44 Projects)

1) Location

North	6
Central and East	7
North-East	18
South	13
Total	44

2) Size

Total land	7,103,675 rai
To be distributable	2,972,975 rai
Distributed	2,244,048 rai
Operated	2,068,215 rai
Number of households	108,801 families
Number of persons	698,951 persons

3) Regional distribution

Region	Total Land	Distributable	Distributed	Operated	No. of Households
North	736,498	462,739	202,935	198,087	13,803
Central & East	2,200,925	976,077	971,042	947,909	34,557
North-East	2,177,857	774,471	624,704	499,323	38,759
South	1,988,395	759,686	445,367	426,896	21,682
Whole Kingdom	7,103,675	2,972,973	2,244,048	2,068,215	108,801

Table 4.5-6 (cont'd)

4. Project size by region (44 Projects)

1) Average size of project (rai)

Region	Total Land	Distributable	Distributed	Operated	No. of Households
North	122,750	77,123	33,823	33,015	2,301
Central & East	314,418	139,440	138,720	135,416	4,937
North-East	120,992	43,026	34,706	27,518	2,153
South	153,800	58,437	34,259	32,838	1,668
Whole Kingdom	161,447	67,568	51,001	47,005	2,473

2) Average size per household (rai)

Region	Total Land	Distributable	Distributed	Operated
North	53.4	33.5	14.7	14.4
Central & East	63.7	28.2	28.1	27.4
North-East	56.2	20.0	16.1	12.8
South	92.2	35.0	20.5	19.7
Whole Kingdom	65.3	27.3	20.6	19.0

5. Main crops

NorthRice, maize, beans, sugarcane, cows.
 Central & EastRice, maize, cotton, sorgham, cassava, sugarcane, pineapple, fruits, coconuts, dairy cows.
 North-EastRice, cassava, beans, kenaf, sugarcane, silk worm.
 SouthRice, rubber, oil palm, coffee

6. Income size per household (Number of project)

Below 5,000	1
5,000 - 10,000	4
10,000 - 20,000	21
20,000 - 30,000	10
30,000 - 50,000	4
50,000 - 100,000	3
over 100,000	1
Total	44

Source: Ministry of Interior (1982)

- c) This area is largely composed of two topographical portions, low land and high land. In the low land area, where 11 villages are located, they grow rice twice a year and sugarcane and other upland crops because of a well-provided irrigation system. While, in the high land area, the main production is focused on upland crops, fruits and livestock, because an irrigation system has not been provided yet. The per family income in 1982 showed 18,874 Baht. Since most of the settlers were shoe-string farmers with farmland of 2 - 6 rai, they are enjoying their new life in the settlement.
- ii) Mae Ngat Dam Project (RID)
- a) The dam site is located about 70 km northward from Muang Chiang Mai. This is the first time that RID itself has been responsible for a resettlement project. In this case, the situation of resettlement is somewhat complicated due to some difficulties of land acquisition. There were 550 families in the reservoir area. They had to be relocated to three separate settlements.
- b) The first settlement is near the dam site being owned by the Agricultural Land Reform Office. Each family was given eight rai. Forty-eight families were already relocated there. RID constructed roads, canals and a tank with a capacity of 0.2 MCM by 1978. The new village is of the cluster type separated from farmlots. Because of a shortage of storage capacity, 20 farms are not blessed by irrigation water.
- c) The second settlement is located 50 km to the north of the dam site, 365 families are scheduled to be relocated there. The settlement is divided into two parts, 199 families settle in RID's area, whereas 166 families settle in the adjoining area owned by Phrao Self-settlement Cooperatives.

Although the management of the settlement is separate, RID is responsible for the construction. A small reservoir with a capacity of seven MCM was completed in 1980. Each family is given seven rai including a homestead of one rai.

- d) The third settlement is planned to be set up in the area owned by the self-settlement cooperatives. It is located further north from the second settlement and is to be constructed and managed by the cooperatives. The remaining 137 families are to be resettled there. The details are not known.

iii) Mae Kuang Dam Project (RID)

- a) The settlement is located about 50 km to the north of Muang Chiang Mai. The construction started in 1978 and is now mostly completed. At present, about 70 per cent of the 328 families are moving into the new area by building permanent or temporary houses.
- b) The shape of this settlement is of the open type, each family is given eight rai including a homestead of two rai. The topographical features are rather good, gently sloping to the south. Two tanks with a capacity of 0.6 MCM and 0.4 MCM for each have been constructed. The two old schools and two wats have been remodeled and united into one modern building for each. Furthermore, some efforts are being made for inviting an agricultural extension and agricultural cooperatives system. The construction costs spent up to now are as follows:

Land clearing (3,600 rai)	1,080,000 Baht
Road construction (60 km)	22,267,000 "
Tank I	8,244,400 "
Tank II	8,349,600 "

Canal I	4,260,000 Baht
Canal II	<u>5,734,300</u> "
<u>Total</u>	<u>49,935,300</u> "

- c) However, irrigation water to be supplied to the settlers is not enough. The volume of water is restricted to 30 m^3 per farm a week for the time being. Therefore, each farmer is compelled to dig a small pond with a capacity of 30 m^3 at a corner of his plot. Since the area is blessed by traffic conditions to Muang Chiang Mai, most of the farmers are eager to grow vegetables. One of the farmers is introducing a hand-moved sprinkler system and growing vegetables on all of his six rai of land.
- iv) Mae Moe Dam Project (EGAT)
- a) The settlement is located in the highland area, 20 km to the southwest of the dam site at an elevation of 350 m. All of the evacuees were relocated to their new places in 1982 though some houses are still now under construction. The total number of families relocated is 370 of which 110 families had been engaged in coal mining and have their own houses but not any farmland.
- b) The sum total of money compensated to them was approximately 55 million Baht, or 150 thousand Baht for each family on an average. Compensation was paid as follows, 20 thousand Baht per rai for farmland and homelot and four thousand Baht per rai for land without any record of use. As for buildings, 30 to 100 thousand Baht was paid to each family. The highest amount paid was 400 thousand Baht for a concrete building.
- c) In the new settlement, homelots of one rai are distributed to each of 260 family and only one ngan (400 m^3) is allotted as homelot to the 110 families mentioned above. A

farmplot of six rai was given to each of 140 families who wanted to be farmers. But, no irrigation system was provided. And, a common grassland of 800 rai was constructed for grazing cattle. Most of the farmers tend to grow fruit trees such as mangoes and coconuts.

Non-farmers are working for coal mines, existing power plant and construction of a new power plant, where about 5,500 workers are employed at a wage of 60 Baht a day.

- d) In the residential district, all of the families have electricity, about ten wells installed with hand pumps are dug, and one school with a kindergarten, and one wat with a bell tower, an assembly hall and lodgings for priests were constructed. Four big ponds are under construction and a police station and a telephone service station will be completed soon. The amount of construction costs totaled about 20 million Baht, of which six million Baht are paid for roads, three million for electricity, three million for the Wat and 1.1 million for the school.

4.5.4. Compensation

1) Appraisal

- i) Objects of immovable property compensation are divided into three major categories, lands, trees and structures. Either privately and publicly owned properties are involved.
- ii) Besides properties inundated under reservoir water, any property that is not flooded, but cannot continue to be used due to implementation of the Project shall be compensated.
- iii) As for assessment of lands, the afore-said compensation committee estimates values by setting the unit price per

rai and listing up the actual acreage based on the land records, by land categories. The land categories range from paddy field to residential and commercial lots. Usually, land prices are estimated on the basis of market prices prevailing in the area concerned.

- iv) Either fruit or ordinary trees owned privately are estimated on a one-by-one basis. For this purpose, an appraisal table is prepared. In the case of Changwat Chiang Mai, 57 species of trees are listed up, ranging from durian to bamboo. The unit price is set by each stage of growth such as mature, premature and infant stages. For instance, the unit price was 500, 250 and 125 Baht for durian, 75, 50 and 25 Baht for mango, 6, 3 and 1 Baht for banana and 2, 1 and 0.5 Baht for pineapple.
- v) Privately owned buildings are assessed by the actual measurement of each building and using a unit cost prepared in advance. Thirty per cent of the estimated value shall be added for moving and disbanding the buildings. Buildings of less than five years since construction shall be evaluated at a rate of 100 per cent and those that have been in use more than six years since construction shall be devaluated at a rate of two per cent per year until 30 per cent of bottom value. The remaining private structures values are estimated by using unit costs prepared according to the capacity, the materials or other items. For example, as for wells and pond, the unit price per cubic meter is fixed in accordance with their water supply capacity, and as for fences, the unit price per meter is set according to the materials.
- vi) Publicly owned properties shall be appraised on a concept of replacement cost and paid for by the responsible authorities or agencies. However, compensation shall not be paid for national reserve forest lands.

2) Compensation for the Alternative Dam Construction Projects

- i) The possible areas to be inundated by the seven alternative dam construction sites are preliminarily estimated as follows:

Dam A	3,250 rai (5.2 square kilometers)
Dam B	6,625 " (10.6 ")
Dam C	8,438 " (13.5 ")
Dam D	10,313 " (16.5 ")
Dam A.C	5,338 " (8.7 ")
Dam A.D.I	5,875 " (9.4 ")
Dam A.D.II	4,875 " (7.8 ")

- ii) The number of family and the acreage of farm land to be submerged or compensated by the dam construction are calculated as shown in Table 4.5-7 and 4.5-8.
- iii) The compensation money to be paid for the immovable properties owned privately is computed as shown in Table 4.5-9 by applying the following unit prices which are prevailing in the project area.

Unit Price	Paddy	13,000 Baht
	Upland	5,000 Baht
	Other Land	2,000 Baht
	Homelots	10,000 Baht
	Houses	96,000 Baht (15 years old, 80% of a new building)
	Trees	800 Baht per household

4.5.5. Resettlement

1) Principle

- i) When a majority of the evacuees (more than fifty per cent) from an inundated area intends to resettle to continue farming, resettlement shall be prepared for them.

Table 4.5-7 Number of Family to be Compensated

Villages	Dam B	Dam C	Dam D	Dam A&C	Dam A&D, I	Dam A&D, II
Ban Mae Lu	-	-	-	22	22	22
Ban Hua Sue	450	450	90	-	-	-
Ban Don Mun	90	27	-	-	-	-
Ban Huai Rai	75	75	-	-	-	-
Ban Huai Maklua	-	-	-	-	-	-
Ban Kom	185	185	185	10	10	-
Ban Mai	224	280	280	140	140	-
Ban Pong Pa Pao	-	105	92	26	26	-
Ban Tung Ton	-	206	164	21	21	-
Ban Sop Po	-	-	53	-	53	-
Total	1,024	1,328	864	219	272	22

Table 4.5-8 Farm Land Area to be Compensated

(Unit: rai)

Villages	Dam B			Dam C			Dam D			Dam A&C			Dam A&D.I			Dam A&D.II			
	Up- Paddy land	Other	Paddy land	Up- Paddy land	Other	Paddy land	Up- Paddy land	Other	Paddy land	Up- Paddy land	Other	Paddy land	Up- Paddy land	Other	Paddy land	Up- Paddy land	Other	Paddy land	
Ban Mae Lu	-	-	-	-	-	-	-	-	200	200	10	200	200	10	200	200	10	200	10
Ban Hua Sue	2,926	1,800	40	2,926	1,800	40	293	180	4	-	-	-	-	-	-	-	-	-	-
Ban Don Mun	244	192	90	163	128	60	41	32	15	-	-	-	-	-	-	-	-	-	-
Ban Huai Rai	105	200	10	105	200	10	32	60	3	-	-	-	-	-	-	-	-	-	-
Ban Huai Maklua	228	161	90	152	107	60	-	-	-	-	-	-	-	-	-	-	-	-	-
Ban Kom	505	342	17	505	342	17	505	342	17	25	17	1	25	17	1	-	-	-	-
Ban Mai	393	214	-	491	267	-	491	267	-	98	53	-	98	53	-	-	-	-	-
Ban Pong Pa Pao	168	21	3	670	83	12	587	73	11	251	31	5	251	31	5	-	-	-	-
Ban Tung Ton	-	-	-	891	455	30	713	364	24	267	137	9	267	137	9	-	-	-	-
Ban Sop Po	-	-	-	-	-	-	1,500	1,000	35	-	-	-	1,500	1,000	35	150	100	4	-
Total	4,569	2,930	250	5,903	3,182	229	4,162	2,318	109	841	438	25	2,341	1,438	60	350	300	14	-

Table 4.5-9 Compensation for the Private Properties

(Unit: '000 Baht)

	Lands				Trees	Total	No. of Household		
	Paddy	Upland	Others	Homelots				Total	Houses
Dam A	2,600	1,000	20	88	3,708	2,112	26	5,846	22
Dam B	59,397	14,650	500	4,096	78,643	98,304	819	177,753	1,024
Dam C	76,739	15,910	450	5,312	98,411	127,488	1,062	226,961	1,328
Dam D	54,106	11,590	218	3,456	69,370	82,944	691	153,005	864
Dam A&C	10,933	2,190	50	876	14,049	21,024	263	35,336	219
Dam A&D.I	30,433	7,190	120	1,088	38,831	26,112	218	65,161	272
Dam A&D.II	4,550	1,500	28	88	6,166	2,112	26	8,304	22

- ii) In the case of RID, the site of resettlement shall be selected in the vicinity of the submerged area on the condition that about ten rai is distributed to each farm family and a modern irrigation system is provided.
- iii) RID shall be responsible for constructing agricultural infrastructure such as land clearing, farm lots, roads and irrigation facilities. As for other public facilities, the authorities or agencies responsible shall construct them, for example, the Ministry of Education for schools and wats and the Provincial Electricity Authority for electricity.
- iv) Resettlers shall individually rebuild their own buildings with compensation money.
- v) The new settlement will be administered under the jurisdiction of the Cooperative Promotion Department for the time being.
- vi) Taking into account of past experiences, the income level in the new settlement should be approximately equivalent to that of the beneficial area of the Project.
- vii) The new settlement has to be completed immediately before closing the dam.

2) Programming

- i) The number of family to be resettled is estimated as indicated in Table 4.5-10 by taking into account the degree of seriousness for each village.

ii) The type of farming is designed below.

Size of Farm	10 rai
Paddy	6 rai (irrigated)
Upland	2 rai
Others	2 rai

Crop Production

Rice	6 rai	600 kg
Tobacco	1 rai	2.5 t
Soybean	3 rai	200 kg
Groundnuts	2 rai	250 kg
Maize	1 rai	300 kg
Sugarcane	1 rai	7 t

Animal Production

Pigs	1 head (Yearly 1 head)
Cows	2 head (Yearly 1/2 head)

Output

	<u>Financial</u> <u>Benefit(unit)</u> (Baht)	<u>Economic</u> <u>Benefit(unit)</u> (Baht)
Rice	11,880 (3.3)	23,040 (6.4)
Tobacco	6,250 (2,500)	7,075 (2,830)
Soybean	4,224 (7.04)	4,770 (7.95)
Groundnuts	2,815 (5.63)	3,300 (6.36)
Maize	831 (2.77)	939 (3.13)
Sugarcane	2,590 (370)	2,590 (420)
<u>Sub-total</u>	<u>28,590</u>	<u>39,124</u>
Pigs	1,500 (1,500)	1,500 (1,500)
Cows	1,500 (3,000)	2,500 (5,000)
<u>Sub-total</u>	<u>3,000</u>	<u>4,000</u>

Input

	<u>Financial</u>	<u>Economic</u>
Water Charge	900 Baht (wet 300, dry 600)	
Fertilizer	F 3,825	E 2,385
Chemicals	F 2,385	E 2,197
Oils	F 1,000	E 880
Tractor	F 2,000	E 1,760
Others	F 2,000	E 2,000
<u>Sub-total</u>	<u>12,120</u>	<u>10,122</u>

Farm Net Income

Financial	19,470 Baht
Economic	33,002 Baht

3) Costs and Benefits

- i) The total resettlement area of each including public land is shown in Table 4.5-10.
- ii) Although the construction costs of the resettlement are hardly calculated because any place for it is yet fixed, they will be as indicated in Table 4.5-11 under the assumption that the unit costs per farm will be 6,000 Baht for land clearing, 88,000 Baht for road construction, 106,000 Baht for providing irrigation facilities (tank irrigation), 9,800 Baht for electrifying and so on.
- iii) The expected benefits from the resettlement are estimated as shown in Table 4.5-12.

Table 4.5-10 Resettlement Areas of the Alternative Cases

(Unit: rai)

	<u>No. of Settlers</u>	<u>Divided Area</u>	<u>Area of Roads and Canals</u>	<u>Area for Public Use</u>	<u>Total Area</u>
Dam B	1,024	10,240	1,024	50	11,314
Dam C	1,328	13,280	1,328	63	14,671
Dam D	819	8,190	819	44	9,053
Dam A.C	125	1,250	125	25	1,400
Dam A.D.I	178	1,780	178	25	1,983
Dam A.D.II	22	220	22	19	261

Table 4.5-11 Construction Costs of the Resettlement

(Unit: '000 Baht)

	No. of settlers	Land Clearing	Public Investment							Private Investment		
			Roads	Irrigation System	Electricity	School	Water	Wells	Total	Houses	Trees	Total
Dam B	1,024	6,144	90,112	108,544	10,035	3,000	5,000	525 (35)	223,360	98,304	819	99,123
Dam C	1,328	7,968	116,864	140,768	13,014	3,000	5,000	675 (45)	287,287	127,488	1,062	128,550
Dam D	819	4,914	72,072	86,814	8,026	2,000	5,000	420 (28)	177,246	78,624	655	79,279
Dam A&C	125	750	11,000	13,250	1,225	1,000	2,000	75 (5)	29,300	12,000	100	12,100
Dam A&D.I	178	1,068	15,664	18,868	1,744	1,000	2,500	90 (6)	40,934	17,088	142	17,230
Dam A&D.II	22	132	1,936	2,332	216	500	1,500	15 (1)	6,631	2,112	18	2,130

Table 4.5-12 Expected Benefits from the Resettlement

(Unit: '000 Baht)

No. of Farm	Financial Benefits				Economic Benefits				
	Outputs		Inputs	Benefits	Outputs		Inputs	Benefits	
	Crops	Animals			Crops	Animals			Total
Dam B	29,276	3,328	12,411	20,193	40,063	4,608	44,671	10,365	34,306
Dam C	37,968	4,316	16,095	26,189	51,957	5,976	57,933	13,442	44,491
Dam D	23,415	2,662	9,926	16,151	32,043	3,686	35,729	8,290	27,439
Dam A&C	3,574	406	1,515	2,465	4,891	563	4,328	1,265	3,063
Dam A&D.I	5,089	579	2,157	3,511	6,964	801	7,765	1,802	5,963
Dam A&D.II	629	72	267	434	861	99	960	223	737

4) Resettlement Sites

i) Under the present socio-economic circumstances in Thailand the resettlement programme is indispensable to implement reservoir dam projects smoothly. Whether or not they can find a place to be settled nearby the project area is one of the most important pre-requisite conditions for this kind of project.

ii) For the resettlement of farmers who are living in the possible submerged area caused by dam construction two areas had been proposed as resettlement lands. One is on the undulating foothills facing the Mae Chang and the Mae Wang rivers (Resettlement Site-1), and another is in the depression located in the upstream right bank of the Mae Chang river adjacent to the Mae Tha Tank Irrigation area (Resettlement Site-2). The land conditions in these areas were surveyed mainly by auger boring and compared with those in the possible submerged lands (Submerged Area). The locations of test pits and auger holes are shown in Fig. 3.2-5 in Appendix 3.2-6, and the columnar sections of soil profiles are made as Fig. 4.5-2.

Apart from these two candidate sites, a hilly place located on the background of Ban Tung Ton is proposed as a site for resettlement (Resettlement Site-3).

iii) Site-1 is hilly and rocky and most of the area is suitable for farming, but it is irregularly developed by the nearby villagers. Site-3 is also hilly and elevated place, and seems to be difficult to provide with a modern irrigation system.

As for the small number of evacuees, the depressed area (Site-2) lying between Dam sites C and D are reasonably suitable for resettlement. However, most of the areas are already enclosed with fence made of bamboo and wooden sticks, and some measures are necessary for acquisition of the land.

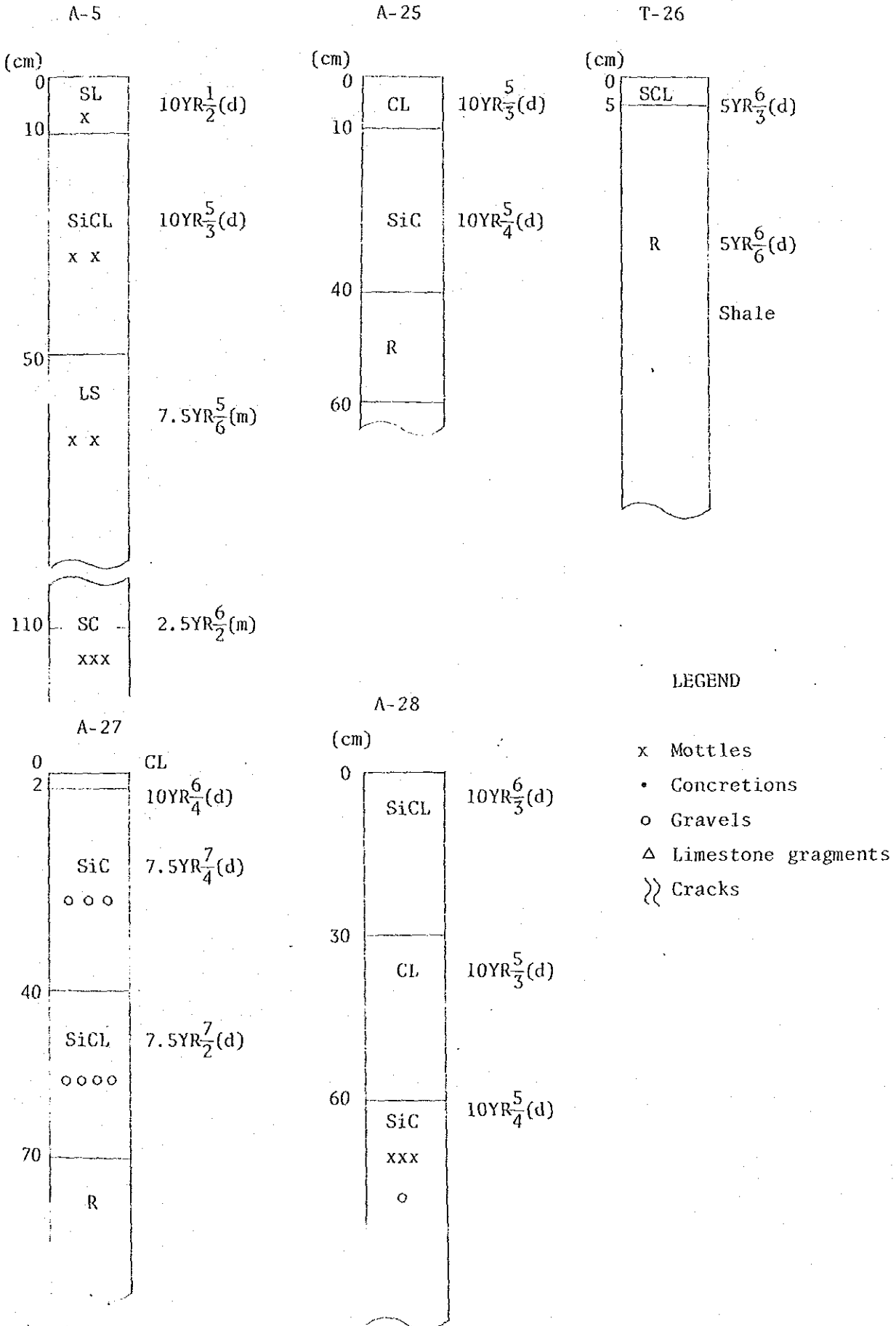
Resettlement Site-1

The area can be roughly separated into two parts; hilly slope lands (predominant) and small valleys/lower lands. The sparse shrubs cover most of the slopes, and some extent of the sugarcane fields are scattered in those shrubs. Further, higher lands are covered with forests composed of mixed kinds of trees. According to the geological map, these hills are composed of Triassic or Pre-triassic igneous rocks in the northern parts, and tertiary igneous rocks, basalts and its equivalent in the southern part. As a result of the field survey (A-25, T-26, A-27), the slope lands have shallow soil and contain a considerable amount of gravels and cobbles. Besides, gravel pavement (T-26) and rock outcrop are distributed in these lands. Due to the sparse vegetation and lack of land conservation management, the fertile topsoils have been washed away caused by severe erosion. Therefore, these lands were classified into the land class group U6/R6 (U6st/R6st).

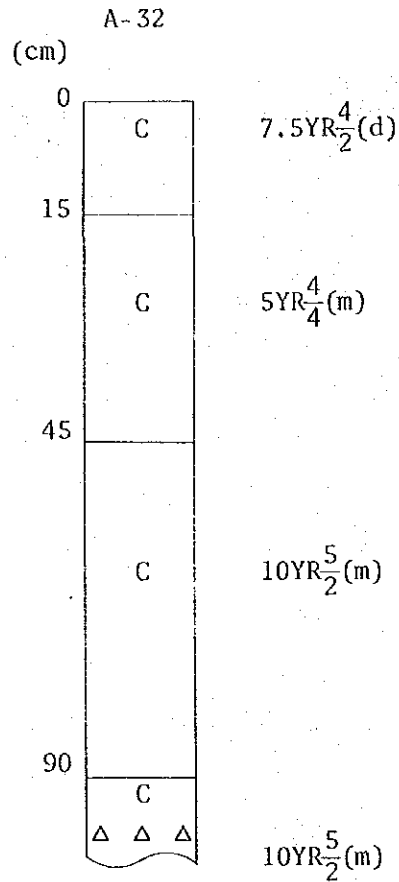
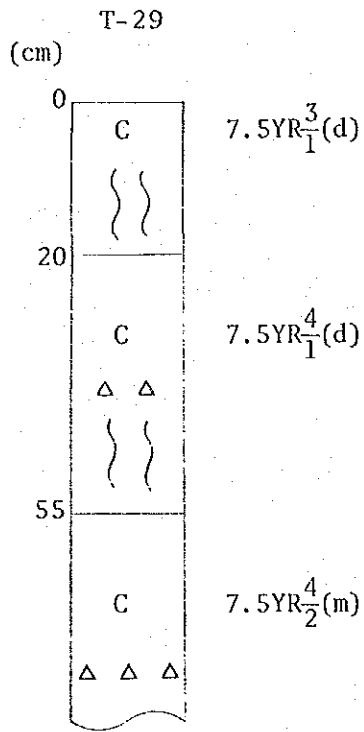
Resettlement Site-2

The area is in the depression. Sparse shrubs occupy most of the area, and rainfed paddy fields are scattered to a small extent. Geologically, limestone prevails around this area and fine clayey, montmorillonitic Grumusols (Typic Pellusterts in Soil Taxonomy, USDA) have been formed. As shown in the columnar sections (T-29 and A-32), clay occupies the entire soil profile. This soil is characterized by its high content of montmorillonitic clay and wide cracks found in dry seasons. The soil is substantially fertile, however, the difficulty in tilth due to its heavy texture make the land uncultivable at present. These lands were classified into the land class group U2/R2 or R2 (U2st/R2st, U3st/R2st).

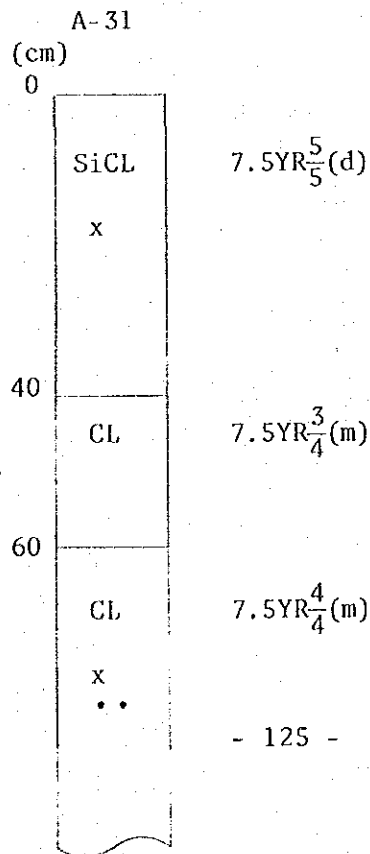
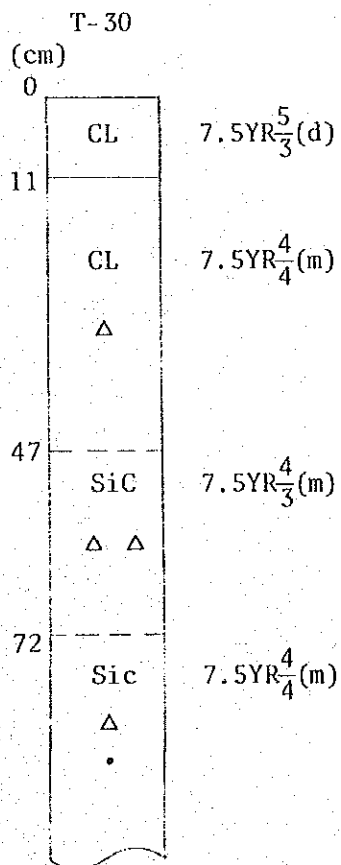
Fig. 4.5-2 Proposed Resettlement Site - 1



Proposed Resettlement Site - 2



Possible Submerged Area



Submerged Area

The possible submerged lands are located along the upper stream of Mae Chang river. Presently, the lands on the old levee are used for intensive cropping (Rice/Tobacco). As shown in the columnar sections (T-30 and A-31), these soils are deep and have medium texture. These soils are classified into fine loamy textured Non-calciic Brown Soils (Udic Haplustatfs) called Kamphaeng Saen series. Because of good drainage, these soils are used for upland fields including orchards as well as residential areas. The lands were considered to be best suitable for upland irrigation crops as the land class group of U1 (U1/R3s).

Consequently, the prevailing land conditions were compared between the resettlement areas and the submerged area, and summarized in Table 4.5-13.

4.5.6. Fresh Water Fishery

1) Inland Fishery

Inland fisheries of Thailand are very important for local consumption by rural people and also for the fishing industry. In 1981, the total catch and value of fresh water fish amounted to 164 thousand tons on 3,921 million Baht. They occupied 8.3 per cent in tonnage and 22.9 per cent in value of the total catch and value. Several inland fisheries stations have been established, which are raising fingerlings by hatching and distributing them to the neighbouring fishing places. Two stations, Chiang Mae and Payao, are located near Lampang. The main kinds of fish raised at the stations are common carp, telapia (Pla Nil), Indian carp (Rohu), tilapia, common silver barb and catfish. The branch office of the Fisheries Department opened in Muang Lampang at the end of 1982.

Table 4.5-13 Comparison of Major Land Conditions between the Proposed Resettlement Areas and the Possible Submerged Area

Land Conditions	Resettlement Site 1	Resettlement Site 2	Submerged Area
Landform	Dissected erosion surface including fans	Depression	Old levee
Parent Materials	Shale, slate and/or phyllite	Limestone	Old alluvium
Soil	Muak Lek/Li/Ngao association	Takhli/Lop Buri association	Kamphaeng Saen series
	Non-Calciic Brown Soils/ Reddish-brown Lateritic Soils/Lithosols	Grumusols	Non-Calciic Brown Soils
Land Class	U6/R6	U2/R2 R2	U1
Present Land Use	Shrub/Sugarcane	Shrub/Rice	Rice/Tobacco
Remarks	Gravelly, rock outcrop Erosion problem	Heavy texture Difficulty in tilling	Productive soil

2) Fisheries in Lampang

In Chagwat Lampang, there are 15 fish ponds and water areas of 13,000 rai. Of which, the Kew Lom reservoir is the largest one with 12,000 rai. At present 50 professional fishermen are engaging in catching fish and 10 merchants are buying it, transporting it to Lampang and selling it there.

The main species of fishes are tilapia, carp, common silver barb and Rohu (Indian carp). Their fingerlings are raised at Payao and Chiang Mai Fresh Water Fish Research Stations are released every April. So, for three months from the middle of May to the middle of August after releasing, fishing by certain specified instruments is prohibited. The most common fishing method is "Set Gill Net" (Kai Pla), which require the use of fishing boats. Most of the above mentioned fishes gain more than one kg in weight per year. The annual catch is 15 to 20 kg per rai. In the extreme case of fish culture, it reaches 80 to 100 kg per rai. The prices of fish are 20 to 30 Baht per kg at farmgate and 25 to 40 Baht at market.

Table 4.6-1 Investment Cost of the Project

Description	Case 5			Case 6		
	Total \$ '000	Foreign C \$ '000	Local C \$ '000	Total \$ '000	Foreign C \$ '000	Local C \$ '000
1. Civil Works (Sub-total)	523,780	22,773	243,180	496,200	21,573	269,280
1-1. Pre-engineering	10,000	435	9,000	10,000	435	9,000
1-2. Preparation	39,640	1,723	27,210	38,030	1,653	25,890
1-3. Storage Dam A	208,930	9,084	66,970	208,930	9,084	66,970
1-4. Diversion Dam C or D	76,480	3,325	31,200	67,660	2,942	39,000
1-5. Main Canal	116,920	5,083	47,190	106,300	4,621	45,790
1-6. Lateral Canal	65,520	2,849	36,550	58,990	2,564	25,620
1-7. Improvement of Drainage Facilities	6,290	274	2,520	6,290	274	3,770
2. Land Acquisition & Compensation (Sub-total)	59,760	2,598	59,760	21,000	913	21,000
2-1. Reservoir Area	39,700	1,726	39,700	8,400	365	8,400
2-2. Resettlement	12,200	530	12,200	5,400	235	5,400
2-3. Project Area	7,860	342	7,860	7,200	313	7,200
3. Construction Equipment	6,000	261	-	6,000	261	-
4. Project Facilities	10,000	435	10,000	10,000	435	10,000
5. Project Administration	16,100	700	16,100	16,100	700	16,100
6. Consulting Services	89,000	3,870	34,000	89,000	3,870	34,000
Total (1 to 6)	704,640	30,637	341,600	638,300	27,752	308,280
7. Contingency	70,460	3,063	34,160	65,830	2,775	30,800
Total (1 to 7)	775,100	33,700	399,340	702,130	30,527	338,820
8. Price Escalation	242,720	10,553	120,910	225,570	9,808	107,710
Grand Total	1,017,820	44,253	497,670	927,700	40,335	446,530

Table 4.6-2 Estimation of the Project (1)

1-2. Preparation (Case 5)

Description	Quantity	Unit	Unit Cost (P)		Amount (P '000)		Equip Depreciation	Equip Depreciation	Total
			Foreign Currency	Local Currency	Foreign Currency	Local Currency			
(1) Storage Dam A									
Access Road	12.0	km	342,300	321,500	4,107.6	3,858.0	223.2	8,188.8	
Transmission Line	3.0	"	180,000	180,000	540.0	540.0	90.0	1,170.0	
Land Clearing	270	rai	-	360	-	97.2	-	97.2	
Camp & Office Services	1	LS	1,420,000	5,660,000	1,420.0	5,660.0	-	7,080.0	
Precaution Safety	1	"	149,000	1,339,000	149.0	1,339.0	-	1,488.0	
Miscellaneous	1	"	70,800	637,200	70.8	638.2	16.8	708.0	
Sub-total					6,600	12,740	530	19,670	
(2) Diversion Dam C									
Access Road	2.0	km	342,300	321,500	684.6	654.0	37.2	1,364.8	
Transmission Line	1.5	"	180,000	180,000	270.0	270.0	45.0	555.0	
Land Clearing	200	rai	-	360	-	72.0	-	72.0	
Camp & Office Services	1	LS	780,000	3,110,000	780.0	3,110.0	-	3,890.0	
Precaution Safety	1	"	52,000	468,000	52.0	468.0	-	520.0	
Miscellaneous	1	"	26,100	234,900	26.1	234.9	7.8	261.0	
Sub-total					1,910	5,050	90	7,050	
(3) Main & Lateral Canal									
Access Road	5.0	km	342,300	321,500	1,711.5	1,607.5	95.0	3,412.0	
Land Clearing	1,700	rai	-	360	-	612.0	-	612.0	
Camp & Office Services	1	LS	1,380,000	5,520,000	1,380.0	5,520.0	-	6,900.0	
Miscellaneous	1	"	140,000	1,260,000	140.0	1,260.0	7.0	1,400.0	
Sub-total					3,400	9,440	100	12,940	
Total					11,910	27,210	520	39,140	

(Cont'd)

Table 4.6-2 Estimation of the Project (2)

1-2. Preparation (Case 6)

Description	Quantity	Unit	Unit Cost (P)			Amount (P '000)			
			Equip Depreciation	Foreign Currency	Local Currency	Equip Depreciation	Foreign Currency	Local Currency	Total
(1) Storage Dam A	1	LS				550	6,600	12,740	19,870
(2) Diversion Dam D									
Access Road	2.0	km	18,600	342,300	321,500	37.2	684.6	643.0	1,364.8
Transmission line	1.5	"	30,000	180,000	180,000	45.0	270.0	270.0	585.0
Land Clearing	150	rai	-	-	360	-	-	54.0	54.0
Camp & Office	1	LS	-	680,000	2,700,000	-	680.0	2,700.0	3,380.0
Services	1	"	-	42,500	382,200	-	42.5	382.2	424.7
Precaution Safety	1	"	-	21,200	191,100	-	21.2	191.1	212.3
Miscellaneous	1	"	-	-	-	7.8	81.7	209.7	299.2
Sub-total						90	1,780	4,450	6,320
(3) Main & Lateral Canal									
Access Road	5.0	km	18,600	342,300	321,500	93.0	1,711.5	1,607.5	3,412.0
Land Clearing	1,600	rai	-	-	360	-	-	576.0	576.0
Camp & Office	1	LS	-	1,240,000	4,970,000	-	1,240.0	4,970.0	6,210.0
Services	1	"	-	150,000	1,150,000	-	130.0	1,130.0	1,260.0
Miscellaneous	1	"	-	-	-	7.0	158.5	416.5	582.0
Sub-total						100	3,240	8,700	12,040
Total						520	11,620	25,890	38,030

(Cont'd)

Table 4.6-2 Estimation of the Project (3)

Description	Quantity	Unit	Unit Cost (B)		Equip Depreciation	Amount (B '000)		Equip Depreciation	Amount (B '000)		
			Foreign Currency	Local Currency		Foreign Currency	Local Currency				
(1) Dam Body											
Excavation Stripping	52,600	m ³	34	12	15	789.0	1,788.4	631.2	3,208.6		
" Earth	100,400	"	34	13	15	1,506.0	3,413.6	1,305.2	6,224.8		
" Soft Rock (A)	15,000	"	50	21	22	286.0	650.0	273.0	1,209.0		
" Hard Rock (A)	5,500	"	129	49	29	159.5	709.5	269.5	1,138.5		
Embankment											
Impervious Zone Tr./Com.	250,500	m ³	75	26	53	8,266.5	18,787.5	6,513.0	33,567.0		
Semipervious Zone Tr.	177,700	"	58	14	19	3,376.3	6,752.6	2,487.8	12,616.7		
" Com.	309,000	"	10	5	6	1,854.0	3,090.0	1,545.0	6,489.0		
Pervious Zone Tr. (A)	29,600	"	39	14	15	444.0	1,154.4	414.4	2,012.8		
" (B)	36,200	"	128	41	40	1,448.0	4,633.6	1,484.2	7,565.8		
Pervious Zone Com.	96,500	"	8	3	4	381.6	763.2	286.2	1,431.0		
Filter & Drain	27,100	"	27	297	12	325.2	731.7	8,048.7	9,105.6		
Core Trench Clearing	5,900	m ²	10	62	5	29.5	59.0	365.8	454.3		
Miscellaneous	1	LS				944.4	2,126.5	1,186.0	4,256.9		
Sub-total						19,810	44,660	24,810	89,280		
(2) Foundation Treatment											
Drilling Curtain Holes	22,700	m	285	159	27	612.9	6,569.5	3,155.3	10,237.7		
" Blanket Holes	2,800	"	154	47	74	207.2	431.2	131.6	770.0		
" Pilot & Test Holes	1,500	"	637	280	52	78.0	955.5	420.0	1,453.5		
Grouting Curtain Holes	24,000	"	159	259	42	1,008.0	3,816.0	5,736.0	10,560.0		
" Blanket Holes	2,800	"	230	287	42	117.6	644.0	803.6	1,565.2		
Miscellaneous	1	LS				1,063	613.8	513.5	1,233.6		
Sub-total						2,130	12,950	10,760	25,820		

Note: Tr. = Transportation, Com. = Compaction

(Cont'd)

Table 4.6-2 Estimation of the Project (4)

Description	Quantity	Unit	Unit Cost (P)			Amount (P '000)			
			Equip Depreciation	Foreign Currency	Local Currency	Equip Depreciation	Foreign Currency	Local Currency	
(3) Spillway									
Excavation Earth	197,000	m ³	15	34	13	2,955.0	6,698.0	2,561.0	12,214.0
" Soft Rock (A)	29,000	"	22	50	21	638.0	1,450.0	609.0	2,697.0
" Hard Rock (B)	57,000	"	27	124	40	1,539.0	7,068.0	2,280.0	10,887.0
Back Fill	540	"	5	9	20	2.7	4.9	10.8	18.4
Rip-rap	100	"	48	140	48	4.8	14.0	4.8	23.6
Concrete Reinforced	6,940	"	131	1,521	1,610	909.1	10,555.7	11,173.4	22,638.2
" plain	3,010	"	141	632	818	424.4	1,902.3	2,462.2	4,788.9
Miscellaneous	1	LS				647.0	2,767.1	1,918.8	5,332.9
Sub-total						7,120	30,460	21,020	58,600
(4) Intake Facility									
Excavation Earth	10,300	m ³	15	34	13	154.5	350.2	133.9	638.6
" Soft Rock (B)	5,200	"	22	43	23	114.4	223.6	119.6	457.6
Back-fill	650	"	5	9	20	3.3	5.9	13.0	22.2
Concrete Reinforced	3,470	"	131	1,521	1,610	454.6	5,277.9	5,586.7	11,319.2
Steel Pipe φ2,000 m/m	150	m	-	69,700	19,900	-	10,455.0	2,985.0	15,440.0
Gate Jet-flow φ1,300 m/m	1	Unit	-	3,734,000	259,000	-	3,734.0	259.0	3,993.0
" Slid 1,000 x 1,000 m/m	1	"	-	2,779,000	222,000	-	2,779.0	222.0	3,001.0
" Sluice 2,000 x 2,000 m/m	1	"	-	8,400	38,600	-	8.4	38.6	47.0
Screen	28.2	m ²	-	3,800	18,600	-	107.2	524.5	631.7
Miscellaneous	1	LS				38.2	1,148.8	497.7	1,679.7
Sub-total						760	24,090	10,380	35,230
Total						29,820	112,140	66,970	208,930

Table 4.6-2 Estimation of the Project (5) (Cont'd)

Description	Quantity	Unit	Unit Cost (\$)			Amount (\$ '000)			Total
			Equip. Depreciation	Foreign Currency	Local Currency	Equip. Depreciation	Foreign Currency	Local Currency	
(1) Fill Dam & Blanket									
Excavation Stripping	7,900	m ³	10	21	8	79.0	165.9	65.3	308.1
" Earth	4,900	"	15	35	14	73.5	171.5	68.6	315.6
" Rock	2,700	"	29	118	59	78.3	318.6	159.3	556.2
Embankment Impervious Zone	55,800	"	34	56	21	1,897.2	3,124.8	1,171.8	6,193.8
" Filter Zone	5,400	"	12	27	297	64.8	145.8	1,603.8	1,814.4
" Rip-rap	6,500	"	28	110	38	182.0	715.0	247.0	1,144.0
Core Trench Clearing	3,500	m ²	5	10	62	16.3	33.0	204.6	254.0
Miscellaneous	1	LS				118.7	238.4	171.7	525.8
Sub-total						2,510	4,910	3,690	11,110
(2) Foundation Treatment									
Drilling Curtain Holes	9,900	m	36	455	201	356.4	4,504.5	1,989.9	6,850.8
" Blanket Holes	1,400	"	78	158	49	109.2	221.2	68.6	399.0
" Pilot & Test Holes	600	"	62	692	328	37.2	415.2	196.8	649.2
Grouting Curtain Holes	10,500	"	42	230	287	441.0	2,415.0	5,013.5	5,869.5
" Blanket Holes	1,400	"	42	487	410	58.8	681.8	574.0	1,314.6
Miscellaneous	1	LS				57.4	412.3	297.2	766.9
Sub-total						1,060	8,650	6,150	15,850

(Cont'd)

Table 4.6-2 Estimation of the Project (6)

Description	Quantity	Unit	Unit Cost (€)		Equip Depreciation	Amount (€ '000)		Equip Depreciation	Amount (€ '000)		
			Foreign Currency	Local Currency		Foreign Currency	Local Currency		Foreign Currency	Local Currency	
(3) Wire											
Excavation Earth	12,100	m ³	15	35	15	14	181.5	423.5	169.4	774.4	
" Rock	5,700	"	29	118	29	59	165.3	672.6	336.3	1,174.2	
Concrete Reinforced	4,960	"	122	1,479	122	1,501	605.1	7,335.8	7,941.0	15,881.9	
" Plain	4,870	"	129	853	129	808	628.2	4,154.1	3,935.0	8,717.3	
" Lean	1,850	"	125	469	125	538	251.3	867.7	995.3	2,094.5	
Bridge 5.0 m x 12.5 m	4	Unit	4,350	64,500	4,350	52,470	17.4	257.2	209.9	484.5	
Radial Gate 12.5 m x 7.1 m	4	"	-	1,790,000	-	560,000	-	7,160.0	2,240.0	9,400.0	
Miscellaneous	1	LS	-	-	-	-	181.2	2,079.1	1,583.1	3,843.4	
Sub-total							2,010	22,950	17,410	42,370	
(4) Intake Facility											
Concrete Reinforced	1,400	m ³	122	1,479	122	1,501	170.8	2,070.6	2,241.4	4,482.8	
" Lean	1,000	"	125	469	125	538	125.0	469.0	538.0	1,132.0	
Sluice Gate 2.50 m x 2.50 m	3	Unit	-	11,800	-	52,900	-	35.4	158.7	194.1	
Screen	45	m ²	-	3,800	-	18,600	-	171.0	837.0	1,008.0	
Hand-rail	20	m	-	50	-	200	-	1.0	4.0	5.0	
Miscellaneous	1	LS	-	-	-	-	14.2	135.0	180.9	328.0	
Sub-total							310	2,880	3,960	7,150	
Total							5,890	59,390	31,200	76,480	

(Cont'd)

Table 4.6-2 Estimation of the Project (7)

1-4. Diversion Dam D

Description	Quantity	Unit	Unit Cost (B)		Amount (B '000)	
			Equip Depreciation	Foreign Currency	Local Currency	Total
(1) Fill Dam						
Excavation Stripping	4,000	m ³	10	21	84.0	156.0
" Earth	6,000	"	15	35	210.0	584.0
" Rock	2,500	"	29	118	295.0	515.0
Embankment Impervious Zone	9,500	"	34	56	532.0	1,054.5
" Filter Zone	800	"	12	27	21.6	268.8
" Rip-rap	1,500	"	28	110	165.0	264.0
Core Trench Clearing	1,000	m ²	5	10	10.0	77.0
Miscellaneous	1	LS	27.9		62.4	130.7
Sub-total			610		1,380	2,850
(2) Foundation Treatment						
Drilling Curtain Holes	6,100	m	36	455	2,775.5	4,221.2
" Blanket Holes	300	"	78	158	47.4	85.5
" Pilot & Test Holes	400	"	62	692	276.8	452.8
Grouting Curtain Holes	6,500	"	42	159	1,035.5	2,860.0
" Blanket Holes	500	"	42	230	69.0	167.7
Miscellaneous	1	LS	26.6		217.8	402.8
Sub-total			580		4,420	8,170

(Cont'd)

Table 4.6-2 Estimation of the Project (8)

Description	Quantity	Unit	Unit Cost (B)		Amount (B '000)		
			Equip Depreciation	Foreign Currency	Local Currency	Total	
(3) Wire							
Excavation Earth	26,600	m ³	15	55	399.0	372.4	1,702.4
" Rock	4,300	"	29	118	124.7	253.7	885.8
Concrete Reinforced	6,500	"	122	1,479	793.0	10,406.5	20,813.0
" Plain	5,250	"	129	853	677.3	4,242.0	9,397.6
" Lean	2,570	"	125	469	321.3	1,382.7	2,909.3
Bridge 5.0 m x 12.5 m	4	Unit	4,350	64,500	17.4	209.9	484.5
Radial Gate 12.5 m x 7.1 m	4	"	-	1,790,000	-	2,240.0	9,400.0
Miscellaneous	1	LS	-	-	237.3	1,912.8	4,567.4
Sub-total					2,570	21,020	50,160
(4) Intake Facility							
Concrete Reinforced	1,600	m ³	122	1,479	195.2	2,561.6	5,123.2
" Lean	-	"	125	469	-	-	-
Sluice Gate 2.50 m x 2.50 m	3	Unit	-	11,800	-	158.7	194.1
Screen	38	m ²	-	3,800	-	706.8	851.2
Hand-rail	20	m	-	50	-	4.0	5.0
Miscellaneous	1	LS	-	-	4.8	178.9	306.5
Sub-total					200	3,610	6,480
Total					3,960	28,660	67,660

(Cont'd)

Table 4.6-2 Estimation of the Project (9)

1-5. Main Canal (Case 5)

Description	Quantity	Unit	Unit Cost (B)		Amount (B '000)		Equip Depreciation	Total	
			Foreign Currency	Local Currency	Foreign Currency	Local Currency			
(1) Mae Chang									
Excavation Stripping	39,900	m ³	8	3	319.2	159.6	119.7	598.5	
Earth	103,800	"	16	8	1,660.8	934.2	830.4	3,425.4	
Soil W/Stone	22,100	"	38	15	839.8	419.9	331.5	1,591.2	
Rock	2,800	"	114	58	319.2	86.8	162.5	568.4	
Embankment Transportation	39,100	"	12	5	469.2	312.8	195.5	977.5	
Compaction	127,800	"	10	7	1,278.0	659.0	894.6	2,811.6	
Sodding	69,300	m ²	4	16	277.2	-	1,108.8	1,386.0	
Pavement	9,500	m ³	48	60	456.0	95.0	570.0	1,121.0	
Concrete Lining	9,100	"	580	1,212	5,278.0	427.7	11,029.2	16,734.9	
Hydraulic Structures	1	LS			5,928.0	208.0	6,407.0	10,545.0	
Miscellaneous	1	LS			1,484.6	327.0	2,160.9	3,972.5	
Sub-total					16,510	5,610	25,810	45,730	
(2) Mae Pung Right									
Excavation Stripping	27,600	m ³	8	3	220.8	110.4	82.8	414.0	
Earth	72,000	"	16	8	1,152.0	648.0	576.0	2,376.0	
Embankment Transportation	11,740	"	12	5	140.9	93.9	58.7	293.5	
Compaction	73,300	"	10	7	733.0	366.5	513.1	1,612.6	
Sodding	58,000	m ²	4	16	232.0	-	928.0	1,160.0	
Pavement	5,800	m ³	48	60	278.4	58.0	348.0	684.4	
Concrete Lining	5,940	"	580	1,212	3,445.2	279.2	7,119.3	10,923.7	
Hydraulic Structures	1	LS			642.0	20.0	1,761.0	2,523.0	
Miscellaneous	1	"			685.8	154.0	1,155.1	1,922.9	
Sub-total					7,530	1,730	12,720	21,980	

(Cont'd)

Table 4.6-2 Estimation of the Project (10)

Description	Quantity	Unit	Unit Cost (P)		Equip Depreciation	Amount (P '000)		Equip Depreciation	Amount (P '000)		
			Foreign Currency	Local Currency		Foreign Currency	Local Currency				
(3) Mae Pung Left											
Excavation Stripping	13,300	m ³	8	3	55.2	106.4	39.9	199.5			
" Earth	36,200	"	16	8	325.8	579.2	289.6	1,194.6			
Embankment Transportation	5,700	"	12	5	45.6	68.5	28.5	142.5			
" Compaction	36,700	"	10	7	183.5	367.0	256.9	807.4			
Sodding	29,000	m ²	4	16	-	116.0	464.0	580.0			
Pavement	2,800	m ³	48	60	28.0	134.4	168.0	330.4			
Concrete Lining	2,600	"	580	1,212	122.2	1,508.0	3,151.2	4,781.4			
Hydraulic Structures	1	LS			16.0	409.0	912.0	1,337.0			
Miscellaneous	1	"			75.7	321.6	529.9	927.2			
Sub-total					850	3,610	5,840	10,300			
(4) Sop Chang											
Excavation Stripping	13,500	m ³	8	3	54.0	108.0	40.5	202.5			
" Earth	37,100	"	16	8	333.9	593.6	296.8	1,224.3			
Embankment Transportation	5,800	"	12	5	46.4	69.6	29.0	145.0			
" Compaction	37,500	"	10	7	187.5	375.0	262.5	825.0			
Sodding	50,100	m ²	4	16	-	120.4	481.6	602.0			
Pavement	5,500	m ³	48	60	55.0	264.0	330.0	649.0			
Concrete Lining	2,500	"	580	1,212	117.5	1,450.0	3,030.0	4,597.5			
Hydraulic Structures	1	LS			229.0	2,584.0	11,249.0	14,062.0			
Miscellaneous	1	"			106.7	555.4	1,370.6	2,232.7			
Sub-total					1,130	6,120	17,290	24,540			
(5) Mae Wa											
Excavation Stripping	18,200	m ³	8	3	72.8	145.6	54.6	275.0			
" Earth	45,700	"	16	8	411.3	731.2	365.7	1,508.1			
Embankment Transportation	7,500	"	12	5	60.0	90.0	37.5	187.5			
" Compaction	46,600	"	10	7	233.0	466.0	326.2	1,025.2			
Sodding	38,600	m ²	4	16	-	154.4	617.6	772.0			
Pavement	6,800	m ³	48	60	68.0	326.4	408.0	802.4			
Concrete Lining	3,330	"	580	1,212	156.5	1,931.4	4,036.0	6,123.9			
Hydraulic Structures	1	LS			51.0	829.0	3,312.0	4,192.0			
Miscellaneous	1	"			107.4	466.0	912.5	1,485.9			
Sub-total					1,160	5,140	10,070	16,370			
Total					8,480	38,710	69,730	116,920			

(Cont'd)

Table 4.6-2 Estimation of the Project (11)

1-5. Main Canal (Case 6)

Description	Quantity	Unit	Equip		Unit Cost (B)		Equip Depreciation	Amount (B '000)		Total
			Depreciation	Depreciation	Foreign Currency	Local Currency		Foreign Currency	Local Currency	
(1) Mae Chang										
Excavation Stripping	37,000	m ³	4	8	148.0	296.0	111.0	555.0		
" Earth	96,400	"	9	16	867.6	1,542.4	771.2	3,181.2		
" Earth w/Some	20,600	"	19	58	391.4	782.8	309.0	1,483.2		
" Rock	2,600	"	31	114	80.6	296.4	150.8	527.8		
Embankment Transportation	36,500	"	8	12	290.4	435.6	181.5	907.5		
" Compaction	118,700	"	5	10	593.5	1,187.0	830.9	2,611.4		
Sodding	64,400	m ²	-	4	-	257.6	1,030.4	1,288.0		
Pavement	8,800	m ³	10	48	98.0	422.4	528.0	1,038.4		
Concrete Lining	8,450	"	47	580	397.2	4,901.0	10,241.4	15,539.6		
Hydraulic Structures	1	LS			208.0	3,928.0	6,407.0	10,543.0		
Miscellaneous	1	"			305.3	1,400.8	1,363.6	3,069.7		
Sub-total					3,370	15,450	15,000	33,820		

(2) Mae Pung Right

Excavation Stripping	27,600	m ³	4	8	110.4	220.8	82.8	414.0		
" Earth	72,000	"	9	16	648.0	1,152.0	576.0	2,376.0		
Embankment Transportation	11,700	"	8	12	93.6	140.4	58.5	292.5		
" Compaction	73,500	"	5	10	366.5	733.0	313.1	1,621.6		
Sodding	58,000	m ²	-	4	-	232.0	928.0	1,160.0		
Pavement	5,800	m ³	10	48	58.0	278.4	348.0	684.4		
Concrete Lining	5,900	"	47	580	277.5	3,422.0	7,150.8	10,850.1		
Hydraulic Structures	1	LS			20.0	642.0	1,861.0	2,523.0		
Miscellaneous	1	"			136.2	679.4	1,151.8	1,987.4		
Sub-total					1,730	7,500	12,670	21,900		

(Cont'd)

Table 4.6-2 Estimation of the Project (12)

Description	Quantity	Unit	Equip Depreciation		Unit Cost (\$)		Amount (B '000)		Equip Depreciation	Amount (B '000)		Total
			Local Currency	Foreign Currency	Local Currency	Foreign Currency	Local Currency	Foreign Currency				
(5) Mae Pung Left												
Excavation Stripping	8,600	m ³	4	8	34.4	68.8	25.8	129.0	34.4	68.8	25.8	129.0
" Earth	23,400	"	9	16	210.6	374.4	187.2	772.2	210.6	374.4	187.2	772.2
Embankment Transportation	5,700	"	8	12	29.6	44.4	18.5	92.5	29.6	44.4	18.5	92.5
" Compaction	23,700	"	5	10	118.5	237.0	165.9	521.4	118.5	237.0	165.9	521.4
Sodding	18,700	m ²	-	4	-	74.8	299.2	374.0	-	74.8	299.2	374.0
Pavement	1,800	m ³	10	48	18.0	86.5	108.0	212.4	18.0	86.5	108.0	212.4
Concrete Lining	1,680	"	47	580	79.0	974.4	2,036.2	3,089.6	79.0	974.4	2,036.2	3,089.6
Hydraulic Structures	1	LS	-	-	16.0	409.0	912.0	1,357.0	16.0	409.0	912.0	1,357.0
Miscellaneous	1	"	-	-	53.9	220.8	577.2	651.9	53.9	220.8	577.2	651.9
Sub-total					560	2,490	4,130	7,180	560	2,490	4,130	7,180
(4) Sop Chang												
Excavation Stripping	17,200	m ³	4	8	68.8	137.6	51.6	258.0	68.8	137.6	51.6	258.0
" Earth	47,500	"	9	16	425.7	756.8	378.4	1,560.9	425.7	756.8	378.4	1,560.9
Embankment Transportation	7,400	"	8	12	59.2	88.8	37.0	185.0	59.2	88.8	37.0	185.0
" Compaction	47,800	"	5	10	239.0	478.0	334.6	1,051.6	239.0	478.0	334.6	1,051.6
Sodding	38,500	m ²	-	4	-	153.2	612.8	766.0	-	153.2	612.8	766.0
Pavement	7,000	m ³	10	48	70.0	336.0	420.0	826.0	70.0	336.0	420.0	826.0
Concrete Lining	3,190	"	47	580	149.9	1,850.2	3,866.3	5,866.4	149.9	1,850.2	3,866.3	5,866.4
Hydraulic Structures	1	LS	-	-	229.0	2,584.0	11,249.0	14,062.0	229.0	2,584.0	11,249.0	14,062.0
Miscellaneous	1	"	-	-	128.4	635.4	1,690.3	2,454.1	128.4	635.4	1,690.3	2,454.1
Sub-total					1,370	7,020	18,540	27,030	1,370	7,020	18,540	27,030
(5) Mae Wa												
Excavation Stripping	18,200	m ³	4	8	72.8	145.6	54.6	273.0	72.8	145.6	54.6	273.0
" Earth	45,700	"	9	16	411.3	731.2	365.6	1,508.1	411.3	731.2	365.6	1,508.1
Embankment Transportation	7,500	"	8	12	60.0	90.0	37.5	187.5	60.0	90.0	37.5	187.5
" Compaction	46,600	"	5	10	233.0	466.0	326.2	1,025.2	233.0	466.0	326.2	1,025.2
Sodding	38,600	m ²	-	4	-	154.4	617.6	772.0	-	154.4	617.6	772.0
Pavement	6,800	m ³	10	48	68.0	326.5	408.0	802.4	68.0	326.5	408.0	802.4
Concrete Lining	3,530	"	47	58	156.5	1,931.4	4,036.0	6,123.9	156.5	1,931.4	4,036.0	6,123.9
Hydraulic Structures	1	LS	-	-	51.0	829.0	3,312.0	4,192.0	51.0	829.0	3,312.0	4,192.0
Miscellaneous	1	"	-	-	107.4	466.0	912.5	1,485.9	107.4	466.0	912.5	1,485.9
Sub-total					1,160	5,140	10,070	16,380	1,160	5,140	10,070	16,380
Total					8,190	37,600	60,510	106,300	8,190	37,600	60,510	106,300

(Cont'd)

Table 4.6-2 Estimation of the Project (13)

1-6. Lateral Canal (Case 5)

Description	Quantity	Unit	Unit Cost (B)			Amount (B '000)		
			Equip Depreciation	Foreign Currency	Local Currency	Equip Depreciation	Foreign Currency	Local Currency
(1) Mae Chang								
Excavation Stripping	32,300	m ³	3	6	3	193.8	96.9	387.6
" Earth	91,600	"	8	12	10	1,099.2	916.0	2,748.0
Embankment Transportation	11,000	"	11	17	8	187.0	88.0	396.0
" Completion	39,300	"	4	9	10	805.7	895.0	2,053.9
Sodding	112,400	m ²	-	4	16	449.6	1,798.4	2,248.0
Pavement	9,800	m ³	10	48	60	470.4	588.0	1,156.4
Hydraulic Structures	1	LS	21.0			762.0	2,099.0	2,882.0
Miscellaneous	1	"	143.1			394.3	640.7	1,178.1
Sub-total			1,570			4,360	7,120	13,050
(2) Mae Pung Right								
Excavation Stripping	58,700	m ³	3	6	3	552.2	176.1	704.4
" Earth	166,500	"	8	12	10	1,998.0	1,665.0	4,995.0
Embankment Transportation	19,800	"	11	17	8	336.6	158.4	712.8
" Completion	162,200	"	4	9	10	1,459.8	1,622.0	5,750.6
Sodding	200,700	m ²	-	4	16	802.8	3,211.2	4,014.0
Pavement	18,500	m ³	10	48	60	878.4	1,098.0	2,159.4
Hydraulic Structures	1	LS	30.0			1,507.0	3,934.0	5,271.0
Miscellaneous	1	"	252.3			715.2	1,185.3	2,152.8
Sub-total			2,840			7,850	13,050	23,740

(Cont'd)

Table 4.6-2 Estimation of the Project (14)

Description	Quantity	Unit	Unit Cost (P)			Amount (P '000)			
			Equip. Depreciation	Foreign Currency	Local Currency	Equip. Depreciation	Foreign Currency	Local Currency	
(3) Mae Pung Left									
Excavation Stripping	19,800	m ³	3	6	3	59.4	118.8	59.4	237.6
" Earth	55,200	"	8	12	10	441.6	562.4	552.0	1,656.0
Embankment Transportation	6,700	"	11	17	8	73.7	113.9	53.6	241.2
" Compaction	53,900	"	4	9	10	215.6	485.1	539.0	1,239.7
Sodding	68,100	m ²	-	4	16	-	272.4	1,089.6	1,362.0
Pavement	6,100	m ³	10	48	60	61.0	292.8	366.0	719.8
Hydraulic Structures	1	LS	8.0			8.0	342.0	1,230.0	1,580.0
Miscellaneous	1	"	80.7			80.7	22.6	380.4	683.7
Sub-total			940			940	2,510	4,270	7,720
(4) Sop Chang									
Excavation Stripping	25,700	m ³	3	6	3	77.1	154.2	77.1	308.4
" Earth	72,500	"	8	12	10	580.0	870.0	725.0	2,175.0
Embankment Transportation	8,600	"	11	17	8	94.6	146.2	68.8	309.6
" Compaction	70,600	"	4	9	10	282.4	635.4	706.0	1,623.8
Sodding	87,600	m ²	-	4	16	-	350.4	1,401.6	1,752.0
Pavement	8,000	m ³	10	48	60	80.0	384.0	480.0	944.0
Hydraulic Structures	1	LS	14.0			14.0	742.0	2,567.0	3,323.0
Miscellaneous	1	"	111.9			111.9	327.8	604.5	1,044.2
Sub-total			1,240			1,240	3,610	6,630	11,480
(5) Mae Wa									
Excavation Stripping	21,300	m ³	3	6	3	63.9	127.8	62.9	255.6
" Earth	62,200	"	8	12	10	497.6	746.4	622.0	1,866.0
Embankment Transportation	7,200	"	11	17	8	79.2	122.4	57.6	259.2
" Compaction	60,400	"	4	9	10	241.6	543.6	604.0	1,389.2
Sodding	69,800	m ²	-	4	16	-	279.2	1,116.8	1,396.0
Pavement	6,800	m ³	10	48	60	68.0	326.4	408.0	802.4
Hydraulic Structures	1	LS	13.0			13.0	571.0	2,110.0	2,694.0
Miscellaneous	1	"	96.7			96.7	273.2	497.7	867.6
Sub-total			1,060			1,060	2,990	5,480	9,530
Total			7,650			7,650	21,320	36,550	65,520

Table 4.6-2 Estimation of the Project (15) (Cont'd)

1-6. Larexal Canal (Case 6)

Description	Quantity	Unit	Unit Cost (P)			Amount (P '000)			
			Equip Depreciation	Foreign Currency	Local Currency	Equip Depreciation	Foreign Currency	Local Currency	Total
(1) Mae Chang									
Excavation Stripping	26,900	m ³	3	6	3	80.7	161.4	80.7	322.8
" Earth	76,300	"	8	12	10	610.4	915.6	763.0	2,289.0
Embankment Transportation	9,200	"	11	17	8	101.2	156.4	73.6	331.2
" Compaction	74,400	"	4	9	10	297.6	669.6	744.0	1,711.2
Sodding	95,600	m ²	-	4	16	-	374.4	1,497.6	1,872.0
Pavement	8,100	m ³	10	48	60	81.0	388.8	486.0	955.8
Hydraulic Structures	1	LS	23.0			23.0	798.0	2,240.0	3,016.0
Miscellaneous	1	"	116.1			116.1	345.8	585.1	1,047.0
Sub-total			1,510			1,510	3,810	6,470	11,590
(2) Mae Pung Right									
Excavation Stripping	51,500	m ³	3	6	3	154.5	309.0	154.5	618.0
" Earth	146,000	"	8	12	10	1,168.0	1,752.0	1,460.0	4,380.0
Embankment Transportation	17,400	"	11	17	8	191.4	295.8	139.2	626.4
" Compaction	142,200	"	4	9	10	568.8	1,279.8	1,422.0	3,270.6
Sodding	176,100	m ²	-	4	16	-	704.4	2,817.6	3,522.0
Pavement	16,100	m ³	10	48	60	161.0	772.8	966.0	1,899.8
Hydraulic Structures	1	LS	29.0			29.0	1,279.0	3,823.0	5,131.0
Miscellaneous	1	"	277.3			277.3	637.2	1,077.7	1,942.2
Sub-total			2,500			2,500	7,030	11,860	21,590

Table 4.6-2 Estimation of the Project (16) (Cont'd)

Description	Quantity	Unit	Unit Cost (B)		Equip Depreciation	Amount (B '000)		Equip Depreciation	Total	
			Foreign Currency	Local Currency		Foreign Currency	Local Currency		Foreign Currency	Local Currency
(S) Mee Pung Left										
Excavation Stripping	23,100	m ³	3	6	3	138.6	69.3	277.2	69.3	277.2
" Earth	64,300	"	8	12	8	771.6	643.0	1,929.0	643.0	1,929.0
Embankment Transportation	7,700	"	11	17	11	130.9	61.6	277.2	61.6	277.2
" Compaction	62,700	"	4	9	4	564.3	627.0	1,442.1	627.0	1,442.1
Sodding	79,300	m ²	-	4	-	317.2	1,268.8	1,586.0	1,268.8	1,586.0
Pavement	7,100	m ³	10	48	10	340.8	426.0	837.8	426.0	837.8
Hydraulic Structures	1	LS	7.0		7.0	339.0	1,220.0	1,566.0	1,220.0	1,566.0
Miscellaneous	1	"	92.8		92.8	267.6	434.3	794.7	434.3	794.7
Sub-total			1,090		1,090	2,870	4,750	8,710	4,750	8,710
(4) Spp Chang										
Excavation Stripping	24,900	m ³	3	6	3	149.4	74.7	298.8	74.7	298.8
" Earth	70,100	"	8	12	8	841.2	701.0	2,103.0	701.0	2,103.0
Embankment Transportation	8,400	"	11	17	11	142.8	67.2	302.4	67.2	302.4
" Compaction	68,500	"	4	9	4	614.7	585.0	1,570.9	585.0	1,570.9
Sodding	84,700	m ²	-	4	-	338.8	1,355.2	16,94.0	1,355.2	16,94.0
Pavement	7,700	m ³	10	48	10	369.6	462.0	908.6	462.0	908.6
Hydraulic Structure	1	LS	13.0		13.0	737.0	2,547.0	3,297.0	2,547.0	3,297.0
Miscellaneous	1	"	108.9		108.9	316.5	579.9	1,005.3	579.9	1,005.3
Sub-total			1,200		1,200	3,510	6,470	11,180	6,470	11,180
(S) Mae Wa										
Excavation Stripping	10,500	m ³	3	6	3	63.0	31.5	126.0	31.5	126.0
" Earth	30,600	"	8	12	8	367.2	306.0	918.0	306.0	918.0
Embankment Transportation	3,500	"	11	17	11	59.5	28.0	126.0	28.0	126.0
" Compaction	29,700	"	4	9	4	267.3	297.0	683.1	297.0	683.1
Sodding	34,400	m ²	-	4	-	137.6	550.4	688.0	550.4	688.0
Pavement	3,400	m ³	10	48	10	163.2	204.0	401.2	204.0	401.2
Hydraulic Structures	1	LS	12.0		12.0	558.0	2,060.0	2,630.0	2,060.0	2,630.0
Miscellaneous	1	"	40.4		40.4	164.2	343.1	547.7	343.1	547.7
Sub-total			520		520	1,780	3,820	6,120	3,820	6,120
Total			6,620		6,620	19,000	33,370	58,990	33,370	58,990

(Cont'd)

Table 4.6-2 Estimation of the Project (17)

1-7. Improvement of Drainage Facilities

Description	Quantity	Unit	Unit Cost (B)				Amount (B '000)			
			Equip		Equip		Foreign		Local	
			Deprecia- tion	Foreign Currency	Local Currency	Deprecia- tion	Foreign Currency	Local Currency	Total	
<u>(1) Upgrading of Trunk Canal</u>										
Excavation	45,000	m ³	8	12	10	360.0	540.0	450.0	1,350.0	
Sub-total						360.0	540.0	450.0	1,350.0	
<u>(2) Rehabilitation/Improvement of Structures</u>										
Reinforced Concrete	880	m ³	28	828	1,024	22.4	662.4	819.2	1,504.0	
Excavation	110	"	8	12	10	0.8	1.2	1.0	3.0	
Sub-total						23.2	663.6	820.2	1,507.0	
<u>(3) Rehabilitation of Major Canal</u>										
Excavation	85,000	m ³	8	12	10	680.0	1,020.0	850.0	2,550.0	
Sub-total						680.0	1,020.0	850.0	2,550.0	
<u>(4) Supplementary Structure</u>										
Reinforced Concrete	100	m ³	47	1,380	1,707	4.7	138.0	170.7	313.4	
Excavation	100	"	8	12	10	0.8	1.2	1.0	3.0	
Filling	60	"	-	-	58	-	-	3.5	3.5	
Sub-total						5.5	139.2	175.2	319.0	
<u>(5) Other Facilities</u>										
	1	LS				101.3	237.2	224.6	613.1	
Total						1,170	2,600	2,520	6,290	

Table 4.6-2 Estimation of the Project (18) (Cont'd)

2. Land Acquisition & Compensation (Case 5)

Description	Quantity	Unit	Unit Cost (₹)	Amount (₹ '000)
<u>2-1. Reservoir Area</u>				
(1) Compensation for Private Property in the Reservoir Area	1	LS		14,300
(2) Compensation for House	1	"		21,100
(3) Compensation for Public Property	1	"		4,300
<u>Sub-total</u>				<u>39,700</u>
<u>2-2. Resettlement</u>				
	1	LS		<u>12,200</u>
<u>2-5. Project Area</u>				
(1) Main Canal	550	rai	6,000	3,300
(2) Lateral Canal	760	"	6,000	4,560
<u>Sub-total</u>				<u>7,860</u>
<u>Total</u>				<u>59,760</u>

Table 4.6-2 Estimation of the Project (19)

(Cont'd)

2. Land Acquisition & Compensation (Case 6)

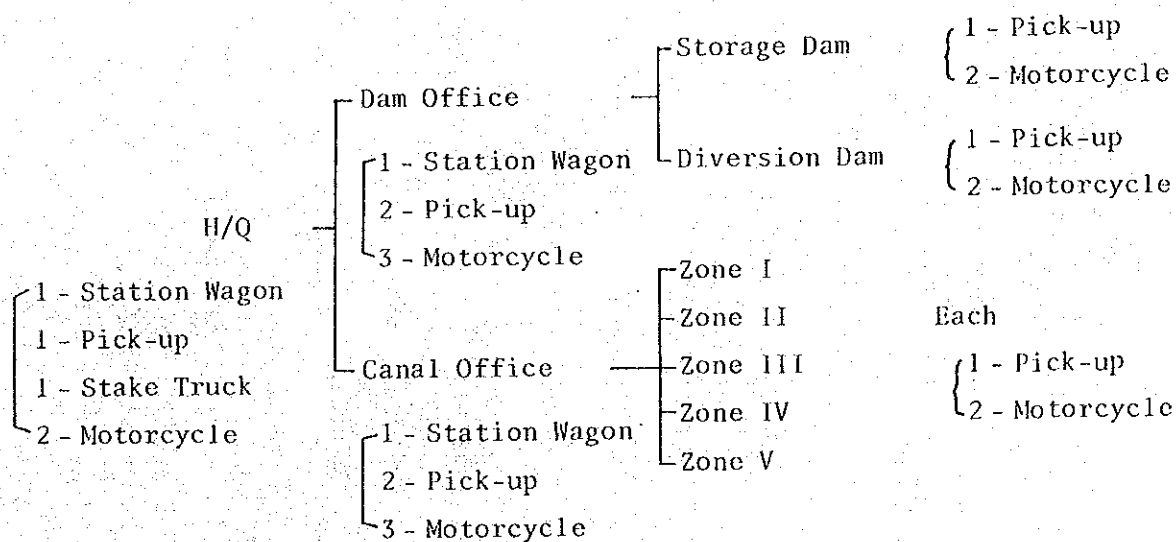
Description	Quantity	Unit	Unit Cost (₹)	Amount (₹ '000)
<u>2-1. Reservoir Area</u>				
(1) Compensation for Private Property in the Reservoir Area	1	LS		6,200
(2) Compensation for House	1	"		2,200
(3) Compensation for Public Property	1	"		-
<u>Sub-total</u>				<u>8,400</u>
<u>2-2. Resettlement</u>				
	1	LS		<u>5,400</u>
<u>2-3. Project Area</u>				
(1) Main Canal	530	rai	6,000	3,180
(2) Lateral Canal	670	"	6,000	4,020
<u>Sub-total</u>				<u>7,200</u>
<u>Total</u>				<u>21,000</u>

Table 4.6-2 Estimation of the Project (20) (Cont'd)

3. Construction Equipment

<u>Description</u>	<u>Quantity</u>	<u>Unit Price</u> (P'000)	<u>Amount</u> (P'000)
Station Wagon	3	500	1,500
Pick-up	12	200	2,400
Stake Truck	2	350	700
Motorcycles	20	40	800
Spareparts & Others			600
<u>Total</u>			<u>6,000</u>

Reference:

Organization and Distribution of Vehicles

(Cont'd)

Table 4.6-2 Estimation of the Project (21)

4. Project Facilities

<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u> (P)	<u>Amount</u> (P '000)
4-1. <u>Office Building</u>				
Wood Building	500	m ²	3,240	1,620.0
Store Keeper	50	"	2,280	114.0
Garage	60	"	780	46.8
<u>Sub-total</u>				<u>1,780.8</u>
4-2. <u>Staff Quarter</u>				
Class 7-8	1	house	391,200	391.2
" 5-6	10	"	359,600	3,596.0
" 3-4	10	"	249,600	2,496.0
" 1-2	5	"	159,600	798.0
Workers & Watchman	10	"	85,200	852.0
<u>Sub-total</u>				<u>7,933.2</u>
4-3. <u>Others</u>				
	1	LS		<u>286.0</u>
<u>Total</u>				<u>10,000.0</u>

Table 4.6-2 Estimation of the Project (22) (Cont'd)5. Project Administration5-1. Remuneration

(Per One Month)

<u>Description</u>	<u>Person</u>	<u>Rate</u> (₱)	<u>Amount</u> (₱)
(1) Key Staff			
Project Manager	1	10,000	10,000
Assistant Manager	1	7,000	7,000
Division Chief	1	6,500	6,500
Office Manager	2	6,500	13,000
Section Chief	15	6,000	90,000
Grade IV Class	7	5,000	35,000
" III Class	8	4,000	32,000
" II Class	15	3,000	45,000
(2) Supporting Staff			
Secretary	2	2,000	4,000
Draft-man	2	3,000	6,000
Clerk	1	4,000	4,000
Accountant	1	5,000	5,000
Assistant Officer	2	5,000	10,000
Total			267,500
Remuneration 267,500 x 12 month x 4 year = <u>12,840,000 ₱</u>			
5-2. <u>Miscellaneous</u> (25% of Remuneration)			<u>3,260,000 ₱</u>
<u>Grand Total</u>			<u>16,100,000 ₱</u>

Table 4.6-2 Estimation of the Project (23) (Cont'd)

6. Consulting Services

6-1. <u>Final Design</u>	<u>Quantity</u>	<u>Unit</u>	<u>Rate</u> (B)	<u>Amount</u> (B '000)
(1) Foreign Currency				
Consultants Remuneration	87	Mos	200,000	17,400
Out-of-pocket Expenses				
International travel expenses	22	Trips	30,000	660
Reimbursable cost	LS			1,400
Topographical & Geological Survey	LS			2,500
Miscellaneous	LS			2,040
<u>Sub-total</u>				<u>24,000</u>
(2) Local Currency				
Consultants Remuneration	99	Mos	80,000	7,920
Consultants per Diem				
Foreign	2,610	Days	600	1,566
Local	2,970	Days	600	1,782
Lining Allowance and Quarter				
Foreign	87	Mos	7,000	609
Local	99	Mos	7,000	693
Local Communication and Transportation	186	Trips	2,300	428
Printing of Reports	LS			1,200
Topographical & Geological Survey	LS			2,000
Miscellaneous	LS			1,802
<u>Sub-total</u>				<u>18,000</u>
<u>Total</u>				<u>42,000</u>

Table 4.6-2 Estimation of the Project (24) (Cont'd)

6-2. <u>Construction Supervision</u>	<u>Quantity</u>	<u>Unit</u>	<u>Rate</u> (฿)	<u>Amount</u> (฿ '000)
(1) Foreign Currency				
Consultants Remuneration	132	Mos	200,000	26,400
Out-of-pocket Expenses				
International travel expenses	18	Trips	30,000	540
Reimbursable Cost	LS			2,200
Miscellaneous	LS			1,860
<u>Sub-total</u>				<u>31,000</u>
(2) Local Currency				
Consultants Remuneration	88	Mos	80,000	7,040
Consultants per Diem				
Foreign	3,960	Dyas	600	2,376
Local	2,640	Days	600	1,584
Living Allowance and Quarter				
Foreign	132	Mos	7,000	924
Local	88	Mos	7,000	616
Local Communication and Transportation	220	Trips	2,300	506
Printing of Report	LS			1,200
Miscellaneous	LS			1,754
<u>Sub-total</u>				<u>16,000</u>
<u>Total</u>				<u>47,000</u>
<u>Grand Total</u>				<u>89,000</u>
Foreign Currency				55,000
Local Currency				34,000

Table 4.6-3 Disbursement Schedule of the Project Cost (Case 5)

Description	1984			1985			1986					
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total			
1. Civil Works (Sub-total)	280,600	243,180	523,780	200	1,800	2,000	5,272	15,584	18,856	17,005	29,119	46,124
1-1. Pre-engineering	1,000	9,000	10,000	200	1,800	2,000	300	2,700	3,000	300	2,700	3,000
1-2. Preparation	12,430	27,210	39,640	-	-	-	4,972	10,884	15,856	7,458	16,326	23,784
1-3. Storage Dam A	141,960	66,970	208,930	-	-	-	-	-	-	4,528	3,120	7,648
1-4. Diversion Dam C	45,280	31,200	76,480	-	-	-	-	-	-	4,719	6,973	11,692
1-5. Main Canal	47,190	69,730	116,920	-	-	-	-	-	-	-	-	-
1-6. Lateral Canal	28,970	36,550	65,520	-	-	-	-	-	-	-	-	-
1-7. Improvement of Drainage Facilities	3,770	2,520	6,290	-	-	-	-	-	-	-	-	-
2. Land Acquisition & Compensation (Sub-total)	-	59,760	59,760	-	11,952	11,952	-	17,928	17,928	-	17,928	17,928
2-1. Reservoir Area	-	39,700	39,700	-	7,940	7,940	-	11,910	11,910	-	11,910	11,910
2-3. Resettlement	-	12,200	12,200	-	2,440	2,440	-	3,660	3,660	-	3,660	3,660
2-3. Project Area	-	7,860	7,860	-	1,572	1,572	-	2,358	2,358	-	2,358	2,358
3. Construction Equipment	6,000	-	6,000	-	-	-	-	-	-	6,000	-	6,000
4. Project Facilities	-	10,000	10,000	-	1,000	1,000	-	5,000	5,000	-	4,000	4,000
5. Project Administration	-	16,100	16,100	-	1,610	1,610	-	2,415	2,415	-	2,415	2,415
6. Consulting Services	55,000	34,000	89,000	9,600	7,200	16,800	14,400	10,800	25,200	3,100	1,600	4,700
Total (1 to 6)	341,600	363,040	704,640	9,800	23,562	33,362	19,672	49,727	69,399	26,105	55,062	81,167
7. Contingency	34,160	36,300	70,460	980	2,355	3,335	1,967	4,972	6,939	2,611	5,506	8,117
Total (1 to 7)	375,760	399,340	775,100	10,780	25,917	36,697	21,639	54,699	76,338	28,716	60,568	89,284
8. Price Escalation	121,910	120,810	242,720	388	1,011	1,399	2,537	6,673	9,010	5,024	12,114	17,158
Grand Total	497,670	520,150	1,017,820	11,168	26,928	38,096	23,976	61,372	85,348	33,740	72,682	106,422

Table 4.6-3

Disbursement Schedule of the Project Cost (Case 5)

(Cont'd)

Description	1987		1988		1989		1990	
	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
1. Civil Works (Sub-total)	45,411	42,685	88,094	62,091	80,151	62,091	52,410	31,812
1-1. Pre-engineering	200	1,800	2,000	-	-	-	-	-
1-2. Preparation	-	-	-	-	-	-	-	-
1-3. Storage Dam A	14,196	6,697	20,895	20,091	42,588	20,091	42,588	20,091
1-4. Diversion Dam C	13,584	9,360	22,944	9,360	13,584	9,360	-	-
1-5. Main Canal	14,157	20,919	35,076	20,919	14,157	20,919	-	-
1-6. Lateral Canal	2,897	3,655	6,552	10,965	8,691	10,965	8,691	10,965
1-7. Improvement of Drainage Facilities	377	252	629	756	1,131	756	1,131	756
2. Land Acquisition & Compensation (Sub-total)	-	11,952	11,952	-	-	-	-	-
2-1. Reservoir Area	-	7,940	7,940	-	-	-	-	-
2-2. Resettlement	-	2,440	2,440	-	-	-	-	-
2-3. Project Area	-	1,572	1,572	-	-	-	-	-
3. Construction Equipment	-	-	-	-	-	-	-	-
4. Project Facilities	-	-	-	-	-	-	-	-
5. Project Administration	-	2,415	2,415	2,415	-	2,415	-	2,415
6. Consulting Services	7,750	4,000	11,750	4,000	7,750	4,000	4,650	2,400
Total (1 to 6)	53,161	61,050	114,211	68,506	87,901	68,506	57,060	36,627
7. Contingency	5,316	6,105	11,421	6,850	8,790	6,850	5,706	3,662
Total (1 to 7)	58,477	67,155	125,632	75,356	96,691	75,356	62,766	40,289
8. Price Escalation	14,326	19,072	33,398	27,204	38,580	33,383	50,315	21,353
Grand Total	72,803	86,227	159,030	102,560	135,271	108,739	93,081	61,642

Table 4.6-4 Disbursement Schedule of the Project Cost (Case 6)

Description	Total Cost (£ '000)			1984			1985			1986		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1. Civil Works (Sub-total)	269,280	226,920	496,200	200	1,800	2,000	5,156	15,056	18,212	16,063	27,151	43,214
1-1. Pre-engineering	1,000	9,000	10,000	200	1,800	2,000	300	2,700	3,000	300	2,700	3,000
1-2. Preparation	12,140	25,850	38,030	-	-	-	4,856	10,356	15,212	7,284	15,554	22,818
1-3. Storage Dam A	141,960	66,970	208,930	-	-	-	-	-	-	-	-	-
1-4. Diversion Dam D	39,000	28,660	67,660	-	-	-	-	-	-	3,900	2,886	6,766
1-5. Main Canal	45,790	60,510	106,300	-	-	-	-	-	-	4,579	6,051	10,650
1-6. Lateral Canal	25,620	35,370	58,990	-	-	-	-	-	-	-	-	-
1-7. Improvement of Drainage Facilities	3,770	2,520	6,290	-	-	-	-	-	-	-	-	-
2. Land Acquisition & Compensation (Sub-total)	-	21,000	21,000	-	4,200	4,200	-	6,500	6,500	-	6,500	6,500
2-1. Reservoir Area	-	8,400	8,400	-	1,680	1,680	-	2,520	2,520	-	2,520	2,520
2-2. Resettlement	-	5,400	5,400	-	1,080	1,080	-	1,620	1,620	-	1,620	1,620
2-3. Project Area	-	7,200	7,200	-	1,440	1,440	-	2,160	2,160	-	2,160	2,160
3. Construction Equipment	6,000	-	6,000	-	-	-	-	-	-	6,000	-	6,000
4. Project Facilities	-	10,000	10,000	-	1,000	1,000	-	5,000	5,000	-	4,000	4,000
5. Project Administration	-	16,100	16,100	-	1,610	1,610	-	2,415	2,415	-	2,415	2,415
6. Consulting Services	55,000	34,000	89,000	9,600	7,200	16,800	14,400	10,800	25,200	3,100	1,600	4,700
Total (1 to 6)	330,280	308,020	638,300	9,800	15,810	25,610	19,556	37,571	57,127	25,163	41,466	66,629
7. Contingency	33,030	30,800	63,830	980	1,580	2,560	1,960	3,760	5,720	2,510	4,140	6,650
Total (1 to 7)	363,310	338,820	702,130	10,780	17,390	28,170	21,516	41,331	62,847	27,673	45,606	73,279
8. Price Escalation	117,860	107,710	225,570	588	678	1,066	2,324	5,042	7,366	4,843	9,121	15,964
Grand Total	481,170	446,530	927,700	11,168	18,068	29,236	23,840	46,373	70,213	32,516	54,727	87,243

Table 4.6-4 Disbursement Schedule of the Project Cost (Case 6) (Cont'd)

Description	1987			1988			1989			1990		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1. Civil Works (Sub-total)	42,772	38,837	81,609	76,842	57,609	134,451	76,842	57,609	134,451	51,405	30,858	82,263
1-1. Pre-engineering	200	1,800	2,000	-	-	-	-	-	-	-	-	-
1-2. Preparation	-	-	-	-	-	-	-	-	-	-	-	-
1-3. Storage Dam A	14,196	6,697	20,893	42,588	20,091	62,679	42,588	20,091	62,679	42,588	20,091	62,679
1-4. Diversion Dam D	11,700	8,598	20,298	11,700	8,598	20,298	11,700	8,598	20,298	-	-	-
1-5. Main Canal	15,737	18,153	31,890	13,737	18,153	31,890	13,737	18,153	31,890	-	-	-
1-6. Lateral Canal	2,562	3,537	5,899	7,686	10,011	17,697	7,686	10,001	17,697	7,686	10,011	17,697
1-7. Improvement of Drainage Facilities	377	252	629	1,131	756	1,887	1,131	756	1,887	1,131	756	1,887
2. Land Acquisition & Compensation (Sub-total)	-	4,200	4,200	-	-	-	-	-	-	-	-	-
2-1. Reservoir Area	-	1,680	1,680	-	-	-	-	-	-	-	-	-
2-2. Resettlement	-	1,080	1,080	-	-	-	-	-	-	-	-	-
2-3. Project Area	-	1,440	1,440	-	-	-	-	-	-	-	-	-
3. Construction Equipment	-	-	-	-	-	-	-	-	-	-	-	-
4. Project Facilities	-	-	-	-	-	-	-	-	-	-	-	-
5. Project Administration	-	2,415	2,415	-	2,415	2,415	-	2,415	2,415	-	2,415	2,415
6. Consulting Services	7,750	4,000	11,750	7,750	4,000	11,750	7,750	4,000	11,750	4,650	2,400	7,050
Total (1 to 6)	50,522	49,452	99,974	84,592	64,024	148,616	84,592	64,024	148,616	56,055	35,673	91,728
7. Contingency	5,050	4,950	10,000	8,460	6,400	14,860	8,460	6,400	14,860	5,610	3,570	9,180
Total (1 to 7)	55,572	54,402	109,974	93,052	70,424	163,476	93,052	70,424	163,476	61,665	39,243	100,908
8. Price Escalation	13,616	15,450	29,066	29,778	25,423	55,201	37,128	31,198	68,326	29,785	20,798	50,581
Grand Total	69,188	69,852	139,040	122,830	95,847	218,677	130,180	101,622	231,802	91,448	60,041	151,489

Table 4.6-5 List of Unit Costs

(The labour, material and repair costs include contractor's overhead and profit of 20%.)

(Unit: B)

Description	Unit	Equip Depreciation	Labour, Material & Repair Cost		Total Cost	Remarks
			F.C.	L.C.		
(Storage Dam)						
Excavation Stripping	m ³	15	34	12	61	
" Earth	"	15	34	13	62	
" Soft Rock (A)	"	22	50	21	93	
" Soft Rock (B)	"	22	43	23	88	Intake Facility
" Hard Rock (A)	"	29	129	49	207	
" Hard Rock (B)	"	27	124	40	191	Spillway
Embankment						
" Impervious Zone Transportation	m ³	24	59	21	104	
" Impervious Zone Compaction	"	9	16	5	30	
" Semipervious Zone Transportation	"	19	38	14	71	
" Semipervious Zone Compaction	"	6	10	5	21	
" Pervious Zone Transportation (A)	"	15	39	14	68	From Stock Pile
" Pervious Zone Transportation (B)	"	40	128	41	209	From Quarry Site
" Pervious Zone Compaction	"	4	8	3	15	
" Rip-rap	"	48	140	48	236	
" Filter & Drain	"	12	27	297	336	

(Cont'd)
(Unit: ₪)

Table 4.6-5 List of Unit Cost

Description	Unit	Equip Depreciation	Labour, Material & Repair Cost		Total Cost	Remarks
			F.C.	L.C.		
Back Fill	m ³	5	9	20	34	
Core Trench Clearing	m ²	5	10	62	77	
Drilling Curtain Hole ϕ 46 m/m	m	27	285	139	451	
" Blanket Hole ϕ 46 m/m	"	74	154	47	275	
" Pilot & Test Hole ϕ 66 m/m	"	52	637	280	969	
Grouting Curtain Hole	"	42	159	239	440	Cement 50 kg/m
" Blanket Hole	"	42	230	287	559	Cement 100 kg/m
Concrete Reinforced	m ³	151	1,521	1,610	3,262	Reinforcement 70 kg/m ³ , $\sigma_{28} = 210 \text{ kg/cm}^2$
" Plain	"	141	632	818	1,591	$\sigma_{28} = 160 \text{ kg/cm}^2$
Steel Pipe ϕ 2,000 m/m	m	-	69,700	19,900	89,600	
Gate Jet Flow ϕ 1,300 m/m	Unit	-	3,734,000	259,000	3,993,000	
" Slid 1,000 x 1,000 m/m	"	-	2,779,000	222,000	3,001,000	
" Sluice 2,000 x 2,000 m/m	"	-	8,400	38,600	47,000	
Screen	m ²	-	3,800	18,600	22,400	
Access Road B = 6.50 m	km	18,600	342,300	521,500	682,400	
Transmission Line	"	30,000	180,000	186,000	390,000	
Land Clearing	rai	-	-	360	360	

Table 4.6-5 List of Unit Cost

(Cont'd)

(Unit: ₪)

Description	Unit	Equip. Depreciation	Labour, Material & Repair Cost		Total Cost	Remarks
			F.C.	L.C.		
(Diversion Dam)						
Excavation Stripping	m ³	10	21	8	39	
" Earth	"	15	35	14	64	
" Rock	"	29	118	59	206	
Embankment						
" Impervious Zone Transportation	m ³	28	47	16	91	
" Impervious Zone Compaction	"	6	9	5	20	
" Rip-rap Transportation	"	20	99	31	150	
" Rip-rap Compaction	"	8	11	7	26	
Drilling Curtain Hole ϕ 46 m/m	m	36	455	201	692	
" Blanket Hole ϕ 46 m/m	"	78	158	49	285	
" Pilot & Test Hole ϕ 66 m/m	"	62	692	328	1,082	
Grouting Blanket Hole	"	42	487	410	939	Cement 200 kg/m
Concrete Reinforced	m ³	122	1,479	1,601	3,202	Reinforcement 70 kg/m ³ , $\sigma_{28} = 210$ kg/cm ²
" Plain	"	129	853	808	1,790	$\sigma_{28} = 160$ kg/cm ²
" Lean	"	125	469	538	1,132	$\sigma_{28} = 120$ kg/cm ²
Bridge 5.00 (B) x 12.50 (L)	Unit	4,350	64,300	52,470	121,120	
Gate Radial 12,50 (B) x 7.10 (H)	"	-	1,790,000	560,000	2,350,000	
" Sluice 2,500 x 2,500 m/m	"	-	11,800	52,900	64,700	
Hand Rail	m	-	50	200	250	

Table 4.6-5 List of Unit Cost (Cont'd)
(Unit: ₱)

Description	Unit	Equip Depreciation	Labour, Material & Repair Cost		Total Cost	Remarks
			F.C.	L.C.		
(Main and Lateral Canal)						
Excavation Stripping (A)	m ³	4	8	3	15	Main Canal
" Stripping (B)	"	3	6	3	12	Lateral Canal
" Earth (A)	"	9	16	8	33	Main Canal
" Earth (B)	"	8	12	10	30	Lateral Canal
" Earth W/Stone	"	19	38	15	72	
" Rock (A)	"	31	114	58	203	Main Canal
" Rock (B)	"	28	92	67	187	Lateral Canal
Embankment						
" Main Canal Transportation	m ³	8	12	5	25	
" Main Canal Compaction	"	5	10	7	22	
" Lateral Canal Transportation	"	11	17	8	36	
" Lateral Canal Compaction	"	4	9	10	23	
Concrete Lining	"	47	580	1,212	1,839	
" Reinforced	"	47	1,380	1,707	3,134	Reinforcement 70 kg/m ³
" Plain	"	47	472	1,076	1,595	
Sodding	m ²	-	4	16	20	
Pavement (Laterite)	m ³	10	48	60	118	

Table 4.6-6 Operation Cost of Major Equipment

Description	Purchase Price (1)	Life Time (2)	Depreciation Cost (3) = $\frac{(1-0.1) \times (1)}{(2)}$ (B)	Repair Cost		Fuel & Lubricant		Labor (Operative) (10)	Administ-rative Cost (11)	Total Foreign Currency (12) = (5)+(8)	Total Local Currency (13) = (6)+(9)+(10)+(11)
				Rate (5) = $\frac{(1) \times (4)}{(2)} \times 0.8$ (B)	Parts Cost (6) = $\frac{(1) \times (4)}{(2)} \times 0.2$ (B)	Fuel (7)	F.C. L.C. (9)				
Bulldozer 11 ton	1,140	6,600	155.5	1.00	138.2	11.4	87.7	21.9	12.1	225.9	105.5
Bulldozer w/Ripper 21 ton	2,540	6,600	346.4	1.05	323.3	22.8	175.5	45.9	26.9	498.8	186.6
Bulldozer w/Ripper 32 ton	3,970	7,200	496.3	1.25	551.4	33.1	254.7	63.7	38.6	806.1	275.1
Fronted Loader 1.2 m ³	990	6,000	148.5	0.90	118.8	7.9	60.8	15.2	11.6	179.6	91.5
Fronted Loader 1.8 m ³	1,410	6,600	192.3	1.05	179.5	16.6	127.8	31.9	15.0	307.3	126.8
Fronted Loader 2.2 m ³	1,920	7,200	240.0	1.05	224.0	20.7	159.3	39.8	18.7	383.3	149.5
Backhoe 0.4 m ³	1,110	6,500	153.7	0.75	102.5	9.5	73.1	18.3	12.0	175.6	90.9
Backhoe 0.8 m ³	2,190	6,500	303.2	0.75	202.2	14.2	109.3	27.3	23.6	311.5	136.4
Dump Truck 8 ton	530	6,400	74.5	0.80	53.0	13.3	137.8	34.4	5.8	190.8	68.8
Dump Truck 11 ton	780	6,800	103.2	0.80	73.4	18.4	170.1	42.5	8.0	243.5	84.2
Dump Truck 18 ton	1,830	7,500	219.6	0.90	175.7	23.8	183.2	45.8	17.1	358.9	122.1
Motor Scraper 11 m ³	4,870	7,200	608.8	0.95	514.1	128.5	334.8	83.7	47.3	848.9	294.5
Tired Roller 20 ton	740	6,300	105.7	0.80	75.2	10.4	80.0	20.0	8.2	155.2	82.0
Tamping Roller 15 ton	620	6,300	88.6	0.75	59.0	-	-	-	6.9	59.0	21.7
Vibratory Roller 8 ton	920	4,500	184.0	0.80	130.8	8.9	68.5	17.1	14.3	199.3	99.1
Aggregate Production Plant 50 ton/H	5,300	7,000	450.0	0.70	280.0	-	-	-	35.0	280.0	105.0
Concrete Plant 0.75 m ³ x 2	4,450	7,000	569.6	0.70	354.4	-	-	-	44.3	354.4	132.9
Boring Machine	190	840 day	203.6	0.75	153.7	-	-	-	15.8	135.7	49.7
Grouting Pump	110	600 day	165.0	0.85	124.7	-	-	-	12.8	124.7	44.0
Grouting Mixer	56	600 day	84.0	0.85	63.5	-	-	-	6.5	63.5	22.4
Motor Grader 3.7 m	1,230	6,000	184.5	0.80	131.2	15.0	100.0	25.0	14.4	231.2	107.2
Water Tank Truck 6,000 l	510	6,000	76.5	0.75	51.0	12.8	84.7	21.2	6.0	135.7	55.3
Tower Crane 180 ton	6,420	11,600	498.1	0.25	110.7	27.7	-	-	38.7	110.7	66.4
Truck Crane 10 ton	1,320	6,000	198.0	0.50	88.0	15.9	122.4	50.6	15.4	210.4	103.0
Crawler Drill 10 m ³ /min	780	4,000	175.5	0.70	109.2	27.3	-	-	13.7	109.2	41.0
Air Compressor	410	940 day	439.3	0.90	351.4	-	-	-	34.2	351.4	122.1
Bulldozer 21 ton	2,280	6,600	310.9	1.05	290.2	72.5	175.5	43.9	24.2	465.7	175.6
Bulldozer 32 ton	3,490	7,200	456.3	1.05	407.2	101.8	254.7	63.7	33.9	661.9	254.4
Vibratory Roller 0.6 ton	114	3,750	27.4	0.80	19.5	4.9	9.6	2.4	2.1	29.1	34.0
Truck 6 ton	360	6,000	54.0	0.90	43.2	10.8	135.4	33.9	4.2	178.6	64.2
Agitator Truck 5.0 m ³	236	5,000	42.5	0.55	20.8	5.2	103.9	26.0	3.3	124.7	49.8
Portable Concrete Plant 0.5 m ³	1,420	5,400	276.7	0.70	172.1	45.0	55.4	13.9	21.5	227.5	78.4

FIG. 5.1-1 PROJECT ORGANIZATION CHART FOR IMPLEMENTATION

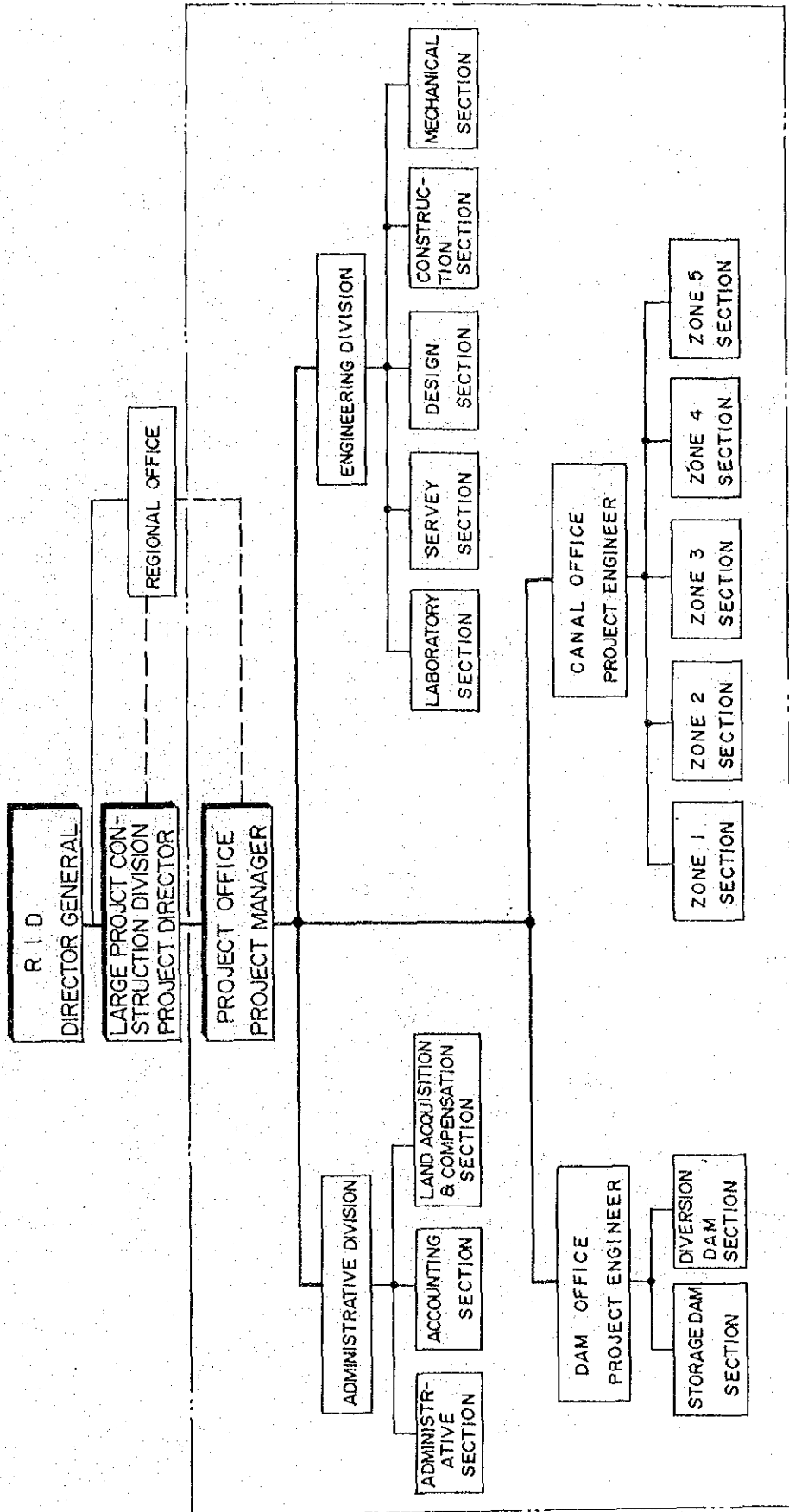
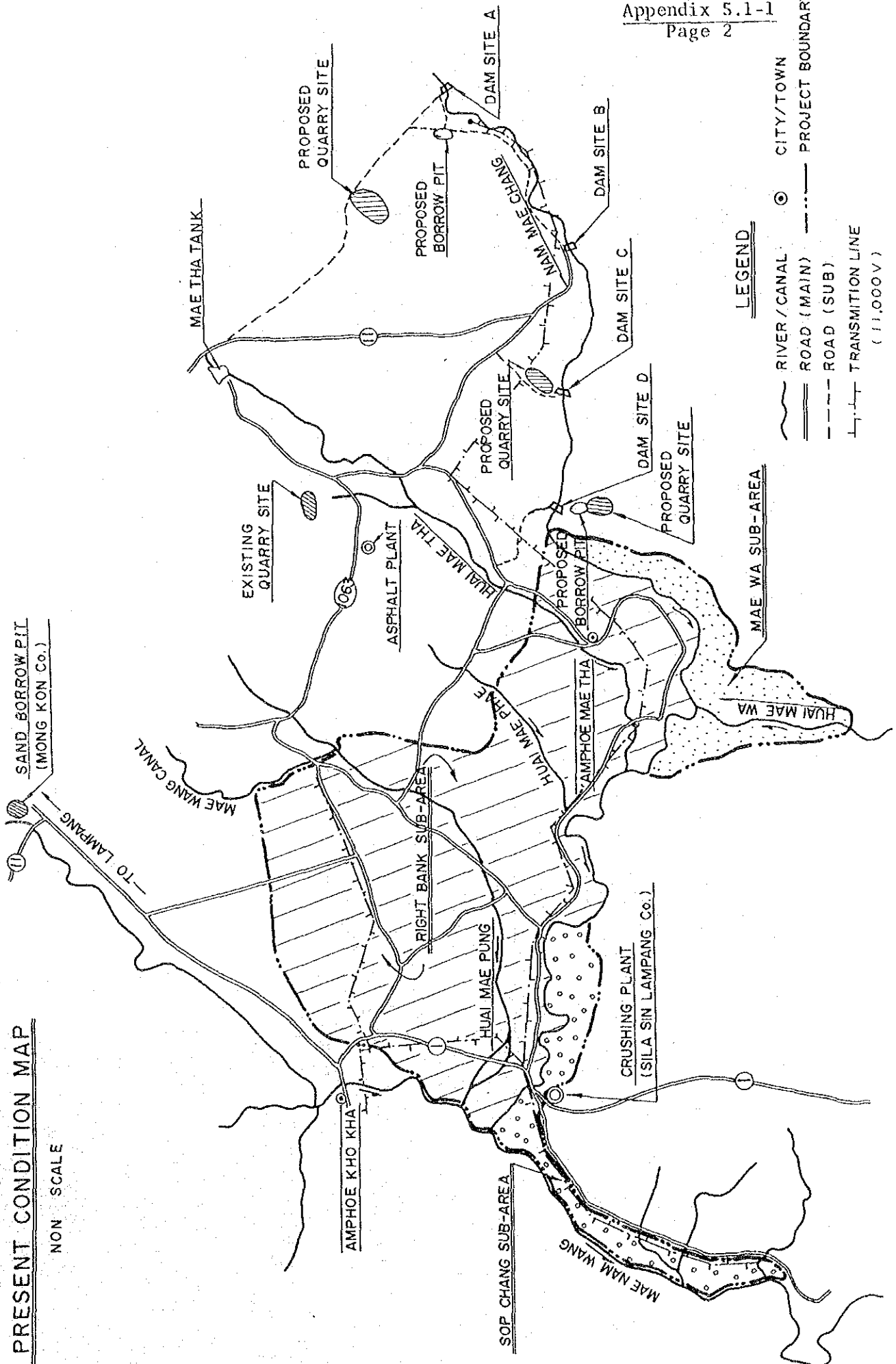


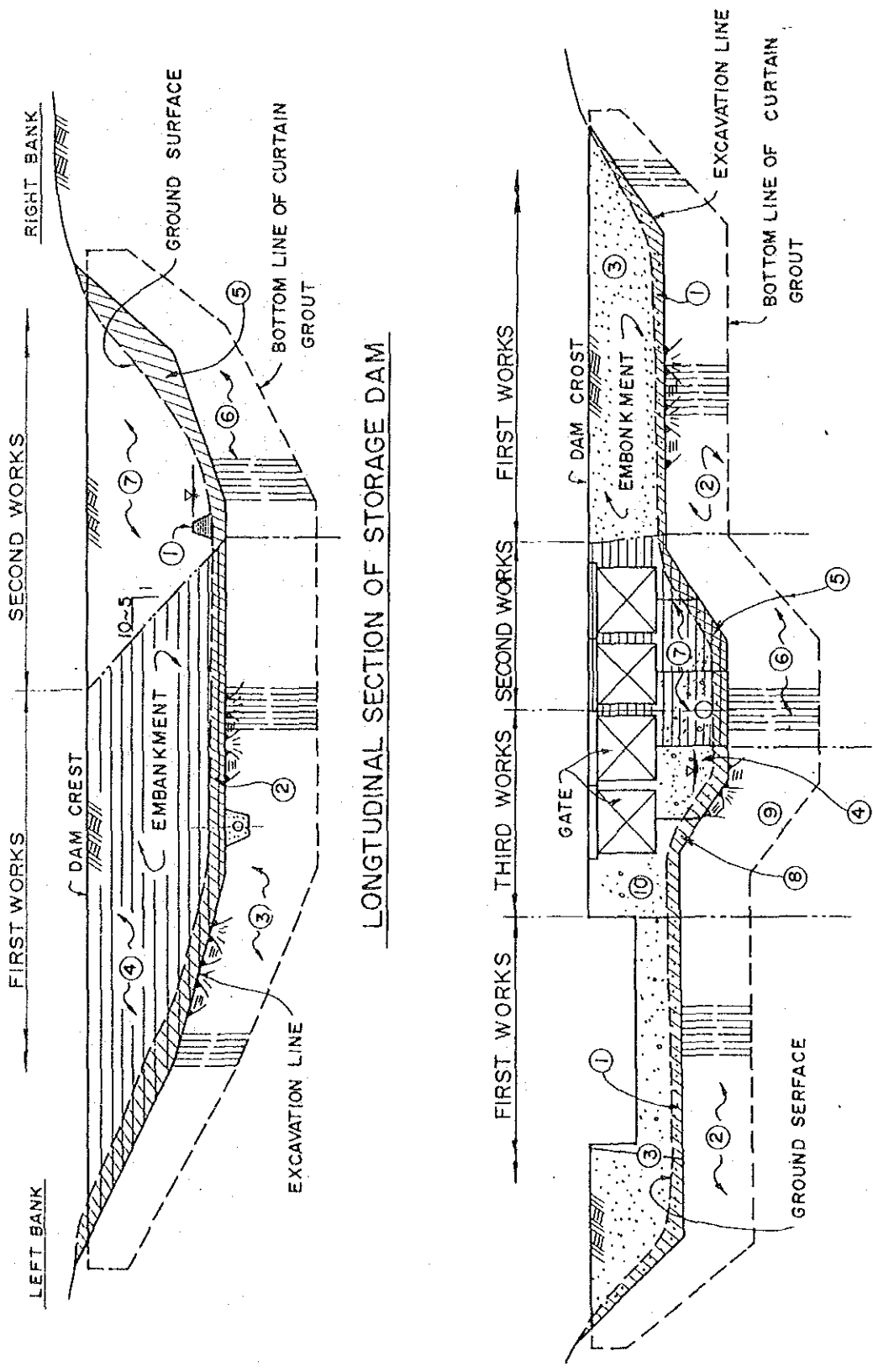
FIG. 5.1-2
PRESENT CONDITION MAP

NON SCALE



LEGEND

- RIVER / CANAL
- ROAD (MAIN)
- ROAD (SUB)
- TRANSMISSION LINE (11,000V)
- ⊙ CITY/TOWN
- PROJECT BOUNDARY



LONGTUDINAL SECTION OF DIVERSION DAM

FIG. 5.1-3 SEQUENCE OF CONSTRUCTION WORK

Fig. 5.1-4 IMPLEMENTATION PROGRAMME FOR THE PROJECT

Item	Year																																			
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992																										
Month	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12
A. Feasibility Study	-----																																			
B. Final Design	-----																																			
C. Project Implementation	-----																																			
1. Pre-Engineering	-----																																			
2. Land Acquisition & Compensation	-----																																			
3. Project Facilities	-----																																			
4. Project Administration	-----																																			
5. Consulting Services	-----																																			
6. Civil Works	-----																																			
(1) Preparation	-----																																			
(2) Storage Dam	-----																																			
(3) Diversion Dam	-----																																			
(4) Main Canal	-----																																			
(5) Lateral Canal	-----																																			
(6) Improvement of Drainage Facilities	-----																																			
7. On-Farm Development	-----																																			

Table 5.3-1 Annual Operation and Maintenance Cost (Unit: ¥ '000)

1. Operation Cost

(1) Salaries and Wages

Officer (A)	1	48	48
- do - (B)	17	42	294
- do - (C)	18	36	648
Permanent Employee (A)	54	30	1,620
- do - (B)	39	18	702
Laborers and Operators	44	18	792
Sub-total			4,104
Part-time Worker	132	4	528
<u>Total</u>			<u>4,632</u>

(2) Materials and Supplies

Fuel and Oil (as per attached)	300
Maintenance Cost of Vehicles	25
Office Supplies	120
<u>Total</u>	<u>420</u>

2. Maintenance Cost

Improvement and Maintenance	<u>748</u>
<u>Grand Total of Operation and Maintenance Cost</u>	<u>5,800</u>
<u>Replace Cost once every six years</u>	<u>6,000</u>

Fuel Cost

	<u>Fuel</u> <u>Per Month</u> (ℓ)	<u>Fuel</u> <u>Per Year</u> (ℓ)	<u>Unit</u>	<u>Annual</u> <u>Fuel</u> (ℓ)
Station Wagon	150	1,800	3	5,400
Pick-up	100	1,200	12	14,400
Stake Truck	50	600	2	1,200
Motor Cycle	8	96	20	1,920
<u>Total</u>				<u>22,920</u>

Fuel Cost per litre ₦ 12.00

₦ 275,040

Say ₦ 275,000

Table 5.3-2 Staffing on Operation & Maintenance of
Mae Chang Irrigation System

	Officer			Permanent Employee		Laborer & Operator
	(A)	(B)	(C)	(A)	(B)	
Mac Chang Irrigation System O & M Office						
Project Engineer	1		1	1	1	1
Administration Section		1	2	2	1	2
Engineering Section		1	2	2	1	2
O & M Section		1	2	2	1	2
Mechanical Section		1	2	2	1	2
Agriculture Service Section		1	2	2	1	2
Storage Dam O.M. Office		1	1	4	4	4
Diversion Dam O.M. Office		1	1	4	4	4
Zone I			1	6	6	6
Zone II			1	4	4	4
Zone III			1	10	8	8
Zone IV			1	8	3	3
Zone V			1	7	4	4
<u>Total</u>	<u>1</u>	<u>7</u>	<u>18</u>	<u>54</u>	<u>39</u>	<u>44</u>

Table 6.1-1 Price Structure of Paddy (Glutinous)

	1983		1990	
	Financial	Economic	Financial	Economic
Export Price, 10% Broken F.O.B. Bangkok				
1981 Constant US\$/ton ^{1/}	271	271	374	374
1983 Constant US\$ ^{2/}	290	290	400	400
Equivalent Thai Baht	6,670	6,670	9,200	9,200
Export Taxes (Duty and Rice Premium) ^{3/}	584	-	710	-
Municipal Tax	10	-	10	-
Port Charges, Handling and Transportation	320	243 ^{4/}	320	243 ^{4/}
Transportation to Bangkok	393	298 ^{4/}	393	298 ^{4/}
Broker's Margin	167	134 ^{5/}	230	184 ^{5/}
Local Wholesale Price of Rice	5,196	5,995	7,537	8,475
Local Price of Paddy ^{6/}	3,377	3,897	4,899	5,509
Miller's Margin	487	390 ^{5/}	706	564 ^{5/}
Milling Cost	250	200 ^{5/}	250	200 ^{5/}
Value of By-product	270	270	270	270
Transportation to Mill	100	76 ^{4/}	100	76 ^{4/}
Farm Gate Price	2,810	3,500	4,110	4,940

- Notes: 1/ Based on Foreign Trade Statistics of Thailand (Exports Classified by Commodity and Year) 1977-1981.
2/ 1981 Constant US\$ x Manufacturing Unit Value (MUV) for 1983 of 1.07 (Source: Same as 1/ above).
3/ Export Duty 5% (Source: Rice Exporters' Association).
4/ Conversion Factor: 0.76
5/ Conversion Factor: 0.80
6/ Paddy to Rice Conversion Rate: 65%

Table 6.1-2 Price Structure of Paddy (Non-Glutinous)

	1983		1990	
	Financial	Economic	Financial	Economic
Export Price, 5% Broken F.O.B. Bangkok				
1981 Constant US\$/ton ^{1/}	306	306	425	425
1983 Constant US\$ ^{2/}	327	327	455	455
Equivalent Thai Baht	7,530	7,530	10,465	10,465
Adjustment to Average Grade x .93	7,003	7,003	9,732	9,732
Export Taxes (Duty and Rice Premium) ^{3/}	715	-	850	-
Municipal Tax	10	-	10	-
Port Charges, Handling and Transportation	320	243 ^{4/}	320	243 ^{4/}
Broker's Margin	175	140 ^{5/}	243	194 ^{5/}
Transportation to Bangkok	393	298 ^{4/}	393	298 ^{4/}
Local Wholesale Price of Rice	5,390	6,322	7,916	8,997
Local Price of Paddy ^{6/}	3,504	4,109	5,145	5,848
Miller's Margin	420	336 ^{5/}	615	492 ^{5/}
Milling Cost	250	200 ^{5/}	250	200 ^{5/}
Value of By-product	270	270	270	270
Transportation to Mill	100	76 ^{4/}	100	76 ^{4/}
Farm Gate Price	3,000	3,770	4,450	5,350

- Notes: 1/ Based on Half-Yearly Revision of Commodity Price Forecasts, IBRD, December 1982.
2/ 1981 Constant US\$ x Manufacturing Unit Value (MUV) for 1983 of 1.07 (Source: Same as 1/ above)
3/ Export Duty 5% (Source: Rice Exporters' Association)
4/ Conversion Factor: 0.76
5/ Conversion Factor: 0.80
6/ Paddy to Rice Conversion Rate: 65%

Table 6.1-3 Price Structure of Soybeans

	1983		1990	
	Financial	Economic	Financial	Economic
Export Price F.O.B. Bangkok				
1981 Constant U.S.\$/ton ^{1/}	288	288	365	365
1983 Constant U.S.\$/ton ^{2/}	308	308	390	390
Equivalent Thai Baht	7,084	7,084	8,970	8,970
Broker's Margin	259	207 ^{3/}	404	323 ^{3/}
Municipal Tax	10	-	10	-
Transportation to Bangkok	275	209 ^{4/}	275	209 ^{4/}
Local Price	6,540	6,668	8,281	8,438
Transportation to Lampang	150	114 ^{4/}	150	114 ^{4/}
Farm Gate Price	6,390	6,550	8,130	8,320

Notes: 1/ Based on Half-Yearly Revision of Commodity Price Forecasts, IBRD, December 1982.

2/ 1981 Constant US\$ x Manufacturing Unit Value (MUV) for 1983 of 1.07 (Source: Same as 1/ above).

3/ Conversion Factor: 0.80

4/ Conversion Factor: 0.76

Table 6.1-4 Price Structure of Groundnuts

	1983		1990	
	Financial	Economic	Financial	Economic
Export Price, Shelled F.O.B. Bangkok				
1981 Constant US\$/ton ^{1/}	713	713	598	598
1983 Constant US\$/ton ^{2/}	763	763	640	640
Equivalent Thai Baht	17,549	17,549	14,720	14,720
Broker's Margin	790	632 ^{3/}	662	530 ^{3/}
Transportation to Bangkok	330	250 ^{4/}	330	250 ^{4/}
Local Price of Groundnuts (Shelled)	16,429	16,667	13,728	13,940
Municipal Tax	10	-	10	-
Sorting, Packaging and Shelling Cost	420	336 ^{3/}	420	336 ^{3/}
Local Price of Dry Groundnuts with Shell ^{5/}	8,000	8,166	6,647	6,802
Wastage during Drying	160	128 ^{3/}	160	128 ^{3/}
Drying Cost	250	200 ^{3/}	250	200 ^{3/}
Transportation to Shelling Mill	130	99 ^{4/}	130	99 ^{4/}
Farm Gate Price	7,460	7,740	6,110	6,380

Notes: 1/ Based on Half-Yearly Revision of Commodity Price Forecasts, IBRD, December 1982.

2/ 1981 Constant US\$ x Manufacturing Unit Value (MUV) for 1983 of 1.07 (Source: Same as 1/ above).

3/ Conversion Factor: 0.80

4/ Conversion Factor: 0.76

5/ 1 ton of shelled groundnuts is equivalent to 2 tons of groundnuts with shell.

Table 6.1-5 Price Structure of Sugarcane

	1983		1990	
	Financial	Economic	Financial	Economic
Export Price F.O.B. Bangkok				
1981 Constant US\$/ton ^{1/}	374	374	372	372
1983 Constant US\$/ton ^{2/}	400	400	398	398
Equivalent Thai Baht	9,200	9,200	9,154	9,154
Exporters' Margin	524	419 ^{3/}	522	418 ^{3/}
Handling Charges and Other Expenses	160	128 ^{3/}	160	128 ^{3/}
Business Tax ^{4/}	644	-	641	-
Municipal Tax ^{5/}	64	-	64	-
Transportation to Bangkok	320	243 ^{6/}	320	243 ^{6/}
Processing Cost	80	64 ^{3/}	80	64 ^{3/}
Price of Sugar	7,408	8,346	7,367	8,301
Value of By-product	24	24	24	24
Farm Gate Price of Sugarcane ^{7/}	690	775	687	771

Notes: 1/ Based on Half-Yearly Revision of Commodity Price Forecasts, IBRD, December 1982.

2/ 1981 Constant US\$ x Manufacturing Unit Value (MUV) for 1983 of 1.07 (Source: Same as 1/ above).

3/ Conversion Factor: 0.80

4/ Business Tax: 7%

5/ Municipal Tax: 0.7%

6/ Conversion Factor: 0.76

7/ 90 kg of sugar is equivalent to 1 ton of sugarcane.

Table 6.1-6 Price Structure of Tobacco

	1983		1990	
	Financial	Economic	Financial	Economic
Export Price F.O.B. Bangkok				
1981 Constant U.S.\$/ton ^{1/}	2,430	2,430	2,110	2,110
1983 Constant U.S.\$/ton ^{2/}	2,600	2,600	2,258	2,258
Equivalent Thai Baht	59,800	59,800	51,934	51,934
Exporter's Margin	2,690	2,152 ^{3/}	2,337	1,870 ^{3/}
Port Charges, Handling	5,505	4,404 ^{3/}	5,507	4,405 ^{3/}
Transportation to Bangkok	880	668 ^{4/}	880	668 ^{4/}
Price Ex-redrying Mill	50,725	52,576 ^{3/}	43,210	44,991 ^{3/}
Redryer's Margin	1,000	800 ^{3/}	1,000	800 ^{3/}
Redrying Cost	11,475	9,180 ^{3/}	11,475	9,180 ^{3/}
Transportation to Chiang Mai	250	190 ^{4/}	250	190 ^{4/}
Broker's Margin	1,000	800 ^{3/}	1,000	800 ^{3/}
Price Ex-curing station	37,000	41,606	29,485	34,021
Curing Station Margin	2,000	1,600 ^{3/}	2,000	1,600 ^{3/}
Sorting Cost	1,500	1,200 ^{3/}	1,500	1,200 ^{3/}
Curing Cost	13,180	10,544 ^{3/}	13,180	10,544 ^{3/}
Farm Gate Price of Cured Tobacco	20,320	28,262	12,805	20,677
Equivalent Price of Fresh Leaf ^{5/}	2,540	3,533	1,601	2,585
Transportation Cost of Fresh Leaf	90	68 ^{4/}	90	68 ^{4/}
Farm Gate Price of Fresh Leaf	2,450	3,470	1,510	2,520

- Notes: 1/ Based on Half-Yearly Revision of Commodity Price Forecasts, IBRD, December 1982.
- 2/ 1981 Constant US\$ x Manufacturing Unit Value (MUV) for 1983 of 1.07 (Source: Same as 1/ above).
- 3/ Conversion Factor: 0.80
- 4/ Conversion Factor: 0.76
- 5/ 8 tons of fresh tobacco leaf is equivalent to 1 ton of cured tobacco

Table 6.1-7 Price Structure of Garlic

	1983		1990	
	Financial	Economic	Financial	Economic
Export Price F.O.B. Bangkok				
1981 Constant U.S.\$/ton ^{1/}	1,748	1,748	1,137	1,137
1983 Constant U.S.\$/ton ^{2/}	1,870	1,870	1,217	1,217
Equivalent Thai Baht	43,000	43,000	28,000	28,000
Transportation to Bangkok (including Broker's Margin)	3,000	2,280 ^{3/}	3,000	2,280 ^{3/}
Local Price (Dried)	40,000	40,720	25,000	25,720
Middleman's Margin	1,800	1,440 ^{4/}	1,125	900 ^{4/}
Transportation to Lampang	300	228 ^{3/}	300	228 ^{3/}
Farm Gate Price (Dried)	37,900	39,050	23,580	24,590

Notes: 1/ Based on the Foreign Trade Statistics of Thailand (1977-1981)
Department of Customs, Bangkok.

2/ 1981 Constant US\$ x Manufacturing Unit Value (MUV) for 1983
of 1.07 (Source: Half-Yearly Revision of Commodity Price
Forecasts, IBRD, December 1982).

3/ Conversion Factor: 0.76

4/ Conversion Factor: 0.80

Table 6.2-1 Cases 5 and 6 Economic Crop Production Costs 'without Project'

Item	Production				Cost (₱/rai)				Net Return (₱/rai)	
	Yield (ton/rai)	Price (₱/ton)	Gross Value	Seed	Manure	Ferti-lizer	Pesti-cide	Others		Total Cost
<u>Wet Season</u>										
Paddy (Glutinous)	.290	4,940	1,452	83	187	20	1	-	291	1,141
Upland Rice (Glutinous)	.280	4,940	1,383	53	-	-	-	-	53	1,330
Sugarcane	2.560	770	1,971	250	5	184	1	-	470	1,501
Groundnuts	.170	6,380	1,085	282	53	-	-	-	335	750
Maize	.320	3,380	1,082	36	-	-	-	-	36	1,046
Mungbean, etc.	.220	8,610	1,894	34	-	-	-	-	34	1,860
<u>Dry Season</u>										
Groundnuts	.210	6,380	1,340	282	53	-	-	-	335	1,005
Soybeans	.170	8,320	1,414	266	-	-	-	-	266	1,148
Tobacco	2.100	2,520	5,292	320	118	670	109	-	1,217	4,075
Others	.125	17,213	2,117	880	284	26	3	-	1,193	924

Table 6.2-2 Cases 5 and 6 Economic Crop Production Costs 'with Project'

Item	Production					Cost (₱/rai)				Net Return (₱/rai)
	Yield (ton/rai)	Price (₱/ton)	Gross value	Seed	Manure	Ferti-lizer	Pesti-cide	Others (Mul-ching)	Total Cost	
<u>Wet Season</u>										
Paddy (Glutinous)	.580	4,940	2,865	53	-	275	213	-	541	2,324
(Non-Glutinous)	.660	5,350	3,531	53	-	275	213	-	541	2,990
Soybeans	.270	8,320	2,246	155	-	278	50	-	483	1,763
Sugarcane	8.000	770	6,160	250	-	762	-	-	1,042	5,118
Groundnuts	.250	6,380	1,595	188	-	191	46	-	425	1,170
<u>Dry Season</u>										
Groundnuts	.300	6,380	1,914	188	-	191	46	-	425	1,489
Soybeans	.300	8,320	2,496	155	-	278	50	-	483	2,013
Tobacco	2.600	2,520	6,552	225	-	793	171	-	1,189	5,365
Garlic	.700	24,590	17,213	2,702	-	762	34	2,250	5,748	11,465

Table 6.2-3 Case 5 Economic Net Value of Production 'without Project'

Item	Area (rai)	Yield (ton/rai)	Production (ton)	Farm Gate Price (₱/ton)	Gross Value of Production ('000 ₱)	Production Cost (₱/rai)	Total Production Cost ('000 ₱)	Net Value of Production ('000 ₱)
<u>Wet Season</u>								
Paddy (Glutinous)	31,350	.290	9,092	4,940	44,914	291	9,123	35,791
Upland Rice (Glutinous)	1,700	.280	476	4,940	2,351	53	90	2,261
Sugarcane	3,200	2.560	8,192	770	6,308	470	1,504	4,804
Groundnuts	1,200	.170	204	6,380	1,302	335	402	900
Maize	460	.320	147	3,380	497	36	17	480
Mungbean, etc.	240	.220	53	8,610	456	34	8	448
<u>Sub-total</u>	<u>38,150</u>		<u>18,164</u>		<u>55,828</u>		<u>11,144</u>	<u>44,684</u>
<u>Dry Season</u>								
Groundnuts	2,500	.210	483	6,380	3,082	535	771	2,311
Soybeans	830	.170	141	8,320	1,173	266	221	952
Tobacco	850	2.100	1,785	2,520	4,498	1,217	1,034	3,464
Others	240	.123	30	17,213	516	1,193	286	230
<u>Sub-total</u>	<u>4,220</u>		<u>2,439</u>		<u>9,269</u>		<u>2,312</u>	<u>6,957</u>
<u>Total</u>	<u>42,370</u>		<u>20,603</u>		<u>65,097</u>		<u>13,456</u>	<u>51,641</u>

Table 6.2-4 Case 6 Economic Net Value of Production 'without Project'

Item	Area (rai)	Yield (ton/rai)	Production (ton)	Farm Gate Price (₹/ton)	Gross Value of Production ('000 ₹)	Production Cost (₹/rai)	Total Production Cost ('000 ₹)	Net Value of Production ('000 ₹)
<u>Wet Season</u>								
Paddy (Glutinous)	26,900	.290	7,801	4,940	38,537	291	7,828	30,709
Upland Rice (Glutinous)	1,600	.280	448	4,940	2,213	53	85	2,128
Sugarcane	3,000	2.560	7,680	770	5,914	470	752	5,162
Groundnuts	1,100	.170	187	6,380	1,193	335	369	824
Maize	430	.320	138	3,380	466	36	15	451
Mungbean, etc.	220	.220	48	8,610	413	34	7	406
<u>Sub-total</u>	<u>33,250</u>		<u>16,302</u>		<u>48,736</u>		<u>9,056</u>	<u>39,680</u>
<u>Dry Season</u>								
Groundnuts	2,150	.210	452	6,380	2,884	335	720	2,164
Soybeans	780	.170	133	8,320	1,107	266	207	900
Tobacco	800	2.100	1,680	2,520	4,234	1,217	974	3,260
Others	220	.123	27	17,213	465	1,193	262	203
<u>Sub-total</u>	<u>3,950</u>		<u>2,292</u>		<u>8,690</u>		<u>2,163</u>	<u>6,527</u>
<u>Total</u>	<u>37,200</u>		<u>18,594</u>		<u>57,426</u>		<u>11,219</u>	<u>46,207</u>

Table 6.2-5 Case 5 Economic Net Value of Production 'with Project'

Item	Area (rai)	Yield (ton/rai)	Production (ton)	Farm Gate Price (₹/ton)	Gross Value of Production ('000 ₹)	Production Cost (₹/rai)	Total Production Cost ('000 ₹)	Net Value of Production ('000 ₹)
<u>Wet Season</u>								
Paddy (Glutinous)	16,200	.580	9,396	4,940	46,416	541	8,764	37,652
(Non-Glutinous)	24,300	.660	16,038	5,350	85,803	541	13,146	72,657
Soybeans	5,000	.270	1,350	8,320	11,232	483	2,415	8,817
Sugarcane	1,800	8.000	14,400	770	11,088	1,042	1,876	9,212
Groundnuts	5,300	.250	825	6,380	5,264	425	1,403	3,861
<u>Sub-total</u>	<u>50,600</u>		<u>42,009</u>		<u>159,803</u>		<u>27,604</u>	<u>132,199</u>
<u>Dry Season</u>								
Groundnuts	6,500	.300	1,950	6,380	12,441	425	2,763	9,678
Soybeans	4,400	.300	1,320	8,320	10,982	483	2,125	8,857
Tobacco	1,300	2.600	3,380	2,520	8,518	1,189	1,546	6,972
Garlic	3,000	.700	2,100	24,590	51,639	5,748	17,244	34,395
<u>Sub-total</u>	<u>15,200</u>		<u>8,750</u>		<u>83,580</u>		<u>23,678</u>	<u>59,902</u>
<u>Total</u>	<u>65,800</u>		<u>50,759</u>		<u>243,383</u>		<u>51,282</u>	<u>192,101</u>

Table 6.2-6 Case 6 Economic Net Value of Production 'with Project'

Item	Area (rai)	Yield (ton/rai)	Production (ton)	Farm Gate Price (฿/ton)	Gross Value of Production ('000 ฿)	Production Cost (฿/rai)	Total Production Cost ('000 ฿)	Net Value of Production ('000 ฿)
<u>Wet Season</u>								
Paddy (Glutinous)	14,600	.580	8,468	4,940	41,832	541	7,899	33,933
(Non-Glutinous)	21,800	.660	14,388	5,350	76,976	541	11,794	65,182
Soybeans	4,600	.270	1,242	8,320	10,353	483	2,222	8,111
Sugarcane	1,800	8.000	14,400	770	11,088	1,042	1,876	9,212
Groundnuts	3,100	.250	775	6,380	4,944	452	1,401	3,543
<u>Sub-total</u>	<u>45,900</u>		<u>39,273</u>		<u>145,173</u>		<u>25,192</u>	<u>119,981</u>
<u>Dry Season</u>								
Groundnuts	7,300	.300	2,190	6,380	13,972	425	3,103	10,869
Soybeans	4,800	.300	1,440	8,320	11,981	483	2,318	9,663
Tobacco	1,000	2.600	2,600	2,520	6,552	1,189	1,189	5,363
Garlic	3,000	.700	2,100	24,590	51,639	5,748	17,244	34,395
<u>Sub-total</u>	<u>16,100</u>		<u>8,330</u>		<u>84,144</u>		<u>23,854</u>	<u>60,290</u>
<u>Total</u>	<u>62,000</u>		<u>47,603</u>		<u>229,317</u>		<u>49,046</u>	<u>180,271</u>

6.2-2. Fishery Benefits

The estimation of benefits derivable from fish production in the reservoir areas is based on data observed up until the end of May 1983 by the Lampang Provincial Fisheries Office at Kew Lom Dam (surface area 12,000 rai) which is located about 40 km from the Project area.

Every year on Songkran Festival Day (April 13) the Fishery Department releases fingerlings in reservoirs throughout the country. In Lampang four species of fish are released, they are Tilapia (33%), Carp (17%), Silver Barb (28%) and Indian Carp or Rohu (22%). The fingerlings are produced at Phayao and Chiang Mai at the following unit costs, Tilapia, Carp and Silver Barb 10 stang each and Indian Carp or Rohu 25 stang. The financial farm gate prices per kg of each species are Tilapia and Silver Barb 20 ฿, and Carp and Indian Carp or Rohu 30 ฿. Using a weighted average and applying the standard conversion factor the economic farm gate price of fish is estimated to be 24.94 ฿ per kg and the economic price of fingerlings 13 ฿ per 100 pieces.

The annual financial costs for fishing consist of the depreciation cost of a boat with engine which has a durable life of three years, fuel, fishing net and gear, and others such as fishing licence, tax, etc. The detailed costs are shown in Table 6.2-7, Appendix. By applying the standard conversion factor the economic costs for fishing are estimated to be 2,400 ฿.

The number of boats is assumed to be one boat per 240 rai, the same as at Kew Lom Dam. This means a total of 22 boats in Case 5 and 19 boats in Case 6. One hundred fingerlings are assumed to be released per rai.

Economic net value of production for both cases was calculated as shown in Table 6.2-8, Appendix.

Table 6.2-7 Financial Costs for Fishing

Item	Costs (฿/year)
Boat with engine (4,000 ฿ ÷ 3 year durable life)	1,300
Fuel (assuming mileage of 5 km /ℓ, 500 km distance - 250 days x 2 km/day - and per liter cost of 6.5 ฿) 6.5 ฿ x 100	650
Fishing net and gear	1,000
Others (licence, tax, etc.)	50
Total	3,000

Table 6.2-8 Economic Net Value of Production from Fish Production in the Reservoir Area

Case	(1) Total Reservoir Surface Area	(2) Yield per rai	(3) Economic Price (฿/kg)	(4) Cost of Fingerlings (1) x 13 ฿ (฿ '000)	(5) Fishing Cost	Economic Net Value of Production (1x2x3) - (4+5) (฿ '000)
5	5,287	15	24.94	69	53	1,856
6	4,569	15	24.94	59	46	1,604

6.2-3. Labor Cost and Requirements

The cost of farm labor per day was determined from interviews carried out at Tambon offices in Amphoes Mae Tha and Kokha. Although daily wages differed depending on the type of job performed, workers age and sex the normal wage given was $\text{฿} 25$ per day.

Table 6.2-9 Financial and Economic Crop Labor Costs per Rai

Crop	Man-days	Financial Cost (฿)	Economic Cost (฿)
Paddy	24.5	797	637
Groundnuts	35.7	1,161	928
Soybeans	19.8	644	515
Sugarcane	22.1	718	575
Tobacco	42.0	1,365	1,092
Garlic	25.7	835	668

Table 6.2-10 Proposed Labor Requirement Case 5 (130%)

Crops	Area (rai)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
		26 1/ 24	24	26	26	26	26	22	21	20	20	26	26	26
Paddy	40,500	-	-	-	-	-	6,295	74,705	184,958	185,528	52,303	262,903	226,800	993,292
Sugarcane	1,800													
Ratoon	1,200	2,194	5,074	5,349	5,264	1,015	878	878	823	411	411	823	823	21,943
New Plant	600	1,097	2,537	2,674	2,159	9,290	459	459	411	206	206	411	411	20,280
Soybeans	9,400													
W.S. 2/	5,000	-	-	-	-	-	-	2,377	18,457	9,943	12,229	26,400	20,000	89,406
D.S.	4,400	13,678	11,666	18,002	23,634	-	-	-	-	-	-	4,667	15,579	87,226
Groundnuts	9,800													
W.S.	3,300	754	-	-	-	-	-	2,187	8,478	5,696	5,657	18,631	52,510	71,913
D.S.	6,500	18,794	15,303	10,400	50,956	47,989	-	-	-	-	-	-	13,059	156,501
Garlic	3,000	8,571	7,200	17,897	28,457	-	-	-	-	-	-	23,787	26,599	112,511
Tobacco	1,500	9,301	13,163	5,794	-	-	-	-	-	-	-	11,701	14,590	54,549
Total	65,800	54,389	54,943	60,116	108,470	58,294	7,612	80,586	213,127	199,584	70,806	349,323	350,371	1,607,621
Ava. L.F. 3/		457,829	422,611	457,829	457,829	457,829	457,829	387,394	369,785	352,176	352,176	457,829	457,829	5,088,945

1/ Working days

2/ W.S.: Wet Season

D.S.: Dry Season

3/ Available Labor Force

Table 6.2-11 Proposed Labor Requirement Case 6 (155%)

Crops	Area (rai)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
		26 1/ 26	24	26	26	26	26	22	21	20	20	26	26	26
Paddy	36,400	-	-	-	-	-	5,658	67,142	166,234	166,566	47,008	236,288	203,840	892,736
Sugarcane	1,800													
Ratoon	1,200	2,194	5,074	5,349	3,264	1,015	878	878	823	411	411	823	823	21,943
New Plant	600	1,097	2,537	2,674	2,159	9,290	459	349	411	206	206	411	411	20,280
Soybeans	7,900													
W.S. 2/	3,100	-	-	-	-	-	-	1,474	11,445	6,165	7,582	16,368	12,400	55,432
D.S.	4,800	14,921	12,727	19,639	25,785	-	-	-	-	-	-	5,091	16,995	95,156
Groundnuts	11,900													
W.S.	4,600	1,051	-	-	-	-	-	3,049	11,818	5,152	7,886	25,970	45,317	100,243
D.S.	7,300	21,107	17,186	11,680	57,232	53,895	-	-	-	-	-	-	14,667	175,767
Garlic	3,000	8,571	7,200	17,897	28,457	-	-	-	-	-	-	23,787	26,599	112,511
Tobacco	1,000	7,154	10,126	4,457	-	-	-	-	-	-	-	9,001	11,223	41,961
(1) Total	62,000	56,095	54,850	61,696	116,895	64,200	6,975	72,982	190,729	178,500	63,093	317,736	332,275	1,516,029
(2) Ava. L.F. 3/		419,375	387,115	419,375	419,375	419,375	419,375	354,856	338,726	322,596	322,596	419,375	419,375	4,661,514

1/ Working days

2/ W.S.: Wet Season

D.S.: Dry Season

3/ Available Labor Force

Table 6.2-12 Calculation of Economic Internal Rate of Return for Case 5 (1)
*** STREAMS OF PROJECT COST AND BENEFIT ***

(UNIT : THOUSAND BAHT)

N	YEAR	INT.COST	REP.COST	O&M.COST	TOTAL	PRO.BEN	NET.BEN
1	1984	22216	0	0	22216	-2350	-24566
2	1985	50502	0	0	50502	-1985	-52487
3	1986	61932	0	0	61932	-1348	-63270
4	1987	100428	0	0	100428	-577	-101005
5	1988	159622	0	0	159622	193	-159429
6	1989	19748	0	3770	19382	12912	-71997
7	1990	7168	0	3770	103518	31521	43484
8	1991	7168	0	3770	10938	54222	65984
9	1992	7168	6000	3770	15938	82922	107822
10	1993	0	0	3770	3770	111392	124704
11	1994	0	0	3770	3770	128474	134277
12	1995	0	0	3770	3770	138047	141786
13	1996	0	0	3770	3770	145556	141786
14	1997	0	0	3770	3770	145556	141786
15	1998	0	6000	3770	3770	145556	135786
16	1999	0	0	3770	3770	145556	141786
17	2000	0	0	3770	3770	145556	141786
18	2001	0	0	3770	3770	145556	141786
19	2002	0	0	3770	3770	145556	141786
20	2003	0	0	3770	3770	145556	141786
21	2004	0	6000	3770	3770	145556	135786
22	2005	0	0	3770	3770	145556	141786
23	2006	0	0	3770	3770	145556	141786
24	2007	0	0	3770	3770	145556	141786
25	2008	0	0	3770	3770	145556	141786
26	2009	0	6000	3770	3770	145556	135786
27	2010	0	0	3770	3770	145556	141786
28	2011	0	0	3770	3770	145556	141786
29	2012	0	0	3770	3770	145556	141786
30	2013	0	0	3770	3770	145556	141786
31	2014	0	0	3770	3770	145556	141786
32	2015	0	0	3770	3770	145556	141786
33	2016	0	6000	3770	3770	145556	135786
34	2017	0	0	3770	3770	145556	141786
35	2018	0	0	3770	3770	145556	141786
36	2019	0	0	3770	3770	145556	141786
37	2020	0	0	3770	3770	145556	141786
38	2021	0	0	3770	3770	145556	141786
39	2022	0	6000	3770	3770	145556	135786
40	2023	0	0	3770	3770	145556	141786
41	2024	0	0	3770	3770	145556	141786
42	2025	0	0	3770	3770	145556	141786
43	2026	0	0	3770	3770	145556	141786
44	2027	0	0	3770	3770	145556	141786
45	2028	0	6000	3770	3770	145556	135786
46	2029	0	0	3770	3770	145556	141786
47	2030	0	0	3770	3770	145556	141786
48	2031	0	0	3770	3770	145556	141786
49	2032	0	0	3770	3770	145556	141786
50	2033	0	0	3770	3770	145556	141786

Table 6.2-12 Calculation of Economic Internal Rate of Return for Case 5 (2)

*** PRESENT WORTH OF BENEFIT ***

YEAR	B. STREAM	10.00 (%)	11.00 (%)	12.00 (%)	13.00 (%)	14.00 (%)	15.00 (%)	16.00 (%)	17.00 (%)
1984	-2350.	-2136.	-2117.	-2098.	-2080.	-2061.	-2043.	-2026.	-2009.
1985	-1966.	-1824.	-1806.	-1788.	-1770.	-1752.	-1734.	-1716.	-1698.
1986	-1348.	-1013.	-986.	-959.	-932.	-905.	-878.	-851.	-824.
1987	-577.	-394.	-380.	-367.	-354.	-342.	-330.	-319.	-308.
1988	193.	110.	115.	108.	100.	92.	84.	76.	68.
1989	12913.	7288.	6504.	5842.	5202.	4583.	3983.	3400.	2834.
1990	31521.	16175.	15182.	14268.	13338.	12397.	11450.	10503.	9556.
1991	54422.	25388.	23515.	21860.	20471.	19078.	17731.	16500.	15388.
1992	82922.	35167.	32416.	29903.	27604.	25496.	23572.	21805.	20184.
1993	111392.	42346.	39231.	36365.	32815.	30047.	27534.	25251.	23174.
1994	128474.	45029.	40783.	36932.	33493.	30396.	27515.	25106.	22944.
1995	138047.	43886.	38458.	34432.	31348.	28553.	25802.	23256.	20980.
1996	145556.	42162.	37483.	33358.	29717.	26501.	23887.	21388.	19007.
1997	145556.	38329.	33768.	29784.	26239.	23247.	20671.	18223.	16160.
1998	145556.	34845.	30422.	26593.	23273.	20382.	17398.	15705.	13812.
1999	145556.	31677.	27407.	23743.	20586.	17888.	15559.	13543.	11845.
2000	145556.	28797.	24631.	21189.	18226.	15691.	13526.	11675.	10090.
2001	145556.	26180.	22244.	18928.	16139.	13764.	11782.	10084.	8624.
2002	145556.	23800.	20040.	16900.	14274.	12074.	10228.	8676.	7371.
2003	145556.	21636.	18054.	15088.	12632.	10591.	8834.	7475.	6300.
2004	145556.	19689.	16265.	13473.	11179.	9290.	7723.	6448.	5334.
2005	145556.	17881.	14653.	12028.	9892.	8148.	6726.	5558.	4602.
2006	145556.	16255.	13201.	10740.	8754.	7149.	5848.	4792.	3933.
2007	145556.	14778.	11893.	9590.	7747.	6271.	5086.	4131.	3362.
2008	145556.	13434.	10714.	8562.	6866.	5501.	4422.	3561.	2878.
2009	145556.	12213.	9652.	7646.	6067.	4825.	3845.	3070.	2456.
2010	145556.	11103.	8696.	6826.	5365.	4233.	3343.	2645.	2090.
2011	145556.	10093.	7834.	6084.	4752.	3713.	2907.	2281.	1794.
2012	145556.	9176.	7058.	5441.	4205.	3257.	2538.	1967.	1533.
2013	145556.	8342.	6358.	4858.	3721.	2857.	2188.	1655.	1311.
2014	145556.	7583.	5728.	4338.	3293.	2506.	1912.	1462.	1120.
2015	145556.	6884.	5161.	3873.	2914.	2198.	1652.	1260.	957.
2016	145556.	6267.	4643.	3456.	2579.	1928.	1445.	1086.	818.
2017	145556.	5697.	4188.	3088.	2282.	1691.	1297.	936.	695.
2018	145556.	5178.	3773.	2757.	2020.	1484.	1093.	807.	599.
2019	145556.	4708.	3398.	2461.	1787.	1302.	950.	696.	511.
2020	145556.	4281.	3063.	2188.	1582.	1142.	825.	600.	437.
2021	145556.	3891.	2758.	1962.	1400.	1001.	719.	517.	373.
2022	145556.	3538.	2486.	1752.	1239.	875.	626.	445.	319.
2023	145556.	3216.	2239.	1564.	1096.	771.	543.	384.	273.
2024	145556.	2824.	2017.	1397.	970.	676.	473.	331.	233.
2025	145556.	2458.	1817.	1247.	858.	598.	411.	286.	199.
2026	145556.	2116.	1637.	1113.	750.	520.	357.	246.	170.
2027	145556.	1797.	1475.	984.	672.	456.	311.	212.	145.
2028	145556.	1567.	1329.	888.	595.	400.	270.	183.	124.
2029	145556.	1315.	1197.	807.	527.	351.	236.	158.	106.
2030	145556.	1079.	1079.	708.	468.	308.	204.	136.	91.
2031	145556.	1500.	872.	632.	412.	270.	178.	117.	78.
2032	145556.	1364.	875.	564.	365.	237.	154.	101.	66.
2033	145556.	1240.	789.	504.	323.	208.	134.	87.	57.
total	10584773.	682321.	6583672.	483176.	418889.	361741.	318571.	276849.	243499.

Table 6.2-12 Calculation of Economic Internal Rate of Return for Case 5 (S)

*** PRESENT WORTH OF COST ***

(UNIT : THOUSAND BAHT)

N	YEAR	C. STREAM	10.00 (%)	11.00 (%)	12.00 (%)	13.00 (%)	14.00 (%)	15.00 (%)	16.00 (%)	17.00 (%)
1	1984	32216.	20196.	20014.	19336.	19560.	19488.	19318.	19152.	18988.
2	1985	50502.	41737.	40889.	40290.	39550.	38860.	38187.	37531.	36892.
3	1986	61922.	46523.	45277.	44075.	42815.	41796.	40715.	39671.	38652.
4	1987	100428.	68534.	66155.	63824.	61584.	59461.	57420.	55468.	53593.
5	1988	159622.	89113.	84728.	80574.	76637.	72903.	69360.	65988.	62765.
6	1989	163892.	82231.	87356.	82780.	78480.	74339.	70639.	67063.	63597.
7	1990	103518.	53121.	49860.	46326.	44001.	41370.	38915.	36628.	34492.
8	1991	10938.	5103.	4746.	4418.	4114.	3834.	3575.	3336.	3115.
9	1992	15838.	7193.	6621.	6108.	5638.	5209.	4815.	4454.	4123.
10	1993	3770.	1453.	1328.	1214.	1111.	1017.	932.	855.	784.
11	1994	3770.	1321.	1186.	1084.	993.	910.	830.	757.	670.
12	1995	3770.	1201.	1078.	988.	870.	782.	705.	635.	573.
13	1996	3770.	1093.	871.	864.	770.	686.	613.	548.	490.
14	1997	3770.	983.	875.	771.	681.	602.	533.	472.	419.
15	1998	3770.	2339.	2042.	1785.	1562.	1369.	1201.	1054.	927.
16	1999	3770.	820.	710.	615.	533.	463.	403.	351.	305.
17	2000	3770.	746.	640.	549.	472.	406.	350.	302.	261.
18	2001	3770.	678.	576.	490.	418.	356.	305.	261.	223.
19	2002	3770.	616.	519.	439.	370.	313.	265.	225.	191.
20	2003	3770.	560.	468.	391.	327.	274.	230.	194.	162.
21	2004	3770.	1320.	1082.	804.	750.	624.	519.	433.	361.
22	2005	3770.	483.	380.	312.	256.	211.	174.	144.	119.
23	2006	3770.	421.	342.	278.	227.	185.	151.	124.	102.
24	2007	3770.	383.	308.	248.	201.	162.	132.	107.	87.
25	2008	3770.	348.	278.	222.	178.	142.	115.	92.	74.
26	2009	3770.	318.	250.	198.	157.	125.	100.	80.	64.
27	2010	3770.	745.	684.	458.	360.	284.	224.	178.	141.
28	2011	3770.	261.	203.	158.	123.	96.	75.	59.	45.
29	2012	3770.	238.	183.	141.	108.	84.	65.	51.	40.
30	2013	3770.	216.	165.	126.	96.	74.	57.	44.	34.
31	2014	3770.	196.	148.	112.	85.	65.	50.	38.	29.
32	2015	3770.	179.	134.	100.	75.	57.	43.	33.	25.
33	2016	3770.	421.	312.	232.	173.	128.	97.	73.	55.
34	2017	3770.	148.	108.	80.	59.	44.	33.	24.	18.
35	2018	3770.	134.	88.	71.	52.	38.	28.	21.	15.
36	2019	3770.	122.	88.	64.	46.	34.	25.	18.	13.
37	2020	3770.	111.	79.	57.	41.	30.	21.	15.	11.
38	2021	3770.	101.	71.	51.	36.	26.	19.	13.	10.
39	2022	3770.	237.	167.	118.	83.	59.	42.	30.	21.
40	2023	3770.	83.	58.	41.	28.	20.	14.	10.	7.
41	2024	3770.	78.	52.	36.	25.	18.	12.	9.	6.
42	2025	3770.	68.	47.	32.	22.	15.	11.	7.	5.
43	2026	3770.	63.	42.	29.	20.	13.	9.	6.	4.
44	2027	3770.	57.	38.	26.	17.	12.	8.	5.	4.
45	2028	3770.	134.	89.	60.	40.	27.	18.	12.	8.
46	2029	3770.	47.	31.	21.	14.	9.	6.	4.	3.
47	2030	3770.	43.	28.	18.	12.	8.	5.	3.	2.
48	2031	3770.	39.	25.	16.	11.	7.	5.	3.	2.
49	2032	3770.	36.	23.	15.	10.	6.	4.	3.	2.
50	2033	3770.	32.	20.	13.	8.	5.	3.	2.	1.
TOTAL		880046.	452659.	431591.	412105.	394004.	377132.	361358.	346573.	332686.

Table 6.2-12 Calculation of Economic Internal Rate of Return for Case 5 (4)

*** CALCULATION OF INTERNAL RATE OF RETURN ****
(UNIT : THOUSAND BAHT)

COUNT RATE	+++++ PRESENT WORTH +++++ BENEFIT	COST	B/C RATIO
10.00 %	562321.	452659.	1.45
11.00 %	563672.	431591.	1.31
12.00 %	483176.	412105.	1.17
13.00 %	416859.	394004.	1.06
14.00 %	361744.	377132.	0.96
15.00 %	315571.	361358.	0.87
16.00 %	276605.	346673.	0.80
17.00 %	243489.	332586.	0.73

INTERNAL RATE OF RETURN ----- 13.6 %

Table 6.2-13 Calculation of Economic Internal Rate of Return for Case 6 (1)

(UNIT : THOUSAND BAHT)

*** STREAMS OF PROJECT COST AND BENEFIT ***

N	YEAR	INT. COST	REP. COST	O&M COST	TOTAL	PRO. BEN	NET BEN
1	1984	21109	0	0	21109	-561	-22070
2	1985	48289	0	0	48289	-893	-49182
3	1986	57623	0	0	57623	-785	-58408
4	1987	92280	0	0	92280	-649	-92929
5	1988	151688	0	0	151688	-513	-152181
6	1989	151688	0	3770	155458	10943	-144495
7	1990	57201	0	3770	100971	28417	-72554
8	1991	6504	6000	3770	10274	49164	58890
9	1992	6504	0	3770	15274	77318	81039
10	1993	0	0	3770	3770	10462	100692
11	1994	0	0	3770	3770	120753	116983
12	1995	0	0	3770	3770	131612	127842
13	1996	0	0	3770	3770	137043	133273
14	1997	0	0	3770	3770	137043	133273
15	1998	0	6000	3770	9770	137043	127273
16	1999	0	0	3770	3770	137043	133273
17	2000	0	0	3770	3770	137043	133273
18	2001	0	0	3770	3770	137043	133273
19	2002	0	0	3770	3770	137043	133273
20	2003	0	0	3770	3770	137043	133273
21	2004	0	6000	3770	9770	137043	133273
22	2005	0	0	3770	3770	137043	133273
23	2006	0	0	3770	3770	137043	133273
24	2007	0	0	3770	3770	137043	133273
25	2008	0	0	3770	3770	137043	133273
26	2009	0	0	3770	3770	137043	133273
27	2010	0	6000	3770	9770	137043	127273
28	2011	0	0	3770	3770	137043	133273
29	2012	0	0	3770	3770	137043	133273
30	2013	0	0	3770	3770	137043	133273
31	2014	0	0	3770	3770	137043	133273
32	2015	0	0	3770	3770	137043	133273
33	2016	0	6000	3770	9770	137043	133273
34	2017	0	0	3770	3770	137043	133273
35	2018	0	0	3770	3770	137043	133273
36	2019	0	0	3770	3770	137043	133273
37	2020	0	0	3770	3770	137043	133273
38	2021	0	0	3770	3770	137043	133273
39	2022	0	0	3770	3770	137043	133273
40	2023	0	6000	3770	9770	137043	133273
41	2024	0	0	3770	3770	137043	133273
42	2025	0	0	3770	3770	137043	133273
43	2026	0	0	3770	3770	137043	133273
44	2027	0	0	3770	3770	137043	133273
45	2028	0	6000	3770	9770	137043	127273
46	2029	0	0	3770	3770	137043	133273
47	2030	0	0	3770	3770	137043	133273
48	2031	0	0	3770	3770	137043	133273
49	2032	0	0	3770	3770	137043	133273
50	2033	0	0	3770	3770	137043	133273

Table 6.2-13 Calculation of Economic Internal Rate of Return for Case 6 (2)

THE PRESENT WORTH OF BENEFIT \$\$\$

(UNIT : THOUSAND BART)

N	YEAR	8.00(%)	10.00(%)	11.00(%)	12.00(%)	13.00(%)	14.00(%)	15.00(%)	16.00(%)	17.00(%)
1	1984	-861.	-874.	-886.	-899.	-912.	-925.	-938.	-951.	-964.
2	1985	-889.	-902.	-915.	-928.	-941.	-954.	-967.	-980.	-993.
3	1986	-785.	-798.	-811.	-824.	-837.	-850.	-863.	-876.	-889.
4	1987	-649.	-662.	-675.	-688.	-701.	-714.	-727.	-740.	-753.
5	1988	-513.	-526.	-539.	-552.	-565.	-578.	-591.	-604.	-617.
6	1989	10343.	5177.	5861.	5544.	5228.	4912.	4596.	4280.	3964.
7	1990	28417.	14582.	13687.	12854.	12021.	11188.	10355.	9522.	8689.
8	1991	49164.	22935.	21334.	19857.	18484.	17225.	16072.	14995.	14001.
9	1992	77313.	32788.	30234.	27880.	25724.	23774.	21977.	20330.	18818.
10	1993	104463.	42275.	36790.	33634.	30724.	28178.	25955.	23980.	21732.
11	1994	120753.	42223.	38313.	34714.	31420.	28572.	26355.	24397.	21471.
12	1995	131612.	41938.	37520.	33782.	30354.	27317.	24598.	22172.	20002.
13	1996	137043.	39696.	35230.	31407.	27979.	24951.	22273.	19902.	17801.
14	1997	137043.	32807.	28643.	25037.	21912.	19189.	16842.	14791.	13004.
15	1998	137043.	29825.	25834.	22255.	19331.	16841.	14845.	12751.	11114.
16	2000	137043.	27113.	23247.	19950.	17180.	14773.	12735.	10992.	9439.
17	2001	137043.	24948.	20943.	17821.	15186.	12959.	11074.	9476.	8119.
18	2002	137043.	23428.	18988.	15912.	13433.	11358.	9629.	8169.	6939.
19	2003	137043.	20271.	16988.	14207.	11823.	9872.	8373.	7042.	5931.
20	2004	137043.	18519.	15313.	12895.	10535.	8747.	7281.	6071.	5069.
21	2005	137043.	16825.	13726.	11229.	9314.	7678.	6331.	5233.	4333.
22	2006	137043.	15205.	12429.	10112.	8242.	6730.	5506.	4512.	3702.
23	2007	137043.	13813.	11197.	9023.	7234.	5904.	4787.	3889.	3155.
24	2008	137043.	12549.	10087.	8061.	6455.	5179.	4153.	3353.	2705.
25	2009	137043.	11489.	9088.	7186.	5712.	4543.	3620.	2890.	2312.
26	2010	137043.	10453.	8187.	6285.	5155.	3985.	3148.	2492.	1976.
27	2011	137043.	9533.	7376.	5428.	4474.	3486.	2737.	2148.	1689.
28	2012	137043.	8639.	6645.	5123.	3959.	3066.	2380.	1852.	1444.
29	2013	137043.	7854.	5936.	4574.	3594.	2690.	2070.	1596.	1234.
30	2014	137043.	7140.	5333.	4084.	3130.	2359.	1800.	1376.	1055.
31	2015	137043.	6491.	4859.	3647.	2744.	2070.	1565.	1186.	901.
32	2016	137043.	5901.	4377.	3255.	2423.	1816.	1361.	1023.	770.
33	2017	137043.	5364.	3943.	2907.	2149.	1593.	1193.	882.	658.
34	2018	137043.	4877.	3553.	2596.	1923.	1397.	1023.	750.	563.
35	2019	137043.	4433.	3201.	2317.	1683.	1225.	885.	655.	481.
36	2020	137043.	4030.	2893.	2059.	1483.	1075.	778.	585.	411.
37	2021	137043.	3664.	2598.	1847.	1318.	843.	607.	420.	300.
38	2022	137043.	3331.	2340.	1650.	1168.	726.	509.	362.	267.
39	2023	137043.	3028.	2103.	1473.	1032.	636.	445.	312.	219.
40	2024	137043.	2753.	1899.	1315.	913.	558.	387.	269.	188.
41	2025	137043.	2503.	1711.	1174.	808.	490.	335.	232.	160.
42	2026	137043.	2275.	1542.	1048.	715.	430.	292.	200.	137.
43	2027	137043.	2068.	1389.	936.	633.	430.	253.	172.	117.
44	2028	137043.	1880.	1251.	836.	560.	377.	254.	149.	100.
45	2029	137043.	1709.	1127.	746.	496.	331.	221.	128.	86.
46	2030	137043.	1554.	1015.	665.	433.	290.	182.	110.	73.
47	2031	137043.	1413.	915.	588.	388.	254.	145.	95.	62.
48	2032	137043.	1284.	824.	531.	344.	223.	116.	82.	53.
49	2033	137043.	1167.	749.	474.	304.	195.	105.	72.	44.
TOTAL		5735170.	6230411.	5303384.	4545411.	3922273.	3404877.	2971065.	260503.	229412.

Table 6.2-15 Calculation of Economic Internal Rate of Return for Case 6 (3)

*** PERSENTI KUPUH OF COST IRR

YEAR	COST	10.00 (%)	11.00 (%)	12.00 (%)	13.00 (%)	14.00 (%)	15.00 (%)	16.00 (%)	17.00 (%)
1	19190	19190	19017	18947	18881	18517	18355	18187	18042
2	42289	39908	39192	38496	37817	37157	36513	35887	35276
3	57623	43292	42133	41015	39936	38884	37858	36817	35878
4	92288	63717	61452	59286	57215	55234	53338	51522	49782
5	151868	84174	80051	76951	73918	70972	68108	65318	62613
6	155488	87741	83103	78750	74660	70816	67200	63788	60556
7	100371	51814	48634	45574	42918	40362	37958	35727	33643
8	4783	4458	4150	3855	3555	3252	2958	2674	2406
9	18274	16302	14559	12947	11411	9904	8426	6987	5591
10	3770	1453	1328	1214	1111	1017	932	855	784
11	3770	1321	1195	1084	983	892	810	737	670
12	3770	1201	1078	968	870	782	703	635	573
13	3770	1082	971	864	770	686	613	548	490
14	3770	963	875	771	681	602	533	472	419
15	3770	833	762	692	625	563	501	444	392
16	3770	703	642	582	525	468	413	361	308
17	3770	573	512	452	395	340	287	237	181
18	3770	443	382	322	265	210	157	107	52
19	3770	313	252	192	135	80	26	-19	-64
20	3770	183	122	62	5	-40	-85	-124	-178
21	3770	53	-7	-47	-92	-125	-159	-178	-141
22	3770	-23	-67	-118	-173	-224	-274	-244	-141
23	3770	-93	-148	-202	-255	-304	-348	-284	-141
24	3770	-163	-218	-272	-322	-366	-404	-324	-141
25	3770	-233	-283	-332	-378	-416	-448	-354	-141
26	3770	-303	-348	-392	-432	-460	-482	-378	-141
27	3770	-373	-412	-452	-488	-510	-528	-416	-141
28	3770	-443	-472	-508	-535	-552	-560	-440	-141
29	3770	-513	-532	-558	-575	-582	-580	-450	-141
30	3770	-583	-592	-618	-625	-622	-610	-480	-141
31	3770	-653	-652	-678	-675	-662	-640	-510	-141
32	3770	-723	-712	-738	-725	-702	-670	-540	-141
33	3770	-793	-772	-808	-785	-752	-710	-580	-141
34	3770	-863	-832	-878	-845	-802	-750	-620	-141
35	3770	-933	-892	-948	-905	-852	-790	-660	-141
36	3770	-1003	-952	-1018	-965	-902	-830	-700	-141
37	3770	-1073	-1012	-1078	-1015	-942	-860	-730	-141
38	3770	-1143	-1072	-1138	-1065	-982	-890	-760	-141
39	3770	-1213	-1132	-1208	-1125	-1032	-930	-800	-141
40	3770	-1283	-1192	-1278	-1185	-1082	-970	-840	-141
41	3770	-1353	-1252	-1338	-1235	-1122	-1000	-870	-141
42	3770	-1423	-1312	-1408	-1295	-1172	-1040	-910	-141
43	3770	-1493	-1382	-1478	-1355	-1222	-1080	-950	-141
44	3770	-1563	-1452	-1548	-1415	-1272	-1120	-990	-141
45	3770	-1633	-1522	-1618	-1475	-1322	-1160	-1030	-141
46	3770	-1703	-1592	-1688	-1535	-1372	-1200	-1080	-141
47	3770	-1773	-1662	-1758	-1595	-1422	-1240	-1130	-141
48	3770	-1843	-1732	-1828	-1655	-1472	-1280	-1180	-141
49	3770	-1913	-1802	-1908	-1715	-1522	-1320	-1230	-141
50	3770	-1983	-1872	-1978	-1775	-1572	-1360	-1280	-141
TOTAL	845514	430390	410203	391553	374242	358119	343068	328947	315701

Table 6.2-13 Calculation of Economic Internal Rate of Return for Case 6 (4)

**** CALCULATION OF INTERNAL RATE OF RETURN ****
(UNIT : THOUSAND BAHT)

DISCOUNT RATE	+++++ PRESENT WORTH +++++ BENEFIT	COST	E/C RATIO
10.00 %	623041.	430390.	1.45
11.00 %	530224.	410203.	1.29
12.00 %	454511.	381552.	1.18
13.00 %	382273.	374242.	1.05
14.00 %	340487.	358113.	0.95
15.00 %	297105.	343055.	0.87
16.00 %	260502.	328947.	0.79
17.00 %	228412.	315701.	0.73

INTERNAL RATE OF RETURN ----- 13.5 %