	- Unit B '000 -	•	Total	
ENANCE COST	4	-	Tha Lat System Bang Pakong System	
ION AND MAINT			Tha Lat System	
TABLE H-3-13 ANNUAL OPERATION AND MAINTENANCE COST			Si Yat System	
TABLE H-3-13			Description	ation and Maintenance Cost

TOPOT	100.06	2,595	9,950	1,007	4,270	38,826	
TTAISAC HITANSAC	אַטּק ער ד	1,517	3,470	371	4,270	16,993	
TIIA TAN OVERUL	0 0 0	0,400 1.294	3,460	397		13,636	
TITANSAC IT TO	i ti ti	4,104 784	3,020	239	•	8,197	
nesutibuou	Annual Operation and Maintenance Cost	 Dataties and wages Fuel and repair for Equipment 	3 Material Supplies and Repair Cost 1/	4 General Expenditure ^{2/}	5 Pump Operation Cost ^{3/}	Total	

(1%)
0.01
<u>х</u>
Cost*)
Civil (
1/
Notes

Diversion Dam, Dam, Pumping Station, Weir Cost are excluded
[1) + 2) + 3)] × 0.03 (3%) . .

% %

Opetarion hour per pump $\Sigma Q = 2,680 \text{ m}^3/\text{s} \cdot \text{day}$ / year $T = 2,680 \times 24 \text{ hr}$ / 17.64 m $^3/\text{s} = 3,650 \text{ hr}$ $3,650 \text{ hr} \times 390 \text{ kw} \times 4 \text{ unit} = 5,694,000 \text{ KWH}$ $5,694,000 \text{ KWH} \times 0.75 \text{ B/KWH} = 4,270,500 \text{ B}$ / YEAR

Bang Pakong System	Amount		160	160 130	160 130 480	160 130 480 1,000	160 130 480 1,000 440	160 130 480 1,000 216 216	160 130 480 1,000 216 2216	160 130 480 440 216 425 860	160 130 1,000 1,000 216 216 2216 360 300	160 130 1,000 1,000 216 216 360 300 400	160 130 1,000 1,000 1,000 216 216 216 300 300 400 640	160 160 130 1,000 1,000 216 216 216 300 300 300 324 324	160 160 130 1,000 1,000 216 440 326 324 250 250	160 160 130 140 1,000 1,000 140 1640 1640 1640 1640 1640 1640 16	1,400 1,400 1,000 1,000 1,000 1,000 1,400 1,400 1,400 1,400 1,400	$\begin{array}{c} 160\\ 160\\ 130\\ 480\\ 440\\ 216\\ 440\\ 300\\ 440\\ 324\\ 250\\ 324\\ 250\\ 840\\ 840\\ 7,365\\ 7,365\end{array}$
N. N.	י 	1-1		ন্	10	ŝ	G	17	ю	'n	90	16	6	10	14	56	170	
	Amount	160	130	480	1,100	440	216	425	288	240	350	880	216	200	1,260	2,100	8,485	
Tha Lat System	Q'tv	1	real	4	11	8	9	17	4	4	2	22	9	Ø ,	21	84	204	
System	Amount	160	130	480	800	220	216	325	144	120	200	360	144	200	180	475	4,154	
Si Yat System	Q'ty	- -1	: •••	4	ø	4	9	13	01	7	4	ග	4	œ	ςΩ	19	. 88	
Salary per	Annum	160	130	120	100	55	36	25	72	- 09	50	40	36	25	60	25		
	Description	1. Operation Manager	2. Asst. Operation Manager	3. Section Chief	4. Engineer	5. Technician	6. Skill Labor	7. Labor	8. Water Master	9. Asst. Water Master	10. Foreman	11. Gate tender	12. Skill Labor	13. Labor	14. Zone Man	15. Labor	Total	

TABLE H-3-14 SALARY AND WAGE FOR O/M

TABLE H-3-15 FUEL AND REPAIR COST FOR O&M EQUIPMENT

SI YAT IRRIGAITON SYSTEM (THA LAT EXPANSION)

Unit B '000

	· .	Fuel		Repair	
Description	Q'tv	<u>Unit Rate</u>	Fuel	<u>Unit Rate</u>	Repair
1. Moter grader, 125 Hp	1	145	145	90	90
2, Loader / Backhoe	1	135	135	55	55
3. Steak truck, 4 ton	1	50	50	10	10
4. Pick up, 2 ton	2	18	36	9	18
5. Station wagon	1	35	35	30	30
6. Truck Crane, 15 ton	-	145	· _	190	-
7. Moter bicycle	14	6	84	2	28
8. Diesel Generating Set, 15 KVA	1	45	45	7	7
9. » , 5KVA	-	15	-	4	7
10. 4" Centrifugal Pump	1	6	6	7	-
11. Chain Hoist, 5 ton	1		-	3	3
Total			536		248

THA LAT IRRIGATION SYSTEM (THA LAT EXISTING)

Unit B '000

		Fue	el	Repair		
Description	_Q'ty	Unit Rate	Fuel	<u>Unit Rate</u>	Repair	
1. Moter grader, 125 Hp	1	145	145	90	90	
2. Loader / Backhoe	1	135	135	55	55	
3. Steak truck, 4 ton	3	50	50	10	30	
4. Pick up, 2 ton	-4	18	72	· 9	36	
5. Station wagon	2	35	70	30	60	
6. Truck Crane, 15 ton	-	145	-	190	-	
7. Moter bicycle	44	6	264	. 2	88	
8. Diesel Generating Set, 15 KVA		45	-	7	-	
9. % 5KVA	3	15	45	4	12	
10. 4" Centrifugal Pump	3	6	18	7	21	
11. Chain Hoist, 5 ten	1	-	-	3	3	
Total			899		395	

BANG PAKONG IRRIGATIONS SYSTEM

Unit B '000

	Fuel		Repair		
Description	Q'ty	Unit Rate	Fuel	<u>Unit Rate</u>	Repair
1. Moter grader, 125 Hp	1	145	145	90	90
2. Loader / Backhoe	1	135	135	55	55
3. Steak truck, 4 ton	2	50	100	10	20
4. Pick up, 2 ton	5	18	90	9	45
5. Station wagon	2	35	70	30	60
6. Truck Crane, 15 ton	1	145	145	190	190
7. Moter bicycle	30	6	180	2	60
8. Diesel Generating Set, 15 KVA	1	45	45	7	7
9. % , 5KVA	2	15	30	4	8
10. 4" Centrifugal Pump	3	6	18	7	21
11. Chain Hoist, 5 ton	1	-	-	3	3
Total			958		559

TABLE H-3-16. BREAKDOWN OF ENGINEERING SERVICE FEE

1. General

The engineering service fees consist of cost for consulting services concerned including oversea's training and equipments to be brought. Breakdown of the fees is divided into two phases such as Phase-1 and Phase-2.

Manning schedules for consulting services are classified into two stages such as pre-construction stage and construction supervision stage, tentatively.

2. Summary of Engineering Service Fees

			Unit: 1,000 baht
Phase	Foreign Currency	Local Currency	Total
Phase-1	174,000	42,000	216,000
Phase-2	160,000	34,000	194,000
Total	334,000	76,000	410,000

3. Phase-1 Sub-project

A) Foreign Currency Portion

		and the second
Remuneration		(157,500)
Foreign expertsLocal experts	$ m B500 imes 240 \ MM$ $ m B150 imes 250 \ MM$	120,000 37,500
Reimbursable Cost		(16,500)
Procurement of eOther costs relateCost for overseas	quipment ed	4,000 2,000 2,500 8,000 174,000
	 Foreign experts Local experts Reimbursable Cost International transitional transitiona	 Foreign experts B500 × 240 MM Local experts B150 × 250 MM Reimbursable Cost International travel expenses B80 × 50 times Procurement of equipment Other costs related Cost for overseas training

B)	Local Currency Portion	· .
-	Perdiem allowance & accommodation	20,000
-	Office rental	5,000
-	Local staff salary concerned	9,000
	Reportings	2,000
	Other costs	6,000
	Total	42,000
	Grand Total	216,000
3)]	Phase-2 Sub-project	
	elen er fer all verskagen 1994 i den er en gener se er en gener. An 1997 - Andre State and an er en gener se er en g	
	A) Foreign Currency Portion	1
· · ·	1) Remuneration	(147,500)
-	Foreign experts $B500 \times 220 \text{ MM}$	110,000
-	Local experts $B150 \times 250 \text{ MM}$	37,500
2) 1	Reimbursable Cost	(12,500)
-	International travel expenses B80 $ imes$ 50 times	4,000
-	Procurement of equipment	1,000
	Other costs related	2,500
÷ _	Cost for overseas training	5,000
	Total	160,000
B)	Local Currency Portion	
-	Perdiem allowance & accommodation	17,000
-	Office rental	4,000
-	Local staff salary concerned	8,000
-	Reportings	2,000
-	Other costs	3,000
	Total	34,000
	Grand Total	194,000

1

2 - -

H-4. TECHNICAL EXAMINATION OF BANG PAKONG DIVERSION DAM

Service States

Page

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	-		

Technical Examination of Bang Pakong Diversion Dam

1. National and Social Condition of Bang Pakong River Basin

1-1. River condition and hydrology

The Bang Pakong River Basin situated in the east-central part of Thailand, has a catchment of 17,660 sq.km which covers about 3.4 percent of the total national land area.

The Bang Pakong river originating from the northern mountain range of more than 900m in elevation and joining a number of affluents such as the Khlong Phra Sathung, Maenum Hanuman, Nakhon Nayok, and others.

Down the conjunction of the Nakhon Nayok river and the Prachin river, the river is called the Bang Pakong river 120km in length, traverses the broad alluvial plains from east to west and empties into the Gulf of Thailand.

The lower reaches of the river characterized by flat bed slope, meandering channel of limited small flow capacity and low banks with a channel slope of 0.1to 0.5 m per km, affected by tidal movement and suffered frequently from floodings.

Even halfway up the river, it is under the tidal effect and, therefore, flood records are available only from several spots at the upper reaches for relatively short period.

The peak flood discharge occurring once in 10 years of 4,000 to 5,000 cu.m/sec at the mouth of the river was obtained.

1-2. Tide and water quality

The tidal levels at the mouth of the Bang Pkong river were actually measured only in flood time in September and October 1983.

During the time, the observed tidal records were as follows :

HWT (High Water Tide) = (+) 1.66 m above sea level LWT (Low Water Tide) = (-) 1.17 m (ditto)

By non-harmonic analysis method, the tidal levels at Koh Sichan were estimated by the records from 1940 until 1982.

> As a result, HHWT (Highest High Water Tide) = (+) 1.84 m about sea level in 1982

LLWT (Lowest Low Water Tide) = (-) 2.48 m (ditto) in 1951 MHWST (Mean High Water Spring Tide) = (+)0.88 m MHWNT (Mean High Water Neap Tide) = (+)0.57 m MLWST (Mean Low Water Spring Tide) = (-)0.75 m MLWNT (Mean Low Water Neap Tide) = (-)0.97 m

As design water level at the diversion damsite about 70km upstream of the estuary with river bed slope of 1/100,000, the following values were taken :

Control Water Level =
$$(+)1.80$$
 m
= $(-)1.50$ m

1.1.4 1.11

The latest data on physio-chemical properties of Bang Pkong river are available from NEB, published in September 1988. The Study Team also carried out water quality survey in the river to extend the NEB information for the period from December 1989 till June 1990.

Concerning the water contamination in the river, it is concluded preliminarily that the values of pesticides, DO, BOD, and coliform bacteria were rather beyond the standard level of NEB.

It is not owing to the Project implementation, but is very important that the measures /programs for controlling the concentration within the allowable limit should be implemented as soon as possible, otherwise the retained water by the diversion dam may become unsuitable for water utilization.

1-3 Water Use (Irrigation, Industry, Domestic/Drinking, Fishery, and others)

1) Irrigation water

Irrigation water requirement was calculated with a 10-day time step combining estimated values of water consumption for respective crops, percolation rate, other field water requirements for initial leaching and land preparation, on-field effective rainfall, and water losses due to conveyance and system operation.

Irrigation diversion requirement varies depending upon the availability of effective rainfall. It was extracted from a specific case of water balance study as follows:

Irrigation wat	er requirement	

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Irrigation Area	Field Water	Effective	Diversion Water
	Requirement	Rainfall	Requirement
578,000 ha	4,078.369 MCM	2,064.116 м	см 3,606.873 мсм

2) Industrial water

The activities to develop large scale industrial complexes by private sectors are privileged and supported by IEAT and the Board of Investment (BOI). On the other hand, the details of the development programme of small scale factories made by private sectors have been unknown so far.

The water demand projection for the industrial purpose was made by taking the existing water supply method, manufacturing categories, water demand applied for the Eastern Seaboard Industrial Complex and the location of the development into account.

The figures proposed by PWA's long term development scheme are adopted for the estimates of water to be supplied for industrial purpose from the urban water work systems under PWA.

On the other hand, about 20% of municipal water consumption for industrial use is added to estimate total requirement in the areas to be newly developed in the rural area.

Only Bang Pakong and Plaeng Yao areas are specified as the IEAT privileged areas in 10,000 rai (1,600 ha) each, for urgent water supply in the target year of 2,000.

A maximum unit water demand for light industry is estimated at 12 cu.m/day/rai by the agreement of IEAT, NESDB and private sectors.

The total water demand was summed to be 204.158 MCM.

3) Domestic / drinking water

general state.

Domestic and drinking water supplies in the area are being conducted through waterwork facilities operated by PWA, Sanitary Districts and a few local community units.

The targets of population ratio to be served in the year of 2,000 in urban and rural areas were set up as around 75 to 95% and 60% respectively.

Water demand projection of 12 existing facilities under PWA adopted the figures planned by the authority.

Averaged water consumption in rural area as well as Sanitary Districts, on the other hand, were assumed to be about 150 liter/capita/day in gross.

and a second second

The rate of total losses due to conveyance, leakage and operation to the gross water demand in urban area is assumed to be 25% in PWA systems as the target.

The reasonable ratio for the rural area, however, will be about 40%. The total water demand was summed to be 115.994 MCM.

4) Fishery water

About 4,000 rai of shrimp ponds extend over the lower reaches of the Bang Pakong river.

In case of a diversion dam construction, fresh water to keep the river salinity contents on a level down to 30 ppt from 33.5 ppt at a maximum, will be needed mainly in dry season.

Existing extent of 4,000 rai in the project area is expected to be expanded to about 8,300 rai (1,350ha) at a maximum.

The fresh water requirement is thus estimated approximately at 14.5 MCM annually.

Besides, about 8,750 rai (1,400 ha) of fresh water fish ponds have been cultivated receiving water from irrigation canals and natural streams, mainly in the existing irrigation project areas of Tha Lat (1,000 ha) and Bang Pakong Left Bank(400ha).

The water demand was estimated at 4.6MCM.

5) Others

The domestic/drinking water supply for the power station of EGAT proposed.

An annual raw water demand of 15 MCM can be included in domestic/ drinking water demand mentioned above.

1-4. Regional industry and land use

In the Bang Pakong river basin, the agro-industry processing agricultural products as raw materials is thriving. The industrial sector in the region is divided into two groups in accordance with type of factory.

The first group comprises traditional agro-industries such as rice mill, cassava pellets and tapioca flour factory, sugar factory, pineapple canning factory, etc.

Rice mills are scattered widely in paddy production areas. Local factories are mostly occupied by rice mills of small scale, cassava chip yard, sand crushing plant, concrete block maker, car and engine parts repair shop, lathe-machinewelding factory, ice maker, etc.

The second group contains new comers of modern light industry with high technology and intensive labour, composed mainly of canning packer, vegetable packing-house for export oriented crops, rubber commodity and plywood factories and tropical fruits processing, etc. with modern container yard.

General land use of the basin is clearly defined by its topography. The low flat land in the west is entirely devoted to paddy cultivation with some orchards along the river banks. The upland and mountainous areas in the east are mostly under several upland crops, orchard plantation and forest. (100%)

Total river basin 1,776,000 ha in which.

Agricultural area 993,760 ha (56%)

in which

Field of paddy, upland crops, orchard and vegetable 467,290 ha (27%)

1-5. Navigation and transportation

Inland navigation along the Bang Pakong river around Chachoengsao City is being made mainly by ferryboats in a short distance, because only a few bridges are provided to connect both the banks of the river and road network in the residential area along the riverside is sparsely distributed. The most common system of navigation is to link major municipal areas by ferryboats of 5 to 20 passengers. There are a few navigation systems along the tributaries through navigation lock at the lower reaches of the main river.

The main measures of transportation in the area are road networks. Six routes of the national roads are distributed.

A new railway to connect Chachoengasao with Sttahip is now under construction under the Eastern Seaboard Development Programme. The railway is extended 159 km long in Prachinburi, 54 km in Chachoengaso and 13km in Nakhon Nayok.

1-6. Outline of development scheme

The study objectives are to formulate comprehensive water resources development programs in the Bang Pakong River Basin, to put forward balanced areal development and to put priorities on the projects to be implemented in order; in which dam reservoirs are constructed upstreams of the river and its tributaries, a diversion dam is built on the river just upstream of Chachoengasao City, existing irrigation facilities for the irrigation projects are radically modified and new irrigation facilities are also partly built; so as to stabilize water supply for paddy and dry croppings as well as drinkings, industries and fisheries through the year and especially in a dry season to prevent saline water from intruding into the area.

The overall basin study area covers the entire Bang Pkong river Basin of about 17,660 sq.km, and its western border is located 60km east of the capital, Bangkok . In the overall basin study, the river basin development plan was established, and the priorities to be developed were given to respective sub-basin projects.

As the project area with top priority, the two sub-basis, that is, Lower Bang Pakong and Khlong Tha Lat, were selected.

In the two sub-basins, the Feasibility Study area of 60,600 ha was chosen, in which 34,800 ha of existing and 9,100 ha of proposed irrigation areas were included. This study area is located in the western part of the whole Bang Pakong river basin and near the main river and its tributaries, favorable to receive the water to be released from Rabom dam under construction, Si Yat dam, and Bang Pakong diversion dam to be constructed.

2. Selection of Bang Pakong Diversion Damsite

2-1. General

In accordance with the overall basin for water resources development of Bang Pakong river with a large catchment area of 17,660 sq.km, the new available water of about 3,950 MCM could be developed by means of constructing several storage dams on the upper and middle tributaries of the Bang Pakong river.

Out of 3,950 MCM water, about 3,600 MCM will be used for irrigation in agricultural service areas and the remaining water of 350 MCM will be available for industry, domestic and fishery uses, based on the water allocation plan of the basin study.

However, the downstream section of about 120km from the river mouth of the Bang Pakong is characterized by the very gentle slope of about t 1/100,000 and influenced by saline water intrusion under tidal movement. About 1,140 MCM (shortages of 635MCM in Upper Bang Pakong sub-basin plus 408 MCM in Lower Bang Pakong sub-basin plus 100 MCM of compensatory supply to Right Bank area) of water, out of the total 3,600 MCM for irrigation, to be allocated to downstream service area cannot, therefore, used without a diversion dam which would prevent the saline water intrusion.

Hence, a diversion dam with the following function should be constructed at the downstream section of the Bang Pakong river:

- To prevent the saline water intrusion

- To divert the developed fresh water to the downstream service area

- To release flood water smoothly downstream of the river
- To regulate stored water in the reservoir and to store released water from the storaged reservoirs in the upstream of the diversion dam

The followings area preliminary technical examination of the selection of proposed diversion damsite.

2-2. Preliminary Selection of Diversion Damsite

In order to select the suitable site of the diversion dam expecting the above mentioned function, 15 possible damsites were preliminarily proposed at downstream sections of the conjunction point of Bang Pakong and Thha Lat rivers. A preliminarily study to select the representative damsites of middle and lower reach of the river was made the followings, taking into account the water operation function, construction cost, benefit in service area, environmental impacts, compensation of occupied land and property.

A) Middle Reach Sites

In total, five possible sites of the diversion dam were preliminarily investigated and compared as shown in Figre H-4-1. Possible sites were comparatively studied on the basis of 1/10,000 scale map, as follows;

Item	No.1	No.2	No.3	No.4	No.5
Length of Diversion Channel (km)	1.3	1.6	1.0	1.4	1.4
Nos. of Houses to be Replaced	32	30	31	48	35
Nos. of Houses to be Compensated	25	12	20	12	18
Length of Road to be Constructed (km)	4.0	2.0	3.0	3.0	5.0
Length of Road to be Rehabilitated (km)	4.0	7.0	7.0	9.5	5.0
Distance from Chachoengasao (km)	5	8	12	14	21

The proposed site No.3 as primarily selected due to the low construction cost from the above comparison was excluded since there exists an important temple (Wat Sao Changok) within the vicinity of the construction site. The site No.2 and No.4 were further studied and the site No.2 was selected by taking into account the following reasons;

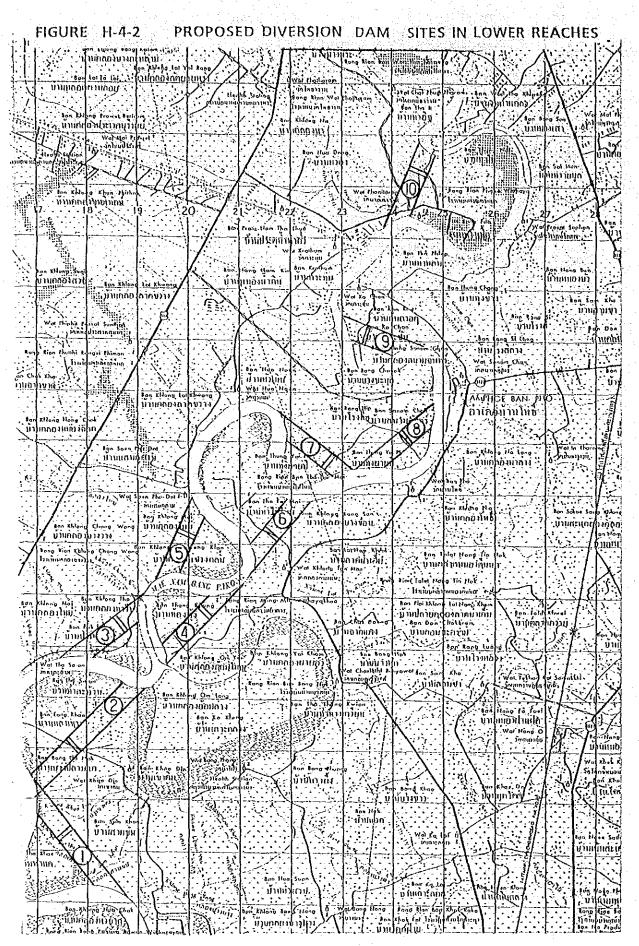
- Despite that the construction cost at the No.2 site will be slightly higher having relatively longer diversion channel, replacement and compensation costs for houses will be much lower than No.4
- Moreover an important temple (Wat Samarum) exists very closely to the No.4 site
- Connection or access road to be constructed or rehabilitated is also shorter if the site No.2 is selected
- Storage volume of fresh water and distance from beneficiaries are advantageous when the site is selected more downstream.

B) Lower Reach Sites

Between the river mouth and Bang Pakong bridge on the national road No.34, there are no suitable damsites because many existing factories and quays are situated along the both banks. On the other hand, upstream site to the Chachoengsao city, there are several suitable damsites No.1 to No.10 as shown in the Figure H-4-2.

Topographical features of respective alternatives can be summarized as follows:

F THA LAT						We have the second		A Contraction of the second seco	1		
JUNCTION OF			PROPOSED	SITE NO. 5 A		יווער איז					
	Summing States	A	PROPOSED Sector Control of Pro-	D. 4 Plantant						The United States	
EACHES				NUMERIA SITE NO		PROPOSED	SITE NO. 3				ALL DURANT AND ALL AND AND ALL AND AND ALL AND ALL AND AND AND ALL AND ALL AND AND ALL AND
SITES IN MIDDLE REACHES			PROPOSED	SITE NO. 2		(500) 101 (500) (5					
DAM SITES						PROPOSED	Anna SLIE NO. L				ייין טרישיער איין איין איין איין איין איין איין איי
PROPOSED DIVERSION	1011110 101111111111111111111111111111				Drusa oru	and and the second					
PROPOSED		- Annakaunut		() maid a same and the sam	North Contractions			And Andrewski and And			AGU
FIGURE H-4-1		is providented to the second s	Land Land Land	Land Constraints		10-3 10-3	CHACHOENCSAO				tuntin UP



No, 1	The area is favorable to a diversion damsite, mostly flat land with
	paddy fields average 1.2 m in elevation, sparsely populated. Connecting
	canal length. $L = 1.8 \text{ km}$
	and the second
No.2	Selecting the connecting canal route in consideration of the stream
	direction, the canal will become somewhat longer ($L = 2.8$ km), with
a starte	low paddy fields average 0.8 m in elevation, sparsely population.
No.3	The area is shrimp farms average 1.2 m in elevation. The connecting
	canal may be short, however, densely populated on the downstream
	side, expecting high compensation. $L = 1.5$ km
•	
No.4	The area of shrimp farms average 1.3 m in elevation, not so densely
1,012	populated. $L = 1.7$ km
	Popurova a arran
No.5	The area is paddy fields, average 1.1 m in elevation. Saen Phu Dat towr
	is located upstream of the connecting canal and comparatively densely
	populated downstream of it. $L = 1.5$ km
No.6	A large island will be formed by constructing the connecting canal. The
	area is composed mostly of paddy fields and of some shrimp farms
	average 1.2 m in elevation comparatively densely populated. $L = 1.5$
	km
No.7	The direction of a diversion dam axis is not favorable. The area consists
	of paddy fields and shrimp farms in half, average 1.4 m in
	comparatively high elevation, fairly densely populated. $L = 1.4$ km
No.8	The area consists of mainly paddy fields and partly of shrimp farms,
	average 1.1 m in elevation, densely populated. $L = 1.8$ km
No.9	The direction of a diversion dam axis is not favorable. The area consists
	of paddy fields average 0.9 m in elevation, densely populated on the
	downstream side. $L = 1.3 \text{ km}$
No.10	The area consists mainly of paddy field and partly of shrimp farm which
	have been increasing recently, average 1.1 m in elevation, densely
	populated, $L = 1.5 \text{ km}$

The following sites are excluded from the detailed comparison study due to the geographical disadvantages.

No. 2	The connecting channel must be elongated	•
No. 3	Many shrimp farms and house are situated	
No. 6	Many houses are located	
No. 7	Direction of dam axis is not favorable and many houses located	÷.
	NATION TO A CONTRACT OF A C	
No. 8	Many houses are located	
No. 8 No. 9	Many houses are located Direction of dam axis is not favorable	

Accordingly, the alternatives No. 1, 4 and 5 are selected for detailed comparative study. The followings are results of comparative study on the technical and economical view points.

TABLE H-4-1. COMPARISON OF CONSTRUCTION COST RATIO FOR DIVERSION DAM BY SITE

	Item		Site No.1	Site No.4	Site No.5
1.	Construction Cost for Diversion Dam				· · · · ·
	1) Foundation Treatment	(0.15)	1.85	1.75	1.55
	2) Civil structure	(0.20)	1.60	1.50	1.35
	3) Apron and Reventment	(0.10)	1.85	1.75	1.55
	4) Gates	(0.30)	2.25	2.00	1.80
	5) Bridge	(0.05)	2.00	1.85	1.65
	6) Connecting Canal	(0.10)	1.90	1.65	1.30
	7) Temporary Works	(0.10)	1.85	1.75	1.55
	Total Cosntruction Cost	(1.00)	1.93	1.77	1.57
2.	Land Compensation Cost				
	1) Area of Connecting Canal (37 ha)		67 ha	58 ha	47 ha
	2) Ratio of Ara of Connecting Canal	(1.00)	1.8	1.6	1.3

(in case that the construction cost for Bang Pakong Diversion Dam at Bang Bang Khwan is assumed to be 1.000)

As the result of comparative study, alternative No.5 is technically feasible and economically viable, and No.5 will also be appropriate site from view point of river engineering conditions. TABLE H-4-2. SCALE COMOMPARSION OF DIVERSION DAM BY SITE

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[Γ	r	I	Ī	1	T	1	1	1		1
Site No.5	The area consists of paddy fields. There are Saen Phu Dat town upstream comparatively many houses downstream of the sites.	2,310 m ²	300 m	13 m	m 1.7	H 0.6 (-)	10.3 m	230 m	$40 \text{ m} \times 4 \text{ gates} + 35 \text{ m} 2 \text{ gates}$	310 m 1.5 km	4.20 MCM	45 MCM
Site No.4	The major parts of a diversion dam and connecting canal sites consist of shrimp farms.	$2,630 \text{ m}^2$	310 m	15 11	8.5 m	u 0.6 (-)	10.3 m	260 m	$40m \times 5$ gates + $30 m \times 2$ gates	340 m 1.7 km	5.27 MCM	45 MCM
Site No.1	It is favorable as diversion damsite, with paddy fields not so densely populated	$2,870 \text{ m}^2$	370 m	15 m	7.8 m	(-) 9.0 m	10.3 m	280 m	$40\mathrm{m} \times 7\mathrm{gates}$	370 m 1.8 km	6.12 MCM	50 MCM
Item	1. Geographic Feature	2. Mean Riverine Sectional Area Upstream and Downstream of the site	3. Mean Riverine width Upstream and down stream of the site	4. Water Depth at the Deepest point of the River	5. Mean Water Depth	6. Riverbed Level for Diversion Weir	7. Water Depth for Weir	8. Weir Width	9. No. of gates	10. Connecting Canal Canal Width Elongation	Excavation Amount	11. Storage capacity

2.3. Detailed Comparative Study for Middle and Lower Sites

A) General

As the results of the preliminarily study, the following two damsites were selected as the most suitable ones to represent the middle and lower damsites:

- (1) Middle damsite (No.2 site) located 70 km far from the river mouth, just upstream of Muang Chachoengsao.
- (2) Lower damsite (No.5 site) located at a distance 20 km from the river mouth, upstream of Saen Phu Dat town.

B) Advantage for Middle Site

(1) River Section

Having the catchment areas of 15,400 sq.km and 17,000 sq.km respectively at the Middle and Lower damsites, the flood discharge passing through the Lower site is accordingly larger than that of the Middle site. The present river sections at both sites are as follows:

River Section	Middle Site	Lower Site
Average Width	21 0 m	300 m
Average Depth	7.4 m	7.7 m
Average Section Area	$1,500 { m m}^2$	$2,310 \mathrm{m}^2$

Since the diversion dam has no flood control function, which would cause inundation problem at the upstream service area along the river, the existing river section area should be kept in the design of diversion dam in order to release the flood not so as to raise up the present flood water level. Therefore, the scale and construction cost for the Lower site becomes inevitably larger than those for the Middle site, as shown in Table H-4-3.

(2) Intake Water Level

Since the Middle site is placed at a distance about 50 km upstream from the Lower site, the full water level (intake water level) at the Middle site becomes about 50 cm higher than that of the Lower site in accordance with the river slope of 1/100,000. When the irrigation main canal starts the diversion damsite and covers the existing irrigation area, a 50 cm higher head in the Middle site can expand the service area under the gravity irrigation system as compared with the Lower site.

Description	Unit	Middle site	Lower site	Remarks
1. Available water in the Tha Lat	- · ·	-	· · · · · · · · · · · · · · · · · · ·	
river basin project area		an a		
- For irrigation use *1	MCM	593.9	610.7 *2	
- For industry use	MCM	160.7	160.7	
- For domestic use	MCM	32.7	32.7	
Total	MCM	787.3	804.1 *3	
2. Beneficial area in F/S study basin		(150%)*9	(100%)	
- Left bank by Tha Lat weir *4	ha	21,100	21,100	
- Left bank by gravity from		(150%)	,	
Si Yat dam *4	ha	7,100	-	
- Left bank by Pump from		(150%)		
diversion dam *5	ha	14,300*7	 .	
- Right bank by gravity from		(100%)	(100%)	
diversion dam *6	ha	10,800*8	82,100 *10	
		(140%)	(100%)	
Total	ha	53,300	103,200	
3. Scale of diversion dam				
- Length	m	65	65	
- No.of gate	m	150	230	
- Diversion channel excavation		30m×5gtes 40r		×2gates
Total	M.cu.m	4.0	4.2	
4. Construction cost	· · · · · · · · · · · · · · · · · · ·	······································		<u></u>
- Diversion dam	m.baht	1,670.0	2,561.7	
- Irrigation canal	m.baht	1,370.0	966.0	
- Compensation for shrimp farm	m.baht	-	229.5	
- Navigation lock cost	m.baht	· · · _	114.4	
- Protection for water pollution	m.baht	-	33.0	
Total	m.baht	3,040.0	3,904.6	
5. Benefit	·			
- Benefit from agriculture	m baht	1,147.8	480.2	
- Benefit from industry	m.baht	192.8	192.8	
- Benefit from domestic water	m.baht	52.3	52.3	
Total	m.baht	1,392.9	725.3	

TABLE H-4-3. COMPARATIVE TABLE ON ALTERNATIVES PLAN OF DIVERSION DAM

Note

*1 : Irrigation component includes water uses for fishery and shrimp farming.

*2 : Includes 16.8MCM of compensatory supply of fresh water for shrimp farming on the right bank of Bang Pakong river.

*3 : Incremental capacity of diversion dam is used 1.12 times a year.

*4 : Irrigated by gravity through irrigation canal.

*5 : Irrigated by pump through irrigation canal.

*6 : Diversion reservoir direct.

*7 : Existing and proposed Bang Pakong Left Bank area.

*8 : To be irrigated by compensatory supply of 100MCM/year in Right Bank area.

*9 : Parenthesis stands for cropping intencity.

*10 : Irrigable area for wet season paddy if water currently allocated to the Bang Pakong Left Bank area, Tha Lat expansion area and double cropping in existing Tah Lat area is used to supplement irrigation in Right Bank area.

C) Advantage for Lower Site

(1) Increase of Reservoir Capacity

In case the diversion dam is placed at the Lower site, the reservoir capacity will become 45 MCM, 15 MCM larger than that of the Middle site, with a incremental storage of 50 km \times 300 m = 15 MCM, although the usable water for irrigation and other purposes will be less than 15 MCM when losses due to evaporation especially in dry season is taken into consideration.

(2) Direct Water Intake from Diversion Dam Reservoir to Service Area

Some agricultural areas with elevations between 1.0 m and 0.0 m extend along the both banks of the river upstream of the diversion dam. These areas situated mainly on the right bank has been receiving supplemental irrigation water for wet season paddy from return flows from the upper irrigation area, but suffered always from water shortage due mainly to small amount of return flow.

When the diversion dam is constructed and keeps the reservoir water level of 1.0 m to 0.5 m, the above service areas could be irrigated easily by introducing the reservoir water directly through the existing irrigation lateral canals.

In the case that the diversion dam is placed at the Lower site, the service area to be irrigated directly by the reservoir water is more expanded than that of the Middle site. These areas will be as follows:

- Middle Site 10,800 ha on right bank by compensatory water
- Lower Site 82,100 ha on right bank for wet season paddy
- Increased Area 71,300 ha

It is noted here that the above plan is possible, if additional development of water sources other than the Rabom dam, Si Yat dam and the diversion dam are not accompanied, only when the water allocated under the current Feasibility Study to the existing and proposed Bang Pakong Left Bank areas and the Tha Lat expansion area is distributed to the right bank area to supplement irrigation water for wet season paddy.

D) Disadvantage for Lower Site

(1) Compensation for Existing Shrimp Farm

Shrimp farm of about 15,000 rai expands along the both banks downstream of Muang Chachoengsao and feeding shrimp by using brackish water downstream the Bang Pakong river. The shrimp production and income in the area reaches presently as follows:

Production :	$0.666 \text{ ton/rai} \times 15,000 \text{ rai} = 10,000 \text{ ton}$
Gross Income :	$147,000 \text{ baht/rai} \times 15,000 \text{ rai} = 2,200 \text{ million baht}$
NetIncome :	$51,300 \text{ baht} \times 15,000 \text{ rai} = 770 \text{ million baht}$

There will be no problem for the existing shrimp farming if the diversion dam is constructed at the Middle site. Compensation for shrimp farm should, however, be required when the dam is constructed at the Lower site, because the diversion dam will not supply brackish water but fresh water only.

Since it is difficult to find the new shrimp farm area for compensation in the further downstream area of the Lower site, the compensation works will be made with the following means:

Pumping station to lift up the saline water downstream the diversion damsite

Construction of conveyance canal to supply saline water from pumping station to the existing shrimp farm

Construction of drainage canal to drain the polluted water from the shrimp pond so as to prevent the waste water from intruding into the diversion reservoir

(2) Compensation for Navigation

The downstream channel of the Bang Pakong river from the mouth up to Muang Chachoengsao is being utilized frequently for navigation to transport commodity and passenger to the city of Chachoengsao. Therefore, compensation for the existing navigation shall be required in the case that the diversion dam is constructed at the Lower site.

Navigation lock will be provided at the existing river section in consideration of the operation of lock to prevent saline water intrusion into the diversion reservoir, since the dam is to be constructed on the bank area using the existing meandering river course as the diversion channel.

(3) Protection for Water Pollution

The right bank area located downstream of Muang Chachoengsao has been developing rapidly as the residential and industrial area. In association with the above development, wasted water from industries and city area will be released to the diversion reservoir in the case the diversion dam is constructed at the Lower site.

In order to prevent the intrusion of polluted water into the reservoir, ponds to collect the wasted water and sewerage channel to drain it to the downstream river shall be required.

E) Comparison of Construction Cost and Benefit for Middle and Lower Dam

In accordance with the above mentioned advantage and disadvantage for Upper and Lower diversion damsites, the required scale of facility, construction cost and benefit were studied as shown in H-4-4 and H-4-5, as summarized below:

an di shunan fa shi kara a tata katiyi birtin ƙwalan ƙwalan ƙafa a suna

Construction Cost (Preliminary Estimate)	Middle Site	Lower Site	Rate
(1) Diversion Dam	1,670.0	2,561.7	1.53
(2) Irrigation Canal	1,370.0	966.0	0.71
(3) Compensation for Shrimp Farming		229.5	
(4) Navigation Lock		114.4	
(5) Drainage Canal for Polluted Water	- i i	33.0	
Total	3,040.0	3,904.6	1.28
Benefit (Net Production Value)			
(1) Right Bank Compensation Area	50.3	382.0	7.59
(2) Tha Lat Area	556.5	98.2	0.18
(3) Bang Pakong Left Bank (by Pump)	541.0	1 . . 1	- , ¹
(4) Industry	192.8	192.8	1.00
(5) Domestic Water Supply	52.3	52.3	1.00
Total	1,392.9	725.3	0.52

Note: Unit = million Baht

F) Conclusion

In accordance with the above study, the diversion damsite should be proposed at the Middle site.

Item	Middle	Lower	Ratio
1. Diversion dam	<u></u>		(L/M)
1) Temporary Work	293.4	454.8	1.55
2) Diversion dam	355.7	480.2	1.35
3) River bed, dike pratection	71.8	111.3	1.55
4) Gate	503.0	905.4	1.80
5) Bridg/road	85.9	141.7	1.65
6) Diversion channel	360.2	468.3	1.30
Total	1,670.0	<u>2,561.7</u>	<u>1.53</u>
A	1 40 0	0	
2. Irrigation canal	143.0	0	
2.1 Phase-I	261.0	. 0	
1) Pumping Station	404.0	0	
2) Main canals	86.0	86.0	
Sub-total 2.2 Phase-II	490.0	86.0	
1) Weir	12.0	12.0	
2) Mian canals	868.0	868.0	
Total	880.0	880.0	
Total $(2.1+2.2)$	<u>1,370.0</u>	<u>966.0</u>	
3. Shrimp farm compensation For Left Bank 8.000 rain		⁹ 1	
For Left Bank 8,000 rain: 160M	CM/180 days = 1	0.3 m ³ /sec	
For Right Bank 10,000 rai : 200	MCM/180 days =		
1) Pump for Left	-	83.5	
2) Pump for Right	-	104.0	
Sub-total	-	187.5	
3) Canal for Left	-	20.0	
4) Canal for Right	-	22.0	
Sub-total	-	42.0	
(D. 1 - 1		000 5	
Total	<u>-</u>	<u>229.5</u>	
4. Navigation lock	<u>-</u>		
4. Navigation lock 1) Civil Work	<u>-</u> -	47.4	
4. Navigation lock 1) Civil Work 2) Gates	- - -	47.4 67.0	·
4. Navigation lock 1) Civil Work 2) Gates Total	- - -	47.4	
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4. Navigation lock 1) Civil Work 2) Gates Total 5. Dreinage canal for water pol 1) Left bank	- - - lutions - - -	47.4 67.0 114.4 15.0	

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TABLE H-4-4. CONSTRUCTION COST (PRELIMINARY ESTIMATE)

H-75

.

PRODUCTIONS VALUE) ESTIMATE	Unit : Milion Baht s Site Lover site	sity 140%) (Crop intensity 100%)		10,800 82,100 ha	50.3 382.0	-	28,200	556.5 The second se			14,300	541.0		$300) \times 1.5 = 74,550$ ha $103,200$ ha	<u>1,147,8</u>	160.7MCM×1.2=192.8	<1.6=52.3	<u>1.392.9</u>	
BENEFIT (NET PRODUCTIONS \	Middle Site	(Crop intensity 140%)	ly)							· · ·				$10,800 + (28,200 + 14,300) \times 1.5 = 74,550ha$		160.7MCM>	$32.7MCM \times 1.6 = 52.3$		
TABLE H-4-5.	Description		1. Right bank compension area (Reservoir directly	- Irrigable area (ha)	- Paddy rive per ha NPV : 4,653 Baht	2. Tha Lat area (Canal directly)	- Irrigable area(ha)	- Paddy mange mixed per ha NPV : Baht	- Paddy rice per ha, NPV: 4,653 Baht	3. Bang Pakong Left bank area (Pumping)	- Irrigable area(ha)	- Paddy rice mango mixed per ha NPV:	<u>Total</u>	Irrigable area (ha)	Net production value(M Baht)	4. Industry per m ⁸ approx 1.2 Baht	5. Drinking per m ³ approx 1.6 Baht	Total (Million Baht)	

2.4. Construction Method of Diversion Dam

A) General

Construction of a diversion dam in a river usually involves the cofferdam works. The Bang Pakong river is relatively narrow for a river of its size, and is therefore deep even at the proposed site, the cofferdam works are quite difficult. Two cofferdam methods, (1) half river closure cofferdam method (HRCC) and (2) complete closure cofferdam and by-path method (CCCB), are proposed for the alternative construction plan of the diversion dam, taking into consideration the size of the river.

B) Proposed Site for the Diversion Dam

The diversion dam should be located at where straight line sections are possible for both the fore and rear aprons. From view points of operation and maintenance as well as safety reasons, placing the diversion dam on the curve section should be avoided. As shown in the attached figure, the upstream section of Wat Chuknua is therefore suitable. This section is also appropriate judging from the construction of access roads on the banks.

c) Half River Closure Cofferdam Method (HRCC Method)

The river width at the proposed site is wider than those of the upper and lower stream. However it is still narrow for a river of this class. As mentioned earlier, the river is deep at the proposed site with the depth exceeding 10 m, making difficult sheet pile cofferdam works. Judging also from the scale of river discharge and construction period, the HRCC method may not be applicable with the following reasons:

- Since the conveyance capacity of the river section is reduced to less than half, there is always danger of flooding upstream during wet season.
- Since the sheet pile will be subjected to about 13 m of hydraulic pressure, independent sheet pile work is not possible.
- Additional sheet pile works to prevent seepage is necessary at the foot of the inland side of levee.
- It is necessary to construct temporary access passage on the both sides of the bank.
- Since the river bed is composed of soft clay, improvement work of soil foundation is required.

The danger is great and damage is irreparable once the flood water enters into the cofferdam.

For the reasons given above, a larger safety factor should be given for the sheet pile, and adequate reinforcement such as girder beam is accordingly required.

D) Complete Closure Cofferdam and By-Path Method (CCCB Method)

Since the site of the diversion dam is located at the straight section of the river, the length of the by-path will be about 1.5 km, equivalent to the length of the diversion channel proposed in the original construction plan. The construction work of the dam body will take about two years and the crosssection of the by-path will be $200 \text{ m} \times 10 \text{ m}$, which is about the mean section of the river, in order to reduce compensation cost for the land. Back-filling of the by-path will be conducted after completion of the dam body. Before filling the by-path, it will be necessary to close the both ends. The oil excavated from the by-path construction site must be temporarily piled for about three years and will be used for back-filling. It will, however, be necessary to purchase soil to fill the upper 1 m of the back-filling layer.

Total cost for this method is estimated to be about 2,620 million baht. The disadvantages of this method as compared with the original plan are as follows:

- Two cofferdams, subject to about 13 m of hydraulic pressure, are required.
- Improvement works for oil foundation on the river bed are also required.
- About 1.5 km of by-path is to be excavated and then to be backfilled after construction of the dam.
- About 1.5 km² of land is required to store temporarily the soil excavated during the by-path construction.
- A temporary or compensatory bridge is to be constructed across the by-path.
- Compensation for the evicted farmers is necessary for the period of construction.

E) Construction Period

The construction period for the original plan (OP) is the shortest, taking about three years, as the parallel execution of construction works for the dam body an diversion channel is possible. As for the CCCB method, the closure work and by-path construction will take about 6 years because that the parallel construction of the by-path and cofferdams is not possible, and the whole construction period will be about 7.5 years.

F) Conclusion

The following table compares the costs and construction periods among the alternative plans:

Mulal	Constructi	on Cost	Construct	ion Period	A
Method	Million Baht	(rate)	Year	(rate)	Appraisal
Original Plan	1,820	(1.00)	3.0	(1.00)	1
CCCB Method	2,620	(1.44)	7.5	(2.50)	2

The original plan requires a relatively higher compensation cost for the land, however, it is the most economical and technically safe method, and therefore is given the top appraisal.

			<u>Constru</u>	iction P	eriod (Y	<u>ears)</u>		
	1-st	2-nd	3-rd	4-th	5-th	6-th	7-th	
 Original Plan Dam Body Diversion Channel 				3.0 ye	ars			
 By-Path Method Closure Dam By-Path Excavation Dam Body 						7.	5 years	
Closure Dams DemolishBy-Path Back-fill								784340

Construction Period by Construction Method

Work Description	Original Plan	By-Path Method
1. Temporary Work	137,663	206,520
2. Diversion Dam Body	930,447	930,447
3. Connection Bridge & Road	85,907	85,907
4. Closure Dam	26,700	129,479
5. Diversion Channel	333,580	333,580
6 do - (Back-filling)	-	585,784
7. Miscellaneous	155,703	228,283
Total	1,670,000	2,500,000

<u>Construction Cost by Construction Method</u> Bang Pakong Diversion Dam

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APPENDIX-I. PROJECT IMPLEMENTATION AND EVALUATION

APPENDIX-I PROJECT IMPLEMENTATION AND EVALUATION

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I.1 PROJECT IMPLEMENTATION

Development		Sub-River	Storage Volume	Storage Volume	Balance	
	Stage	Basin	To be Developed	Available	Accumulated MCM)	
		· · · ·	MCM)	MCM)		
1)	First Stage	LBP	202	No.4 dam: 300		
•	(F/S area)	KTL	66	Rabon dam: 40		
	(Sub-Total)	· .	286	340	(+) 54	
2)	Second Stage	LBP	307	No.1 dam: 119		
		KPS	117	No.8 dam: 470		
		MPP	58			
	(Sub-Total)		482	589	(+)161	
3)	Third Stage	UBP	768	No.20 dam: 133		
		UPP	186	No.10 dam: 160		
	. 1	MHM	109	No.11 dam: 86		
		MNN	260	No.12 dam: 290		
				No.15 dam: 98		
				No.18/19 dam: 322		
				No.21 dam: 188		
			•	No.22 dam: 98		
	(Sub-Total)		1,323	1,375	(+)213	
	Total		2,091	2,304	(+)213	

TABLE I-1-1. STAGED WATER RESOURCES DEVELOPMENT PLAN

Note: The figures of dam storage volume to be developed include seepage and evaporation losses from proposed storage dams with 10 percent of active storage volumes.

I.2 EVALUATION

This section contains the following articles, tables and figures:

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Table I-2-2	Technical Difficulty on Dam Construction
Table I-2-3	Social Difficulty on Dam Compensation
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	People
· · ·	

Table I-2-5Priority on Urgency with Industrial and Domestic WaterTable I-2-6Incremental Benefit per ha

I.2.2 Irrigation development Project Cost

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I.2.3 Cost Allocation Method

I.2.4 Commodity Prices

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I.2.7 Farm Economic Survey

Figure I-2-1 Percentage of Drought Damage Area to Cultivated Land

RAT
BENEFIT
COST
1.1
I-2-1

				••• • • •	· · ·							
• •	(unit: million Baht)	B/C	Discount Ratio	12%	1.02	1.22	1.37	0.23	0.80	0.66	1.02	1.83
	n)	Project Cost		Economic	4,651	636	1,306	3,041	740	2,754	1,761	1,627
		Projec		Financ.	5,168	207	8,118	3,379	822	3,060	1,957	1,808
COST BENEFIT RATIO		Justifiable Expenditure Value	Discount Ratio	12%	4,761	776	10,019	688	596	1,822	1,805	2.983
TABLE I-2-1			Annual Benefit		517.3	93.1	1,202.3	82.6	71.5	218.6	216.6	358.0
TAB		Annual	O&M	Cost	52.7	6.9	97.7	54.4	13.5	21.4	22.4	32.0
		Annual	Increment	A L A	624	100	1,300	137	85	240	239	390
	-	•	Irrigation Block		LBP	KTL	UBP	NNM	MPP	NHM	KPS	UPP

•

Irrig. Block	Dam Site		es Point ore, Construction	Evaluation Grade	Final Asses Point	
LBP	1		8	В	2	
KTL	4	•	8	В	2	
KPS	8		7	С	1997 - 1	
UPP	10		6	E)	
	\mathbf{O}		9	Α	} 1	
МНМ	Ø		6.5	D	3	
÷	Б		8	В		
	(13)		6	E	1	
	(19		7	С)	
UBP	2		8.5	В	2	
MNN	21		5.5	Е	1	
	22		7	С	j 1	
	Evaluati A-3, B-2,	, C-1, D-1, E-0	ssed as the followin			
3LE 1-2-	Evaluati A-3, B-2,	on grade is asse C-1, D-1, E-0		<u>INSATION</u>		
	Evaluati A-3, B-2, 3 <u>SOCIAL</u>	on grade is asse C-1, D-1, E-0 <u>DIFFICULTY</u>	ssed as the followin OF DAM COMPE		Asses Point	
3LE I-2- Irrig.	Evaluati A-3, B-2, 3 <u>SOCIAL</u> Dam	on grade is asse C-1, D-1, E-0 <u>DIFFICULTY</u> Own	ssed as the followin <u>OF DAM COMPE</u> Household	<u>INSATION</u> Difficulty of	Asses Point	
BLE I-2- Irrig. Block	Evaluati A-3, B-2, 3 <u>SOCIAL</u> Dam Site	on grade is asse C-1, D-1, E-0 <u>DIFFICULTY</u> Own Right	ssed as the followin OF DAM COMPE Household Inundated	Difficulty of Compensation	· · · · · · · · · · · · · · · · · · ·	
SLE I-2- Irrig. Block LBP	Evaluati A-3, B-2, 3 <u>SOCIAL</u> Dam Site ① ④ ⑧	on grade is asse C-1, D-1, E-0 <u>DIFFICULTY</u> Own Right Private	ssed as the followin OF DAM COMPE Household Inundated over 500	Difficulty of Compensation C	1	
BLE I-2- Irrig. Block LBP KTL	Evaluati A-3, B-2, 3 <u>SOCIAL</u> Dam Site (1) (4) (8) (0)	on grade is asse C-1, D-1, E-0 <u>DIFFICULTY</u> Own Right Private	ssed as the followin OF DAM COMPE Household Inundated over 500 ¢	Difficulty of Compensation C C	1 1 1 1	
BLE I-2- Irrig. Block LBP KTL KPS	Evaluati A-3, B-2, 3 <u>SOCIAL</u> Dam Site (1) (4) (8) (1) (1)	on grade is asse C-1, D-1, E-0 DIFFICULTY Own Right Private % % National	ssed as the followin OF DAM COMPE Household Inundated over 500 ~ ~	Difficulty of Compensation C C C C	1 1	
BLE I-2- Irrig. Block LBP KTL KPS UPP	Evaluati A-3, B-2, 3 <u>SOCIAL</u> Dam Site (1) (4) (8) (1) (9) (1) (2)	on grade is asse C-1, D-1, E-0 <u>DIFFICULTY</u> Own Right Private <i>*</i> <i>*</i>	ssed as the followin OF DAM COMPE Household Inundated over 500 % %	Difficulty of Compensation C C C C C C	1 1 1 1	
BLE I-2- Irrig. Block LBP KTL KPS UPP	Evaluati A-3, B-2, 3 <u>SOCIAL</u> Dam Site (1) (4) (8) (1) (2) (1) (2) (5)	on grade is asse C-1, D-1, E-0 DIFFICULTY Own Right Private % % National	ssed as the followin OF DAM COMPE Household Inundated over 500 % % %	Difficulty of Compensation C C C C C A	1 1 1 } 2	
BLE I-2- Irrig. Block LBP KTL KPS	Evaluati A-3, B-2, 3 <u>SOCIAL</u> Dam Site (1) (4) (8) (1) (2) (6) (8) (1) (2) (6) (8) (1) (2) (6) (8) (8)	on grade is asse C-1, D-1, E-0 DIFFICULTY Own Right Private % National Private	ssed as the followin OF DAM COMPE Household Inundated over 500 % % less 500	Difficulty of Compensation C C C C C A B	1 1 1 1	
BLE I-2- Irrig. Block LBP KTL KPS UPP MHM	Evaluati A-3, B-2, 3 <u>SOCIAL</u> Dam Site (1) (4) (8) (1) (2) (1) (2) (5) (6) (8) (1) (2) (1) (2) (1) (2) (1) (2) (1) (2) (3) (3) (3) (3) (3)	on grade is asse C-1, D-1, E-0 DIFFICULTY Own Right Private % National Private %	ssed as the followin OF DAM COMPE Household Inundated over 500 % % % less 500 over 500	Difficulty of Compensation C C C C C A B C	1 1 1 } 2	
BLE I-2- Irrig. Block LBP KTL KPS UPP MHM	Evaluati A-3, B-2, 3 <u>SOCIAL</u> Dam Site (1) (4) (8) (1) (2) (1) (2) (1) (2) (1) (2) (1) (2) (1) (2) (2) (3) (3) (3) (3) (3) (3) (3) (3) (3) (3	on grade is asse C-1, D-1, E-0 DIFFICULTY Own Right Private % National Private % National	ssed as the followin OF DAM COMPE Household Inundated over 500 % % less 500 over 500 %	Difficulty of Compensation C C C C C A B C A A	1 1 1 } 2	
UBP	Evaluati A-3, B-2, 3 <u>SOCIAL</u> Dam Site (1) (4) (8) (1) (2) (6) (1) (2) (6) (1) (2) (6) (1) (2) (6) (1) (2) (6) (1) (2) (2) (2) (2) (2) (2) (2) (2) (2) (2	on grade is asse C-1, D-1, E-0 DIFFICULTY Own Right Private % % National Private % National % %	ssed as the followin OF DAM COMPE Household Inundated over 500 % % less 500 over 500 % % %	Difficulty of Compensation C C C C C A B C A A A	$\left.\begin{array}{c}1\\1\\1\\\end{array}\right\}$	
BLE I-2- Irrig. Block LBP KTL KPS UPP	Evaluati A-3, B-2, 3 <u>SOCIAL</u> Dam Site (1) (4) (8) (1) (2) (1) (2) (1) (2) (1) (2) (1) (2) (1) (2) (2) (3) (3) (3) (3) (3) (3) (3) (3) (3) (3	on grade is asse C-1, D-1, E-0 DIFFICULTY Own Right Private % National Private % National % %	ssed as the followin OF DAM COMPE Household Inundated over 500 % % less 500 over 500 % % %	Difficulty of Compensation C C C C C A B C A B C A B C A B B	$\left.\begin{array}{c}1\\1\\1\\\end{array}\right\}$	

I-4

TABLE I-2-4PRIORITY ON REQUIREMENT TO GOVERNMENT
HELP BY TAMBON PEOPLE

Irrig. Block	Agriculture Water	Consumer Water	Road	Electricity	Asses Point for Point for Agri. & Consum. Water
LBP	2 (2)	3 (1)	1 (3)	4(1)	3
KTL	1 (3)	4(1)	2 (2)	3 (1)	4
UBP	1 (3)	4 (1)	2 (2)	3 (1)	4
MNN	2 (2)	4 (1)	1 (3)	3 (1)	3
MPP	2 (2)	3 (1)	1 (3)	4 (1)	3
MNH	2 (2)	3 (1)	1 (3)	4(1)	3
KPS	3 (1)	3 (1)	1 (3)	2(1)	2
UPP	3 (1)	3 (1)	1 (3)	3 (1)	2

Source : Socio - economic survey, 1987, NSO.

Criteria for priority

Priority 1 ···· Asses Point 3 Priority 2 ···· Asses Point 2 Priority 3 ···· Asses Point 1 Priority 4 ···· Asses Point 1

(): Assed Point

TABLE I-2-5 PRIORITY ON URGENCY WITH INDUSTRIAL AND DOMESTIC WATER

Item	LBP	KTL	UBP_	MNN	MPP	MNH	KPS	UPP
Industry Water	High	High	Med.	Med.	Low	Low	Low	Low
Domestic water	High	High	Med.	Med.	Low	Low	Low	Low

<u>Criteria for priority</u>

.

High urgency	····· Point 3
Medium urgency	····· Point 2
Low urgency	\cdots Point 1

Irrigation Block	Annual Incremental NPV	Project Area	NPV/ha High	Medium	Low Point
	106/Baht	ha	10 ³ /Baht		
LBP	624	68,900	9.1	O	2
KTL	100	6,900	14.5 O		3
UBP	1,300	136,900	9.5	0	2
MNN	137	76,400	1.8		0 1
MPP	85	16,600	5.1		O 1
MHN	240	28,100	8.5	O	2
KPS	239	29,700	38. a. (2 8.0) (a. a. a. (3.		2
UPP	390	43,300	9.0	0	2
Total	3,115	406,800	7.7		

TABLE I -2-6 INCREMENTAL BENEFIT PER HA

Criteria for priorityHigh......3 pointMedium....3 pointLow....3 point

	Dam	Diversion Dam	Irrigation facility	On - Farm	Total Cost
LBP	1,943	595	1,957	673	5,168
KTL	178	1997 - 19	444	85	707
UBP	3,524		3,247	1,247	8,118
MNN	800		1,824	755	3,379
MPP	199	ана на селото на село По селото на селото н По селото на селото н	457	166	822
мнм	445	_	2,324	291	3,060
KPS	262		1,398	297	1,957
UPP	734	-	651	423	1,808
Total	8,085	595	12,302	4,037	25,019

(unit : million Baht)

Irri, Block	Dam	Diversion	Irri, Canal	On-farm	Total	Weighted Eco. Life
Eco. Life	80 yrs	50 yrs	40 yrs	40 yrs		
LBP Cost Deprec. cost	1,943 24.3	595 11.5	1,957 48.9	673 16.8	5,168 101.5	51 years
KTL Cost Deprec.Cost	178 206 2.2		444 11.1	8.5 2.1	707 15.4	46

TABLE 1-2-8 WEIGHTED ECONOMIC LIFE FOR PROJECT

I-2-9. Cost Allocation Methods

1. Investment cost and O & M of the Si Yat Dam and the Diversion Dam are allocated to irrigation component and industry and domestic water component, in order to clarify the size of investment cost to be borne by each related agency and estimate the water costs.

2. Cost allocation method is internationally used by Separable Cost Alternative Justifiable Expenditure method. This method was already adapted to the Feasibility study on Khlong Thap Ma Dam and Khlong Yao Dam Scheme, 1983.

3. Separable Cost Alternative Justifiable Expenditure Method is illustrated as follows.

Item	Irrigation	Industry Water	Domestic Water	Total
a. Alternative Cost	1,250	800	700	2,750
b. Justifiable Expenditure Value	1,170	800	700	2,670
c. Smaller Either of a. and b.	1,170	800	700	2,670
d. Specific Cost	250	320	280	850
e. c-d	920	480	420	1,820
f. Separable Cost	700	180	120	1,000
g. Remaining Benefit	220	300	300	820
h. %of g.	26.8	36.6	36.6	100.0
i. Remaining Benefit	160.8	219.6	219.6	600
j. Allocated Cost (f + i)	860.8	399.6	339.6	1,600
k. Burden Ratio %	53.80	24.98	21.22	100.00

Example of Cost Allocation

(106 Baht)

- I. Alternative Cost: Alternative facility is schemed at the same place as the project dam. Alternative facility for industry water and domestic water would be selected from dam, wear and pump station.
- II. Justifiable Expenditure Value: Justifiable expenditure value in irrigation sector is estimated based on annual incremental net production value. Justifiable expenditure value in industry water

production value. Justifiable expenditure value in industry water sector and domestic water sector are the same value as the alternative cost.

Sector		Maxin	num Burden Cos	t	
<u> </u>	Alternative Cost		Specific Cost		
Irrigation	1,250	·	250	 ₩	1,000
Industry Water	800	-	320	=	480
Domestic Water	700	-	280	=	420

III. Separable Cost: The following method is illustrated as follows.

-1 ÷	Common		
Sector	Facility Cost	Maximum Burden Cost	<u>Separable Cost</u>
Irrigation	1,600	- (<u>480</u> + <u>420)</u> =	700
		Industry W. Domestic W.	가 가 가 다. 1997년 - 1997년 - 1997년 1997년 - 1997년 -
Industry	1,600	- (1,000 + 420) =	180
Water		Irrigation Domestic W.	ngat Angelo in ngangatan si in Ang
Domestic	1,800	- (<u>1,000</u> + <u>480</u>) =	320
Water		Irrigation Industry W.	

IV. After completion construction of common facilities, each sector should be simultaneously benefited. However, benefits growing in advanced investment sector will be delayed. Hence, in order to assist this disadvantageous sector, the following discounts will be adopted.

(c - d) mentioned above table $/(1 + i)^n$

- n : time lag between completion period of common facilities and growing period of a part of benefits
- i : interest rate

4.

Cost allocation method will be convertible to other methods in the following cases.

- I. Adaptation of Separable Cost Alternative Justifiable Expenditure method is very un-proper.
- II. Urgent necessity to water supply by sector is very different.

- Other method are considered as the following cases.
- I. Priority burden methods

5.

- **II.** Alternative cost allocation
- III. Annually used water quantity allocation

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- - - - .

IV. Dam capacity by sector allocation

TABLE I-2-10 COMMODITY PRICES

		Socio-Agro. Economic		Economic
Item	Unit	Survey (1989)	Other Statistics	Price (2000)
Paddy	Baht/ton	3,726 to 4,595	4,170	3,255
Soybean	"	n.a	8,920	6,440
Mungbean	, 22	n.a	7,570	
Groundnut	>>	n.a	5,000	5,000
Maize		2,658		2,870
Cassava	· 33	647		
Mango	Baht/kg	6 to 28	5.9 to 10	
(Vegetable)				
Kale	Baht/ton	10,000	2,500	
Chinese Cabbage	>>	n.a	1,500	
Green Bean	»	n.a	4,000	
Tomato	<i>n</i>	n.a	2,000	
Cucumber	33	n.a	2,000	
Watermelon	Baht/one piece	· ·	5,000	
		n.a		
Sweet Corn	Baht/ton	n.a	2,500	
Baby Corn	Baht/kg	n.a	20(with shell)	
Pumpkin	Baht/ton	n.a	3,000	
Chilly	4	n.a	4,500	
Kunchai	>>	12,800		
(Fertilizer)				
Urea (46%)	Baht/ton	5,700		8,280
DAP (18-46-0)	57			10,400
Potassium	Chloride (60%)			5,550
16-20-0	n	4,713	5,500	6,000
15-15-15	33	5,600	5,700	6,420
16-16-16	"	n,a	6,000	6,850
16-24-12	"		n.a	7,730
Manure	**		1,800	.,
Lime	22	n.a	264	
(Seed)				
Paddy	Baht/kg	4.06 to 4.19		
Maize	»	8.71		
Mungbean	"	48		
Cassava	Baht/1,000/pc.	40		· ·
Cassava Chinese Kale	Bant/1,000/pc.	75		
Kunchai	Bant/t	1	ļ	
nunchal		94		
(Chemical)				
Pesticide	D D U U		1001 000 0	
Paddy	Baht/rai	2.0 to 0.45	180 to 200 Baht/ <i>l</i>	
Maize	· · ·	20	180 to 200 Baht/ <i>l</i>	
Cassava	37	1.9		
Mango	"	50		
Herbicide				
Paddy	Baht/rai	1.2 to 26.9	80 Baht/l	
Maize	"	-		
Cassava	33	16.2		
Mango	33	-		

Item	Unit	Socio-Agro. Economic Survey (1989)	Other Statistics	Economic Price (2000)
(Machine)				
Hired (Small)	Baht/hour			
Paddy	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	72 to 119		
Maize	>>	52		
Cassava	a ≫ 11. 1. 11	195		
Mango	87 - 600	19		
Hired (Large)				
Paddy	Baht/hour	199 to 227		
Maize	"	137		
Cassava	>>	260		•
Mango	22	84		• • •
(Oil)		•		
Gasoline	Baht/l	4.2 to 3.9		
Lubricant		21 to 23		
r .				
(Labor)			- -	
Hired Labor				
Paddy	Baht/day	64.3 to 78.8		
Maize	"	50		ана. С
Cassava	"	195		
Mango	n	55.4		
(Average exclud.		(56.5)		
Cassava)				
Family Labor	4			
Paddy	Baht/day	48.3 to 70.1		
Maize	**	40.3		
Cassava	22	32.7		
Mango	· »	32.4		
(Average)		(38.4)		

Note: Paddy figures show both of transplanting paddy and broadcasting paddy

٠	Unit price : Ba	ht/t	on
	3,726	to	4,595
	Transplan	t	Broadcast
٥	Seed : Baht/kg		
	4.06	to	4.19
	Transplan	t	Broadcast
•	Family labour	: Ba	aht/day
	48.3	to	70.1
· ·	Transplan	ŀ.	Broadcast

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PADDY
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I-2-11
TABLE

- 1989 Constant Price -

300 <u>16</u>/ 145 <u>16</u>/ 65 15/ Economic 175 15/ 1666,324 6,135 3,255 248 5,450 128 3,660 200 160 4 2000 **Financia**] 310 330 160 200 285 4,775 3,210 220 220 175 2,545 166248 6,324 6,135 ы С 50 100 Economic 370 <u>16/</u> 185 <u>16/</u> 65 <u>15/</u> 250 <u>16</u>/ 45 <u>15</u>/ 175 15/ 3,870 203 304 7,752 4,345 152 6,725 1989 5,915 3,030 119 Financial 203304 7,752 7,520 200 350 380 400 200 35 3,820 270 200 50 Baht/ton US\$/ton US\$/ton Unit 2 W.B. projection price in 2000 at 1985 Constant price 1221 10/ 님 2 2 2020 6 4 Baht/mt - Baht/mt (5% broken white rice, FOB Bangkok) Transport cost farm gate to mill Converted to 1989 constant price Bangkok to Chachoengsao Adjusted to average grade Item Wholesaler's margin Farm gate price of paddy **Converted to Thai Baht** Merchant's margin Ex-mill price of paddy Transportation Cost Ex-mill price of rice Miller's margin Exporter's margin Rice premium Less:Port charge Exporter tax Less:Milling tax A ଲ ଳ Ð ភ ଡ ، ଛ 6

Commodity prices and price projections in 1985 constant Dollars, July 11,1989, IBRD. G-5, GNP Deflator 1985 = 100, 1989 = 149.55 in Inflation Indices, IBRD

<u>1/</u> 2/.....

Note:

<u>3/</u>...... 4/.....

US\$1.0 = Baht 25.50. Adjustment ratio is estimated at 97% as the following table.

ESTIMATION OF AVERAGE GRADE TO BE ADJUSTED

	1983	1984	1985	1986	1987	Average	Adjusted
	85,692 520,674 6 076		123,005 670,424 5.450	238,353 1,119,740	258,871 1,323,040	ר אדע ער וי	, co
•	0,7,0	0,001	0,400	4,030	111°C	0,400	0001
	2,576,948 14,769,172	3,414,278 19,049,973	2,877,716 16,346,317	3,613,300 16,258,840	3,244,597 16,339,061		
	5,731	5,580	5,680	4,500	5,036	5,305	6
	3.3%	2.5%	4.3%	6.6%	8.0%		

Source: Agricultural Statistics of Thailand 1987/88, Page 149, MOAC, Thailand

•

(Note: Continue)

<u>5</u> 7	Currently Baht 400/mt for 100% and 5%, Baht 350 for 10% and 15%, Baht 250 for 20% to 45%.
<u>6</u> /	Export tax is 5% of export price.
<u></u>	Data on business margin is based on the Rice Trading Report, NESDB, 1983.
	Exportor margin was about 20% of ex-mill price of rice in 1980.
	But this margin couldn't be realized due to the low FOB price.
	According to this facts, margin is assumed at about 7% of ex-mill price.
<u>8</u> /	According to the Rice Trading Report, NESDB, 1983, wholesaler margin is assumed at about 3.5% of ex-mill price.
9/	From Bangkok to Project Area.
	Chachoengsao - BKK 75km, Chonburi - BKK 80 km, Nakon Nayok - BKK 102 km.
	Prachinburi - BKK 127 km, Transportation cost is estimated at 1 Baht/km.
<u>10/</u>	Rice Conversion rate classified by size of rice mills are as follows according to the Rice Trading Report, NESDB, 1983.
	Small size 64.6%, medium size 66.7%, large size 67.2%.
	In this study, the conversion rate of small size is used for 1989, and that of medium size 2000.
11/	7% value of ex-mill price of paddy.
12/	Approximately 7% of paddy output before tax.
<u>13</u> /	Approximately 7% of import price of paddy at mill.
<u>14</u> /	Average distance from project area to mill in Chachoengsao City is assumed at about 50 km.
<u>15</u> /	Conversion factor, 0.87 of transportation is applied.
16/	Conversion factor of business margin is applied on standard conversion factor 0.92.

TABLE I-2-12 PRICE STRUCTURE FOR SOYBEAN

- 1989 Constant Price -

		,		2000	
	Item		Unit	Financial	Economic
1)	W.B. Projection price in 2000 at 1985 constant price (US Soybean, CIF	5			
	Rotterdam)	<u>1/</u> ·	US\$/ton	150	150
2)	Convert to 1989 constant price	<u>2</u> /	22	224	224
3)	C.I.F. Bangkok	<u>3/</u>	**	290	290
4)	Convert to Thai Baht	<u>4/</u>	Baht/ton	7,395	7,395
5)	Business tax	<u>5/</u>	19	370	• –
6)	Port handling charge		"	200	175
7)	Transport cost to oil mill		"	150	130
8)	Importers margin	<u>6/</u>	"	425	390
9)	Wholesale price in Bangkok		"	8,540	8,090
10)	Quantity adjustment		"	7,690	7,280
11)	Transport/handling Chachoengsao to)			
	Bangkok		22	75	60
12)	Marketing costs		"	500	460
13)	Local merchant margin		**	350	320
14)	Farm gate price of soybean		33	6,765	6,440

Note: <u>1/</u>: Commodity price and price projections in 1985 constant Dollars, July 11, 1989, IBRD.

2/: Inflation Indies, IBRD, 1985 = 100, 1989 = 149.55

<u>3/</u>: Flight and insurance charge are assumed.

 $\underline{4/}:$ US\$1.0 = Baht 25.50

5/: Assumed at about 5% of CIF Price.

6/: Assumed at about 5% of wholesale price in BKK.

						1988			1.
	Item			Unit		Financial		Economic	
1)	FOB price, BKK			Baht/to	n	10,317			
2)	Port handling			"		20			
3)	Charges for keeping	<u>1/</u>		"	· ·	98	· ·		
4)	Insurance			"		9			•
5)	Transport port to ship			**	an a	33	· ·	ta di secolo di secol	•
6)	Weighing charge		· .	'n		20	· · ·		
7)	Truck handling	•	:			10	· .	· .	
8)	Exporter margin	<u>2</u> /	· · .	·))		800		era da ta	
9)	Exporter marketing cost	<u>3/</u>		"		420			
10)	Adjustment cost	<u>4/</u>		"		1,050			
11)	Wholesale price, BKK		100 A. A.	**		7,857	:	1. A.	
12)	Transport cost Prachinburi to BKK			» ·		130		:	
13)	Local merchant margin	5/				367	÷.,	÷	
14)	Farm gate price of mungbean			37	· · ·	7,360	•		

TABLE I-2-13 PRICE STRUCTURE FOR MUNGBEAN

Note: 1/:

six months = 182 days 0.067 Baht/bag/day interest (16.5%, six month), margin and profit <u>2/</u>: <u>3/</u>:

selection 20 Baht/bag, weight loss 5%

<u>4/</u>: rejected bean

<u>5/</u>: about 5% of farm gate price

Source: Department of Farm Economy, MOAF, Thailand

TABLE I-2-14 PRICE STRUCTURE FOR MAIZE

- 1988 Constant Price -

			2000							
	Item		Unit	Financial	Economic					
1)	FOB, Bangkok	1/	US\$/ton	142	142					
2)	Convert to Thai Baht	_	Baht/ton	3,620	3,620					
3)	Port handling charge		52	180	150					
4)	Transport port to ship		37	30	25					
5)	Exporter margin		"	210	195					
6)	Export tax		"	180	-					
7)	Wholesale price in Bangkok		**	3,020	3,250					
8)	Transport Prachinburi to Bangkok		**	130	115					
9)	Truck handling cost		**	30	25					
10)	Local merchant margin		**	260	240					
11)	Farm-gate price of maize		"	2,600	2,870					

Note: <u>1/</u> :	W.B. projection price at 19	85 constant price
	1988 77 US\$/ton, 2000	. 73 US\$/ton
	FOB Bangkok at 1988	3,830 Baht/ton = 150 US\$/ton
	" 2000	$150 \times 73/77 = 142 \text{ US}/\text{ton}$

TABLE I-2-15 PRICE STRUCTURE FOR CASSAVA

			19	89
	Item		Financial (Baht/ton)	Economic (Baht/ton)
1)	Pallets, FOB, Bangkok	<u>1/</u>	3,140	3,140
2)	Business tax		55	-
3)	Exporter's cost and margin	2/	140	130
4)	Pellets' delivered godown price		2,945	3,010
5)	Delivering cost to godown		40	35
6)	Pelletizing cost		100	92
7)	Filler cost		30	28
. 8)	Saving on chip requirement		50	45
9)	Pelleter's margin		50	45
10)	Chips, delivered pelletiser		2,675	2,765
11)	Transport		210	185
12)	Chips pre-delivered to pelleter		2,465	2,580
13)	Chippers margin	<u>3/</u>	615	645
14)	Chips after dring		1,850	1,935
15)	Cost of root weight loss (60%)		1,110	1,160
16)	Chipping cost		10	9
17)	Transportation cost farm-gate to chip mill		150	130
18)	Root fresh farm-gate price			
	Chonburi		645	695
	Chachoengsao		570	615
	Prachinburi		560	605
	Average		590	640

Note: 1/ Average price Jan. to Nov. 1989, Office of Agri. Economics

2/ 4.5% of FOB price

3/ 25% of chips pre-delivered to pelleter

I - 19

				19)89	2000		
	Item		Unit	Financial	Economic	Financial	Economi	
1)	FOB, Urea, NW Europe in 1985			· · · · ·				
	constant price	<u>1/</u>	US\$/ton	119	119	130	130	
2)	Convert to 1989 constant	2/	я	178	178	194	194	
3)	Freight (US\$70) & insurance							
	(2% of FOB price)		"	74	74	74	74	
4)	CIF price at Bangkok port		***	252	252	268	268	
5)	Convert to Thai Baht		Baht/ton	6,425	6,425	6,835	6,835	
6)	Commission fee	<u>3</u> /	· · · · ·	15	14	15	14	
7)	Taxes expenses	<u>4</u> /	13	115		125		
8)	Port Expenses	<u>5</u> /		320	295	340	295	
9)	Godown expenses	<u>6/</u>	**	60	55	60	55	
10)	Import/factory price		53	6,935	6,789	7,375	6,999	
1Ì)	Marketing costs and margins	7/	**	1. T.	i e li i i i i i i i i i i i i i i i i i			
	a. Transport costs			170	150	170	150	
	b. Storage costs			90	80	90	80	
	c. Bagging costs		÷	220	200	220	200	
	d. Handling costs			200	185	200	185	
	e. Physical losses			40	35	40	35	
	f. Taxes, levies, cutom duties			110	-	110		
	g. Interest charges			35		35	- -	
	h. Other costs		•	200	185	200	185	
	i. Importers margin			35	30	35	30	
	j. Wholesale margin			180	165	180	165	
	k. Retail margin			245	225	245	225	
	(Sub-total)			(1,525)	(1,255)	(1,525)	(1,255)	
12)	Transport cost from farm to shop		Baht/ton	30	25	30	25	
	Farm-gate price of Urea		. 11	8,490	8,069	8,950	8,280	
	Farm-gate price of nutrient		**	18,455	17,540	19,455	18,000	
	- ·			(N)	(N)	(N)	(N)	

TABLE 1--2-16 PRICE STRUCTURE FOR UREA (N: 46%)

Note : 1/···· Commodity prices and price projections in 1985 constant Dollars, July 11, 1989, IBRD,

2/···· IBRD, Inflation indices, 1985=100, 1989=149.55

3/···· Commission fee is about 0.25% of CIF price. Source is Fertilizer market, Division of Agricultural economic research, Agricultural Statistics Office.

 $4/\cdots$ Income tax and municipal tax. Source is ibid 3/.

5/.... Port fee, Expenses on receiving merchandise, freight on small bout, labor cost for carrying to small boat, labor cost for carrying to godown and survey expenses.

 $6/\cdots$ Godown is average three month usage.

7/···· Marketing Costs and margins are estimated based on Fertilizer advisory, Development and Information Network for Asia and the Pocific, ESCAP/FAO/UNIDO, 1985/86.

TABLE I-2-17 PRICE STRUCTURE FOR DAP (18-46-0) AND POTASSIUM CHLORIDE (K 60)

				AP 189	Potassium Chloride 2000		
1. 1. 1. 1. 1. 	Item	Unit	Financial	Economic	Financial	Economi	
1)	FOB, in 1985 constant	US\$/ton	194	194	75	75	
2)	Convert to 1989 constant	22	290	290	112	112	
3)	Freight (US\$70) & insurance						
	(2% of FOB)	**	76	76	72	72	
4)	CIF price at Bangkok port	22.	366	366	184	184	
5)	Convert to Thai Baht	Baht/ton	9,330	9,330	4,690	4,690	
6).	Commission fee	"	20	18	10	. 18	
7)	Taxes expenses	**	160	-	80	-	
8)	Port Expenses	"	465	427	230	212	
9)	Godown expenses	>>	60	55	60	55	
10)	Import/factory price	>>	10,035	9,830	5,070	4,975	
11)	Marketing costs and margins	33					
	a. Transport costs		170	150	170	150	
	b. Storage costs		90	80	90	80	
	c. Bagging costs		-	-	-	-	
	d. Handling costs		105	100	105	100	
	e. Physical losses		-	-		-	
	f. Taxes, levies, custom duties		105	-	105	-	
	g. Interest charges		20		20	-	
	h. Other costs		130	120	130	120	
	i. Importers margin		60	55	60	55	
	j. Wholesale margin		15	15	15	15	
	k. Retail margin		30	25	30	25	
	(Sub-total)		(725)	(545)	(725)	(545)	
12)	Transport cost from farm to shop	Baht/ton	30	25	30	25	
13)	Farm-gate price of blend	>>	10,790	10,400	5,795	5,550	
14)	Farm-gate price of nutrient	**	15,850	15,570	9,660	9,240	
			(P)	(P)	(K)	(K)	

•

	<u>(Tr</u>	ansplanting)		0	Broadcasting)	
Crop	Paddy	y (wet) w/o Pro	ject	Pade	ly (wet) w/o Proj	iect
Item	Quantity	Price	Value	Quantity	Price	Value
1. GPV	(ton/ha) 2.364	(Baht/t) 3,255	(Baht) 7,695	(ton/ha) 2.364	(Baht/t) 3,255	(Baht 7,695
2. Cost						
- Seed	50 k	3,900	195	84 k	3,900	328
- Fertilizer	00 K	0,000	100	U-1 K	0,000	020
Urea	4.8 k	8,280	40	1.5 k	8,280	12
DAP	1.0 A	0,200	10		0,200	14
16-20-0	114 k	6,000	684	140	6,000	840
12-24-12	4 777 77	6,420			-,	
15-15-15	0.04 k	6,420	1	1.2	6,420	8
20-20-0	0.4 k	6,720	3	5.3	6,720	36
Dung						
Lime		264		·		
- Agro-chemical						
Pesticide			12			3
Herbicide			7.4			27
- Machine	(32.22 hr)	Baht/hr		(8.85 hr)	Baht/hr	
Hire (Small)	2.5 hr	72	180	$0.56\mathrm{hr}$	119	67
Hire (Large)	0.75	199	149	3.19	227	724
Own (Small)	28.8	24	691	4.63	24	111
Own (Large)	0.17	55	9	0.47	220	103
- Oil					et al de la composition de la compositi	
Gasoline	42 l	4.2 Baht/ℓ	176	3.1 ℓ	4.2 Baht/ℓ	13
Lubricant	1 ℓ	21	21	0.14 <i>E</i>	21	3
- Labor	46.6 day	48Baht/day	2,237	22.9 day	48 Baht/day	1,099
Hire	(16.3)			(7.2)		
Family	(25.0)			(11.8)		
Total Cost		(64%)	4,405			3,374
3. NPV			3,290			4,321

TABLE I-2-18 CROP BUDGET PER HA IN ECONOMIC PRICE

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				(Tra	insplanting)	•	(Broadcasting)				
· .		Crop		Paddy	(wet) with Pr	oject	Padd	y (Dry) with Pr	oject		
·	,	Item		Quantity	Price	Value	Quantity	Price	Value		
1.	GPV	7		(t/ha) 4.0	(Baht/t) 3,255	(Baht) 13,020	(t/ha) 4.5	(Baht/t) 3,255	(Baht) 14,648		
2.	Cost	t .									
		Seed		63 k	3,900	246	94 k	3,900	367		
	- 1	Fertilizer									
		Urea		63 k	8,280	522	63 k	8,280	522		
		DAP									
		16-20-		280 k	6,000	1,680	280 k	6,000	1,680		
		12-24-									
		15-15-	10								
		Dung Lime		1.26 t	264	333	1.26 t	264	333		
		TUILE		1.20 t	204	000	1.206	204	000		
	_	Agro-cher	nical	2 times			2 times				
·		Pestic				24		· .	6		
		Herbi				15			55		
		Machine		98.3 hr	Baht/hr		25 hr	Baht/hr			
	. •	Hire	(Small)	7.6	72	547	1.6	72	115		
		Hire	(Large)	2.3	199	458	9.0	199	1,791		
÷ .		Own	(Small)	87.9	24	2,110	13.0	24	314		
		Own	(Large)	0.5	55	28	1.3	55	72		
	- 1	Oil									
		Gasoli Lubric						·			
		Labor		70 day 🖓	48Baht/day	3.360	60 day	48Baht/day	2,880		
		Hire		(Socia a	gro economy		-	-	-		
		Famil	У	(50010 - a	gro economy	survey, sam	this min mg	nicyteta)			
				•				(56%)			
	:	Total Cost	5		(72 %)	9,323			8,135		
3.	NPV	7				3,697			6,513		

			(B)	roadcasting)					
•	Сгор		Paddy	(wet) with Pr	oject	Maize (wet) with Project			
	Item		Quantity	Price	Value	Quantity	Price	Value	
			(t/ha)	(Baht/t)	(Baht)	(t/ha)	(Baht/t)	(Baht)	
1. (GPV		4.0	3,255	13,020	1.6	2,870	4,592	
2. (Cost								
	- Seed		94 k	3,900	367	21 k	8,710	183	
_	- Fertilizer			0,000			0,110	100	
	Urea		63 k	8,280	522	30 k	8,280	248	
	DAP	:					-,		
	16-20-0)	280 k	6,000	1,680				
	12-24-1	12							
	15-15-1	15				70 k	6,420	449	
	Dung						· · ·		
	Lime		1.26 t	264	333	1 t	264	264	
			<u></u>						
-	Agro-chem		2 times						
	Pestici				6			405	
	Herbic	aae			55			125	
-	Machine	· ·	25 hr	Baht/hr		hr	·		
	Hire	(Small)	1.6	72	115	5.0	52	260	
	Hire	(Large)	9.0	199	1,791	7.0	137	959	
	Own	(Small)	13.1	24	314	7.0	24	168	
	Own	(Large)	1.3	55	72	1			
-	• Oil								
	Gasoli					6.3 <i>l</i>	4.2	26	
	Lubric	ant							
-	- Labor		60 day	48Baht/day	2,880	30 day	48	1,440	
	Hire		•		•	*			
	Family	,	· · ·	··· .	· · ·	·			
	Total Cost				8,135			4,122	
3. I	NPV				4,885			470	

Crop		Soybe	an with Proj	ect	Mungbean with Project			
Item		Quantity	Price	Value	Quantity	Price	Value	
	1	(t/ha)	(Baht/t)	(Baht)	(t/ha)	(Baht/t)	(Baht	
1. GPV		1.857	6,440	12,075	1.125	7,360	8,280	
2. Cost		n de la composition de la comp						
- Seed	· · ·	44 k	4,800	211	50 k	4,800	240	
- Fertilizer	н ·							
Urea			, · ·					
DAP								
16-20	-0							
12-24	-12	156 k	7,730	1,205	156 k	7,730	1,205	
15-15	-15							
Dung								
Lime		1.26 t	264	333	1.26 t	264	333	
- Agro-che	mical							
Pestic	eide							
Herbi	cide							
- Machine		49 hr			40 hr			
Hire	(Small)	(30%) 15	52	780	(30%) 12	52	624	
Hire	(Large)	(35%) 17	137	2,329	(35%) 14	137	1,918	
Own	(Small)	(35%) 17	24	408	(35%) 14	24	336	
- Oil								
Gasol	ine	6 l	4.2	24	5 l	4.2	21	
Lubri	cant					·		
- Labor		56 day	48	2,688	53 day	48	2,544	
Hire								
Fami	ly							
Total Cos	t		(66 %)	7,978		(87 %)	7,221	
B. NPV				4,097			1,059	

Сгор	Ground	lnuts with P	roject	Cassava with Project			
Item	Quantity	Price	Value	Quantity	Price	Value	
·····	(t/ha)	(Baht/t)	(Baht)	(t/ha)	(Baht/t)	(Baht)	
. GPV	1.857	5,000	9,375	13.0	640	8,320	
. Cost	· .	· ·		priece	(Baht)		
- Seed	75 k	4,800	360	8,500	0.042	357	
- Fertilizer	14 14	алан 1					
Urea				· · · · ·	· .		
DAP					n an an Angel Angel		
16-20-0							
12-24-12	156 k	7,730	1,205	. ta a second	· .		
15-15-15							
Dung				1	¹		
Lime	1.26 t	264	333	· .			
- Agro-chemical					· 1		
Pesticide						12	
Herbicide					2	100	
- Machine	32 hr			8.5 hr	• •		
Hire (Small)	(30%) 10	52	520	3.0	195	585	
Hire (Large)	(35%) 11	137	1,507	4.4	260	1,144	
Own (Small)	(35%) 11	24	264	1.1	24	26	
			(Animal)	1.3 day	90	117	
- Oil					·		
Gasoline	5 l	4.2	21	3.1 l	4.2	13	
Lubricant				2 l	21	42	
- Labor	70 day	48	3,360	62.8 day	48	3,014	
Hire				(38)	· · ·		
Family				(23.8)	·.		
Total Cost		(81 %)	7,570		(65 %)	5,410	
3. NPV		-	1,805			2,910	

Note : Yield for Cassava is average of those in 8 Irrigation Blochs.

Crop	Man	go w/o Proje	ect	Mang	o with Proj	Project	
Item	Quantity	Price	Value	Quantity	Price	Value	
	(t/ha) (6 Year)	(Baht/t)	(Baht)	(t/ha)	(Baht/t)	(Baht)	
1. GPV	3,132	5,900	18,480	12.42	5,900	73,280	
2. Cost	plants				-,		
- Seed	180 k	· ·					
- Fertilizer			. •		•		
Urea		•		139 k	8,280	1,150	
DAP	280 k	10,400	2,912		,		
16-20-0							
12-24-12							
15-15-15	156 k	6,420	1,002				
Dung			280	2.78 t	1,800	5,004	
Lime				1.26 t	264	333	
- Field ridge					* e	2,000 to	
						2,400	
- Agro-chemical						-,	
Pesticide			4,500			6,000	
Herbicide	(88.9 hr)		-,	(100 hr)		-,	
	4.7 hr	19		5 hr	20		
- Machine	2.8 hr	84		$5\mathrm{hr}$	85		
Hire (Smal		24	90	90 hr	25	100	
Hire (Large			235			425	
Own (Small			1,954			2,250	
0	″ 37.5ℓ	4.2	-,			7,000	
- Oil	1.6 ℓ	21				1,000	
Gasoline	-100		158				
Lubricant	56.3 day	48	34	(100 day)	48		
Hubricano	(37)		01	(100 44)	10		
- Labor	(19.3)		2,702			4,800	
Hire	(10:0)		2,100			1,000	
Family							
I annry						(29,062)	
Total Cost		-	13,867			(29,002)	
I vial VUSI	•		10,007			(48,410Z	
3. NPV			12,019			(44,218)	
0. 1VF ¥			=12,019 = 12,020			43,818	
			14,040				
 						(44,220) =43,820	

Note: Yield w/o Project is based on Secio - Agro Economic Survey

NPV 43,820 Baht... new orchard from forest land

44,220 Baht ... new orchard from paddy field

46,220 Baht ... existing orchard

Thomas	Quantity	Price	Value	Quantity	Price	Value
Item GPV	(t/ha) 9.3	(Baht/t) 4,000	(Baht) 37,200	(t/ha) 0.625	(Baht/t) 20,000 with shell	(Baht) 12,500
Cost	•		:		W1011 911011	· ·
- Seed	25 k	40	1,000	19 k	30	570
- Fertilizer						1.
Urea	31 k	8,280	257	31 k	8,280	257
DAP	€ [†]	•				-
16-20-0						
12-24-12			_			
15-15-15	220 k	6,420	1,412	220 k	6,420	1,412
Dung	10 t	-		10 t	-	
Lime	1.26 t	264	333	1.26 t	264	333
- Agro-chemical			750			560
Pesticide			190	1	· .	000
Herbicide		·			. **	
	-					
- Machine						
Hire (Small)						
Hire (Large)						
Own (Small)	$15\mathrm{hr}$	24	360	15 hr	24	360
- Oil						
Gasoline Lubricant					· ·	
Dubi leant						
- Labor	51.3 day	48	2,462	56.8 day	48	2,726
Hire			·- , ·			- , ,
Family	-			-		
	. *					
		(18%)	6,574		(78%)	6,218
Total Cost						10
Total Cost			30,626			• `

(Crop	S	weet Corn			Chilli	
a de la composición de	tem	Quantity	Price	Value	Quantity	Price	Value
		(t/ha)	(Baht/t)	(Baht)	(t/ha)	(Baht/t)	(Baht)
1. GPV		6.0	2,500	15,000	3.0	4,500	13,500
0 Cont							• • •
2. Cost - Seed		19 k	30	570	0.6 t	200	120
	lizer	13 K	50	510	0.01	200	140
	Jrea				31 k	8,280	257
)AP				01 A	0,200	201
	6-20-0						
	2-24-12		i.				
	5-15-15	315 k	6,420	2,022	220 k	6,420	1,412
	Dung	10 t	_ ·	,	10 t		-,
	ime	1.26 t	264	333	1.26 t	264	333
	* 1 •	۰.					
· F	-chemical Pesticide Ierbicide			560			560
			•				
- Mach							
	Hire (Small)						
	Hire (Large)						
)wn (Small)	18 hr	24	432	15 hr	24	360
	fasoline Lubricant						
 Th	· .	40 4 1		1 090	00.1.1.	40	0.0.13
- Labo	er Hire	40.4 day	48	1,939	82.1 day	48	3,941
	amily						
г	anny						
Total	l Cost		(39%)	5,856		(52 %)	6,983
3. NPV		· ;		9,144			6,517

1-29

				······································			
	Item	Quantity	Price	Value	Quantity	Price	Value
		(t/ha)	(Baht/t)	(Baht)	(t/ha)	(Baht/t)	(Baht)
1.	GPV	12.0	2,000	24,000	12.0	1,500	18,000
			1. A. A.				
2.	Cost			· · · · · ·			
	- Seed	0.3 k	1,500	450	3.2 k	110	325
	- Fertilizer		.*			· ·	
	Urea				31 k	8,280	257
	DAP	1					
• .	16-20-0						
	12-24-12		·				
	15-15-15	220 k	6,420	1,412	220 k	6,420	1,412
	Dung	10 t	· -	_	10 t	,	
	Lime	1.26 t	264	333	1.26 t	264	333
		•			• • • •		
	- Agro-chemical			560			750
	Pesticide	92 -		·			
	Herbicide						
	- Machine						
	Hire (Small)						
	Hire (Large)						
	Own (Small)	19 hr	24	456	$25\mathrm{hr}$	24	600
	- Oil	• •		· .		·	
	- Off Gasoline						
	Lubricant					· · · ·	
	LUDITCAIL						
	- Labor	60 day	48	2,880	57.4 day	48	2,755
	Hire				···		-,
	Family						· .
	Total Cost		(25 %)	6,091		(36 %)	6,459
3.	NPV			17,909			11,541

TABLE I-2-19 GROWING MODEL FOR VEGETABLE WITH THE PROJECT

(1) Sequntaial cropping system on three plots per hectrare of arable land.

Actual planting acreage

Plot 1	:	$1.0 \mathrm{ha} imes 0.4 = 0.4 \mathrm{ha}$	Green bean - baby corn
Plot 2	:	$1.0 \text{ ha} \times 0.3 = 0.3 \text{ ha}$	Sweet corn - Chilli
Plot 3	:	$1.0 \text{ ha} \times 0.3 = 0.3 \text{ ha}$	Tomato - Chinese Cabbay

(2) N.P.V per ha. with Project 28,300 Baht

Plot 1	Green bean	30,626	Baht/ha	$\times 0.4$ ha =	12,250	Baht
11	Baby corn	6,282	11	\times 0.4 ha =	2,513	
Plot 2	Sweet corn	9,144	. 4	$\times 0.3$ ha =	2,743	
11	Chilli	6,517	11	\times 0.3 ha =	1,955	
Plot 3	Tomato	17,909	"	\times 0.3 ha =	5,373	
11	Chinese cabbage	11,541	11	\times 0.3 ha =	3,462	
	Total			·	28,296	T
					<u>28,300</u>	

(3) N.P.V per ha with Project

		<u>Per Ha</u>			
Стор	GPV/wp+1.2	<u>P.C</u>	<u>NPV</u>	<u>Area</u>	NPV
	Baht	Baht	Baht	ha	Baht
Green bean	31,000	6,574	24,426	0.4	9,770
Baby corn	10,420	6,282	4,138	0.4	1,655
Sweet corn	15,500	5,856	6,644	0.3	1,993
Chilli	11,250	6,983	4,267	0.3	1,280
Tomato	20,000	6,091	13,909	0.3	4,173
Chinese Cabbage	15,000	6,459	8,541	0.3	2,562
Total				2.0	21,433
					= <u>21,400</u>

TABLE I-2-20 ALTERNATIVE DEVELOPMENT PLAN-1

(Unit) million Baht Incremental 10.78 15.18 36.79 32.78 5.82 9.75 8.43 100.95 1.03 149.47 50.37 (105.72)243.38 (542.15)VUN <u>.</u> Increment 0.564 6.513 1.059 1.805 30.504 0.4074.097 (-) 3.833 0.47 28.3 0.0 28.3 N.P.V per ha 1,000 Baht Incremental NPV 15.716 d o/m 3.290 3.833 4.321 21.46.513 1.805 3.697 4.885 0.4701.05946.2204,097 w. p 28.328.3 28.3 1 (53, 400)(8,600) 2,2007,300 5,500 26,480 2,2001,300 8,000 5,4004,900 2,000 8,600 26,920 15,500 Cropped Area (ha) (Exist) Total (New) (T.P) (C) B ŀ <u>-</u> Θ Irrigation Block LBP Grund nuts Wets. Total Mungbeea Dry. Total Vegetable Vegetable Crop Soybean Cassava Orchard Cassava Paddy Maize Paddy Season Wet Dry

648

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647.87

Grand Total

Irrigation Block KTL

Irrigati	Irrigation Block KTL	0		Increm	Incremental NPV			(Unit) million Baht	•
		Croppe	Cropped Area	N.P.V	per ha 1,000 Baht	0 Baht	Incremental		
Season	Crop	(p	a)	w.p	d o/m	Increment	NPV		
	Dodder	(T.P)	2,040	3.697	1.952	1.745	3.56		·
	rauuy	(B.C)	1,260	4.885	2.983	1.902	2.40		
		Total	(3,300)						
	Maize		1,700	0.470	3	0.47	0.80		
Wet	Cassava	(-)	1,700	1	4.338	(-) 4.338	7.37		·
		(Exist)							
	Vegetable	(New)	1	-					
	Wets. Total						(-) (0.61)		
	Paddy	(B.C)	1,200	6.513	2	6.513	7.82		
	Soybean		1,600	4.097		4.097	6.56		
	Mungbeea		600	1.059		1.059	0.64		
	Grund nuts		500	1.805		1.805	06.0		
Dry	Orchard		2,000	43.820	1	43.820	87.64		
•	AIMIN U			-					
	Cassava	(-)	1,600						
	Vegetable		'		- - - -				
	Dry. Total						(103.56)		
ଞ	Grand Total						102.95	= 103	

Irrigation Block MNN (4)

Incremental NPV

Irrigati	Irrigation Block MNN	Ð		Increm	Incremental NPV		- - - -	(Unit) million Baht	-
		Cropp	Cropped Area	N.P.V	per ha 1,000 Baht) Baht	Incremental		
Season	Crop		(ha)	w.p	w/o p	Increment	NPV		
	Do. 4.4	(T.P)	34,850	3.697	2.968	0.729	25.41		
	rauuy	(B.C)	41,550	4.885	3.999	0.886	36.81		• • •
		Total	76,400						
	Maize		1						
Wet	Cassava								
		(Exist)	ł						
	Vegetable	(New)	ı						· · .
	Wets. Total						(62.22)		
	Paddy	(B.C)	15,000	6.513		6.513	97.70		
	Soybean		-			-			·.
	Mungbeea		•						
	Grund nuts		-						
Ŋrv			•						
	Orcnard								
• • •	Vegetable		'						
									•
	Dry. Total	· .	-				(97.70)		
ຮັ	Grand Total						159.92	= 160	

Irrigation Block UBP

6

Incremental NPV

.

(Unit) million Baht

)					-	(Unit) million Bant
		Crop	Cropped Area	N.P.V	per ha 1,000 Baht	0 Baht	Incremental	
Season	Crop		(ha)	w.p	w/o p	Increment	NPV	
	Dodd	(T.P)	55,390	3.697	1.363	2.334	129.28	
	r auuy	(B.C)	59,710	4.885	2.394	2.491	148.74	
		Total	(115,100)					
	Maize							
Wet	Cassava		1					
		(Exist)	8,500	28.3	21.4	6.9	58.65	
	Vegetable	(New)	4,500	28.3	5	28.3	127.35	
			(13,000)					
	Wets. Total					· · ·	(464.02)	
	Paddy	(B.C)	26,300	6.513	-	6.513	171.29	
	Soybean		23,500	4.097	8	4.097	96.28	
	Mungbeea		8,800	1.059	•	1.059	9.32	
	Grund nuts		8,800	1.805		1.805	15.88	
Drv			8,800	46.220	18.908	27.312	240.35	
	Urcnard							
	Vegetable		13,000	28.3		28.3	367.9	
	Dry. Total			-			(901.02)	
ß	Grand Total						1,365.04	= 1,365

	-			pir-mi-ma						· .		·							 	
(Unit) million Baht																				
(Unit)																			×	= 96
	Incremental	NPV	27.51	14.62		0.33	(-) 1.74	3.45		(44.17)	10.42	22.53	1.59	2.71				14.15	(51.40)	95.57
~	0 Baht	Increment	2.666	2.823		0.470	(-) 2.479	6.9			6.513	4.097	1.059	1.805				28.3		
Incremental NPV	per ha 1,000 Baht	d o/m	1.031	2.062		3	2.479	21.4				1		•						
Increm	N.P.V	w.p	3.697	4.885		0.470	-	28.3			6.513	4.097	1.059	1.805				28.3		
Ð	Cropped Area	(ha)	(T.P) 10,320	(B.C) 5,180	Total (15,500)	200) 700	(Exist) 500	(New) -		(B.C) 1,600	5,500	1,500	1,500) 600	500		
Irrigation Block MPP		Crop		r auuy (B.	Ţ	Maize	Cassava (-)	E)	Vegetable (N	Wets. Total	Paddy (B.	Soybean	Mungbeea	Grund nuts		Urcnard	Cassava (-)	Vegetable	Dry. Total	Grand Total
Irrigatio		Season					Wet							·	 Drv	 }		1		Grs

(Unit) million Baht

46.55 14.151.60 8.92 VIN Ĵ Increment 2.155 0.470 2.623 28.3 per ha 1,000 Baht Incremental NPV d o/m 1.5422.623 N.P.V 0.4703.697 w.p 28.3 ı (21,600)3,400 3,400 21,600500 Cropped Area (ha) (Exist) Total (New) 6 (\mathbf{T},\mathbf{P}) --Irrigation Block | MHN Vegetable Crop Cassava Paddy Maize Season Wet

Incremental (53.38)13.68 43.84 128.2414.15 1.80 3.07 4.47 <u>.</u> 6.513 1.0591.805 44.224.097 (-) 1.54228.3 1.5426.513 1.059 1.8054.097 44.22 28.3 1,700 10,700 1,700 2,900 3,100 500 2,90021,600 ŀ <u>·</u> Paddy (wet) Wets. Total Grund nuts Mungbeea Vegetable Cassava Soybean Orchard Paddy

254

H

253.69

(200.31)

Dry. Total

Dry

Grand Total

Irrigati	Irrigation Block KPS	Ø		Incren	Incremental NPV			(Unit) million Baht
		Cropi	Cropped Area	N.P.V	per ha	1,000 Baht	Incremental	
Season	Crop		(ha)	w. p	d o/m	Increment	NPV	
		(T.P)	15,430	3.697	2.603	1.094	16.88	
	Anna 1	(B.C)	6,270	4.885	3.634	1.251	7.84	
		Total	(21, 700)					
- 	Maize		3,800	0.470	1	0.470	1.79	
Wet	Cassava	(-)	3,800		2.653	2.623	(-) 10.08	
		(Exist)	1,800	28.3	21.4	6.9	12.42	
	Vegetable	(New)	600	28.3	1	28.3	16.98	
			(2,400)					
	Wets. Total						(45.83)	
	Paddy	(B.C)	2,200	6.513		6.513	14.33	
	Soybean		8,000	4.097		4.097	32.78	
	Mungbeea		3,200	1.059		1.059	3.39	
	Grund nuts		3,200	1.805		1.805	5.78	
Arri()	, - -		1,600	44.22		44.22	70.75	
	Orchard		500	46.22	12,020	34.20	17.10	
	Cassava	(-)	3,500					
· ·	Vegetable		2;400	28.3	-	28.3	67.92	
	Paddy (wet)	(-)	1,600		2.603	(-) 2.603	(-) 4.16	
	Dry. Total						(207.89)	
ଓ	Grand Total						253.72	= 254

Irrigati	Irrigation Block UPP	<i>∞</i> 1		Incren	Incremental NPV			(Unit) million Baht
		Crop	Cropped Area	N.P.V	per ha 1,000 Baht) Baht	Incremental	
Season	Crop		(ha)	w.p	d o/w	Increment	NPV	
	Dadaw	(T.P)	26,410	3.697	1.617	2.080	54.93	
	rauuy	(B.C)	6,190	4.885	2.648	2.237	13.85	
		Total	(32,600)					
	Maize		4,600	0.470		0.470	2.16	
Wet	Cassava	(-)	4,600	3	2.472	2.472	(-) 11.37	
		(Exist)	500	28.3	21.4	6.9	3.45	
	vegetable	(New)	1,200	28.3	•	28.3	33.96	
	Paddy	(-)	1,200		1.617	(-) 1.617	(-) 1.94	
	Wets. Total						(95.04)	
Vince of	Paddy	(B.C)	3,300	6.513	-	6.513	21.49	
	Soybean		12,700	4.097		4.097	52.03	
	Mungbeea	-	3,700	1.059	8	1.059	3.92	
	Grund nuts		3,900	1.805		1.805	7.04	
Drv			3,500	44.200	2	44.200	154.70	
• •	Urcnard							
	Cassava	(-)	4,200					
	Vegetable		3,000	28.3	1	28.3	84.90	
_	Paddy	(-)	4,70		1.617		(-) 7.60	
	Dry. Total						(316.48)	
G	Grand Total				-		411.52	= 412

TABLE I-2-21 ALTERNATIVE DEVELOPMENT PLAN-2

Incremental 10.78 8.43 32.78 15.18 1.03 50.37 36.79 62.52 5.829.75 164.0 (105.72)243,38 NPV (518.25)3 (-) 3.833 Increment 1.059 0.407 6.513 1.805 0.564 4.097 33.467 0.47 6.9 28.3 28.3 N.P.V per ha 1,000 Baht Incremental NPV 12.753 ₫ o/m 3.833 3.2904.32121.4 4.885 6.513 1.805 3.697 1.059 0.470 4.097 46.220 w.p 28.3 28.3 28.3 (8,600)(53, 400)2,2002,200 7,300 9,600 5,500 8,000 5,400 4,900 26,920 1,300 2,000 8,600 Cropped Area 26,480(ha) (Exist) Total (New) (T.P) (B.C) (B.C) <u>.</u> <u>.</u> Θ Irrigation Block LBP Grund nuts Wets. Total Vegetable Mungbeea Dry. Total Vegetable Crop Soybean Orchard. Cassava Cassava Paddy Paddy Maize Season Wet Dry

624

II

623.9

Grand Total

(Unit) million Baht

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Irrigati	Irrigation Block KTL	8		Increm	Incremental NPV			(Unit) million Baht
		Cropped Area	Area	N.P.V	per ha 1,000 Baht) Baht	Incremental	
Season	Crop	(ha)		w.p	w/o p	Increment	NPV	
	Dodd	(T.P) 2	2,040	3.697	1.952	1.745	3.56	
	r auuy	(B.C) 1	1,260	4.885	2.983	1.902	2.40	
		Total (3	(3,300)		- - - - - - 			
-	Maize		1,700	0.470		0.47	0.80	
Wet	Cassava	I (-)	1,700		4.338	(-) 4.338	7.37	
		(Exist)						
	Vegetable	(New)						
			,					
	Wets. Total						(-) (0.61)	
	Paddy	(B.C)	700	6.513	1	6.513	4.56	
	Soybean		1,600	4.097	1	4.097	6.56	
	Mungbeea		600	1.059		1.059	0.64	
	Grund nuts		500	1.805		1.805	06.0	
Drv	-	5	2,000	43.820		43.820	87.64	
ŝ	Urcnara							
	Cassava	1 (-)	1,600					
	Vegetable		1					Soutor Annue
	Dry. Total						(100.3)	
ତ	Grand Total						99.69	= 100

I-41

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Irrigation Block MNN

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Incremental NPV

(Unit) million Baht

																				ľ
Incremental	NPV	25.41	36.81						(62.22)	74.90									(74.90)	
) Baht	Increment	0.729	0.886							6.513										
per ha 1,000 Baht	d o/m	2.968	3.999							2 2										
N.P.V	w.p	3.697	4.885							6.513										
Cropped Area	(ha)	34,850) 41,550	1 76,400			st) -	- (1		11,500	I			•						
Č –		(T.P)	(B.C)	Total			(Exist)	(New)		(B.C)								- -		
	Crop	FE - CL	rauuy		Maize	Cassava		Vegetable	Wets. Total	Paddy	Soybean	Mungbeea	Grund nuts	-	Urcnara		Vegetable		Dry. Total	
	Season					Wet								U.v.	ì		,		L	

rrigatio	Irrigation Block UBP	(()		Increm	Incremental NPV	7		(IInit) million Raht
		_	····					
		Crop	Cropped Area	N.P.V	per ha 1,000 Baht	0 Baht	Incremental	· · ·
Season	Crop		(ha)	w p	d o/m	Increment	NPV	
		(T.P)	55,390	3.697	1.363	2.334	129.28	
	raddy	(B.C)	59,710	4.885	2.394	2.491	148.74	
		Total	(115,100)					
	Maize		1					
Wet	Cassava		,					
		(Exist)	8,500	28.3	21.4	6.9	58.65	
	Vegetable	(New)	4,500	28.3	н До	28.3	127.35	
			(13,000)					
	Wets. Total			-			(464.02)	
	Paddy	(B.C)	16,400	6.513		6.513	171.29	
	Soybean		23,500	4.097	1	4.097	96.28	
	Mungbeea		8,800	1.059	ł	1.059	9.32	
	Grund nuts		8,800	1.805	1	1.805	15.88	
D.v.			8,800	46.220	18.908	27.312	240.35	
 7	Urchard						 	
	Vegetable		13,000	28.3	1	28.3	367.9	
I								
	Dry. Total						(836.54)	
5	Canad Tratel			-				

6 Irrigation Block MPP

on Baht																							
(Unit) million Baht																						= 85	
	Incremental	NPV	27.51	14.62		0.33	(-) 1.74	3.45			(44.17)		22.53	1.59	2.71				14.15		(40.98)	85.15	
7	0 Baht	Increment	2.666	2.823		0.470	(-) 2.479	6.9					4.097	1.059	1.805				28.3				
Incremental NPV	per ha 1,000 Baht	d o/m	1.031	2.062			2.479	21.4						*									-
Increm	N.P.V	w.p	3.697	4.885		0.470		28.3					4.097	1.059	1.805				28.3				
9	Cropped Area	(ha)	(T.P) 10,320	(B.C) 5,180	Total (15,500)	700	002 (-)	(Exist) 500	(New) -			(B.C) -	5,500	1,500	1,500	-		(-) 600	500				
Irrigation Block MPP		Crop		raduy		Maize	Cassava ()	Vegetable C		Wets. Total	Paddy 0	Soybean	Mungbeea	Grund nuts		Urchard	Cassava (Vegetable		Dry. Total	Grand Total	
Irrigatio		Season				l	Wet	L		· · · · · ·				L	L	L L L	, ,		.	L		Gre	

6 Irrigation Block MHN

Incremental NPV

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(IInit) million Raht

	0) 			A TAT TRATTATION TAT A			(Unit) million Baht
Crop (ha) w,p mcment NPV NPV Paddy (E.C) -<			Crop	ped Area	N.P.V	per ha 1,00	0 Baht	Incremental	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Season	Crop		(ha)	w.p	w/o p	Increment	NPV	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		Dodder	(T.P)	21,600	3.697	1.542	2.155	46.55	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		r auuy	(B.C)	ľ	3	£ - 1			
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$			Total	(21,600)					
		Maize		3,400	0.470	1	0.470	1.60	
	Wet	Cassava	(-)	3,400	E	2.623	2.623		
Vegetable (New) 500 28.3 - 28.3 14.15 1 Wets. Total Wets. Total (Sew) 500 28.3 (Sew)			(Exist)						
		Vegetable	(New)	500	28.3		28.3	14.15	
		Wets. Total						(53.38)	
		Paddy	(B.C)	1					
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		Soybean		10,700	4.097		4.097	43.84	
Grund nuts1,7001.805-1.805 3.07 3.07 Orchard2,90044.220-44.220 128.24 128.24 Orchard-3,100-44.220 128.24 128.24 Cassava(-)3,100-28.3 14.15 128.24 Vegetable 500 28.3 - 28.3 14.15 114.15 Paddy (wet)(-) $2,900$ - 1.542 $(-)$ 4.47 Dry. Total- 1.542 $(-)$ $1.66.63)$ 128.01 128.01		Mungbeea		1,700	1.059		1.059	1.80	
		Grund nuts		1,700	1.805	1	1.805	3.07	
Orcnard Orcnard Orcnard Cassava $(-)$ $3,100$ 28.3 14.15 Cassava $(-)$ $3,100$ 28.3 14.15 Vegetable 500 28.3 $ 28.3$ 14.15 Paddy (wet) $(-)$ $2,900$ $ 1.542$ $(-)$ 4.47 Dry. Total $ 1.542$ $(-)$ $1.6.63$ $-$ Grand Total $ 240.01$ $ 240.01$ $-$	Drv			2,900	44.220		44.220	128.24	
	; ;	Urchard							
le		Cassava	(-)	3,100		*.			
vet) (-) 2,900 - 1.542 (-) 1.47 tal (186.63) (186.63) (186.63) (186.63) (186.63)		Vegetable		500	28.3		28.3	14.15	
tal (186.63) (186.63) 240.01 =		Paddy (wet)	(-)	2,900		1.542	(-) 1.542		
240.01		Dry. Total						(186.63)	
	යි	rand Total				•		240.01	

(Unit) million Baht Incremental NPV 16.88 10.08 12.42 16.98 (45.83)32.78 1.79 7.84 3 Increment 1.094 4.097 0.470 2.623 1.251 28.3 6.9 N.P.V per ha 1,000 Baht Incremental NPV d 0/m 2.6033.634 2.653 21.43.697 4.885 0.4704.097 w.p 28.3 28.3(2,400)3,800 1,800 15,4306,270(21, 700)3,800 600 8,000 Cropped Area (ha) (Exist) Total (New) \odot (J.F) (B.C) (B.C) <u>·</u> Irrigation Block KPS Wets. Total Vegetable Crop Soybean Cassava Paddy Paddy Maize

Season

239

H

239.39

67.92

4.16

(-) 2.603

2.603

28.3

28.3

2,400

1,600

<u>.</u>

Paddy (wet)

Vegetable

Dry. Total

Grand Total

3,500

Cassava

Orchard

Dry

(193.56)

5.78

3.39

1.059 1.805 70.75

44.22 34.20

1.805 1.059

> 3,200 1,600

Grund nuts

Mungbeea

3,200

44.22 46.22

12.020

500

17.10

I-46

Wet

UPP
Block
ation

∞ ['		Increm		V		(Unit) million Baht	-1-2
ped (ha)	Cropped Area	w. p	per na 1,000 Bant w/o p Incre	JU Bant Increment	Incremental NPV		
2	26,410	3.697	1.617	2.080	54.93		•
:	6,190	4.885	2.648	2.237	13.85		P*********
ල	(32,600)						1
	4,600	0.470	I	0.470	2.16		
	4,600		2.472	2.472	(-) 11.37		
	500	28.3	21.4	6.9	3.45		
	1,200	28.3	1	28.3	33.96		******
	1,200		1.617	(-) 1.617	(-) 1.94		
					(95.04)		
	12,700	4.097	3	4.097	52.03		
	3,700	1.059		1.059	3.92		
	3,900	1.805	1	1.805	7.04		
	3,500	44.200	1	44.200	154.70		r
	4,200						
	3,000	28.3	Ľ	28.3	84.90		
	4,70		1.617		(-) 7.60		
					(294.99)		
					300.03	300	-

TABLE I-2-22 ALTERNATIVE DEVELOPMENT PLAN-3

Cropped Area N.P.V per ha 1,000 Baht
(ha) w. p
(T.P) 26,480 3.697
(B.C) 26,920 4.885
Total (53,400)
2,200 0.470
(-) 2,200 -
(Exist) 7,300 28.3
(New) 1,300 28.3
(8,600)
(B.C)
8,000 4.097
5,500 1.059
5,400 1.805
4,900 46.220
(-) 2,000
8,600 28.3

Irrigation Block | KTL | 2

Incremental NPV

•

N.P.V per ha 1,000 Baht r. p w/o p Increment .697 1.952 1.745 .697 1.952 1.745 .697 1.952 1.745 .697 1.952 1.745 .697 1.952 1.745 .470 - 0.47 .470 - 0.47 .470 - 4.338 .470 - 0.47 .513 - 4.338 .513 - 4.097 .513 - 4.097 .059 - 4.097 .513 - 4.097 .513 - 4.097 .513 - 4.097 .513 - 4.097 .513 - 4.097 .805 - 4.097 .820 - 43.820
--

Irrigation Block MNN

Incremental NPV

Irrigatic	Irrigation Block MNN	4	Increm	Incremental NPV	L		(Unit) million Baht
		Cropped Area	N.P.V	per ha 1,000 Baht	0 Baht	Incremental	
Season	Crop	(ha)	w.p	w/o p	Increment	NPV	
	Dodder	(T.P) 34,850	3.697	2.968	0.729	25.41	
	r auuy	(B.C) 41,550	4.885	3.999	0.886	36.81	
		Total 76,400					
1	Maize	1					
Wet	Cassava	1	-				
		(Exist) -					
	Vegetable	(New) -					
	· · · · · · · · · · · · · · · · · · ·				•		
	Wets. Total					(62.22)	
	Paddy	(B.C) -	r	- -			
	Soybean	•					
	Mungbeea						
	Grund nuts	-					
Drv		1					
 	Orchard						
	Vegetable						
:							
	Dry. Total			•			
Ğ	Grand Total					62.22	= 62

1-50

Irrigation Block UBP ③

Incremental NPV

mgrin	TTO WOOT TOWNSTIT	•	TTA INIT	THCLETHERICAL TAL A			(Unit) million Baht
		Cropped Area	N.P.V	per ha 1,000 Baht	0 Baht	Incremental	
Season	Crop	(ha)	w.p	₫ o/m	Increment	NPV	
	Dodder	(T.P) 55,390	3.697	1.363	2.334	129.28	
	r auuy	(B.C) 59,710	4.885	2.394	2.491	148.74	
		Total (115,100)					
	Maize	2 2 2 2					
Wet	Cassava	-					
		(Exist) 8,500	28.3	21.4	6.9	58.65	
	Vegetable	(New) 4,500	28.3	5	28.3	127.35	
		(13,000)					
	Wets. Total					(464.02)	
	Paddy	(B.C) -	•		2 2 2 3	•	
	Soybean	23,500	4.097	1	4.097	96.28	
	Mungbeea	8,800	1.059	T	1.059	9.32	
	Grund nuts	8,800	1.805		1.805	15.88	
Drv		8,800	46.220	18.908	27.312	240.35	
	Orchard						
	Vegetable	13,000	28.3	T	28.3	367.9	
	Dry. Total					(729.73)	
ō	Grand Total			۰.		1,193.75	= 1,194

(Unit) million Baht 821 11 Incremental (44.17) 10.42(40.98)22.53 14.62 0.33 1.743.45 1.59 14.15 85.15 27.51 2.71 VIN <u>.</u> Increment 2.666 2.823 0.470 (-) 2.479 1.059 1.8054.097 6.9 28.3 per ha 1,000 Baht Incremental NPV w/o p 2.4791.031 2.06221.4 N.P.V 0.4703.697 4.097 1.059 4.885 1.805w.p 28.3 28,3 (15,500)700 5,1801,500 5,50010,320 700 500 1,500 600 500 Cropped Area (ha) (Exist) Total (New) (B.C) (C) B.C) (T.P) 6 9 9 Irrigation Block MPP Grund nuts Wets. Total Mungbeea Vegetable Dry. Total Vegetable Crop Cassava Soybean Orchard Cassava Grand Total Paddy Paddy Maize Season Wet Dry

(Unit) million Baht																					
(Unit) mi																					= 240
	Incremental	NPV	46.55			1.60	(-) 8.92		14.15	(53.38)		43.84	1.80	3.07	128.24			14.15	(-) 4.47	(186.63)	240.01
) Baht	Increment	2.155	1		0.470	2.623		28.3			4.097	1.059	1.805	44.220			28.3	(-) 1.542		
Incremental NPV	per ha 1,000 Baht	w/op	1.542				2.623		1	- -				I	1			-	1.542		
Increm	N.P.V	w.p	3.697			0.470	•		28.3			4.097	1.059	1.805	44.220			28.3	I		
	Cropped Area	(ha)	21,600	e	(21,600)	3,400	3,400	• ()	500		••••••	10,700	1,700	1,700	2,900		3,100	500	2,900		
©	Cro Cro		(T.P)	(B.C)	Total		(-)	(Exist)	(New)		(B.C)						(-)		<u>·</u>		
Irrigation Block MHN		Crop	Doddu	T and		Maize	Cassava		Vegetable	Wets. Total	Paddy	Soybean	Mungbeea	Grund nuts		Urcnara	Cassava	Vegetable	Paddy (wet)	Dry. Total	Grand Total
Irrigatio	-	Season				,	Vet								Drv.	<u>}</u>		·			Gr

	n Blo	Irrigation Block KPS	0		Incren	Incremental NPV			(Unit) million Baht
			Crop	ped Area	N.P.V) Baht	Incremental	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		Crop		(ha)	w.p	w/o p	Increment	NPV	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	- p		(T.P)	15,430	3.697	2.603	1.094	16.88	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	й Ц	aay	(B.C)	6,270	4.885	3.634	1.251	7.84	
$ \left(\begin{array}{c c c c c c c c c c c c c c c c c c c $			Total	(21,700)					
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Ma	Maize		3,800	0.470	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0.470	1.79	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	S	Cassava	<u>(-</u>	3,800		2.653	2.623		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$			(Exist)	1,800	28.3	21.4	6.9	12.42	
(2,400) (2,400) (45.83) tal (B.C) (45.83) (B.C) $(.105)$ $(.105)$ $(.15.83)$ (B.C) $(.001$ 4.097 32.78 (B.C) $8,000$ 4.097 32.78 ea $3,200$ 1.059 1.059 32.78 uts $3,200$ 1.805 1.805 5.78 uts $3,200$ 1.805 1.805 5.78 0 1.600 44.22 -7 $44,22$ 70.75 0 $1,600$ 46.22 12.020 34.20 17.10 $(-)$ $3,500$ 46.22 12.020 34.20 17.10 $(-)$ $3,500$ 28.3 -7 28.3 67.92 $(-)$ $3,500$ 28.3 -7 21.603 $(-)$ 41.62 70.76 10 -7 28.3 67.92 70.76 -7 44.22 70.76 -7 $(-)$ $3,500$ 28.3 -7 28.3 <t< td=""><td>Ve</td><td>getable</td><td>(New)</td><td>600</td><td>28.3</td><td>2</td><td>28.3</td><td>16.98</td><td></td></t<>	Ve	getable	(New)	600	28.3	2	28.3	16.98	
trail(45.83) (EC) $(B.C)$ (-1) $(B.C)$ (-1) (-1) $(B.C)$ (-1) </td <td></td> <td></td> <td></td> <td>(2,400)</td> <td></td> <td></td> <td></td> <td></td> <td></td>				(2,400)					
3,000 4.097 4.097 32.78 $8,000$ 4.097 32.78 32.78 $3,200$ 1.059 1.059 3.39 $3,200$ 1.805 1.805 5.78 $1,600$ 44.22 $ 44.22$ 500 46.22 12.020 34.20 500 46.22 12.020 34.20 500 46.22 12.020 34.20 500 28.3 $ 28.3$ $5,400$ 28.3 $ 28.3$ $2,400$ 28.3 $ 28.3$ $1,600$ 2.603 $(-) 2.603$ $(-) 4.16$ $1,600$ $ 2.603$ $(-) 2.603$ $(-) 2.603$ $(-) 2.603$ $ -$	Me	Wets. Total						(45.83)	
	Pa	ddy	(D) (B) (C)	T					
ea $3,200$ 1.059 1.059 3.39 uts $3,200$ 1.805 5.78 5.78 uts $3,200$ 44.22 1.805 5.78 500 44.22 $ 44.22$ 70.75 $(-)$ $3,500$ 46.22 12.020 34.20 17.10 $(-)$ $3,500$ 28.3 $ 28.3$ 67.92 $(-)$ $1,600$ 28.3 $ 2.603$ $(-)$ 4.16 $(-)$ $1,600$ 28.3 $ 23.39$ $ (-)$ $1,600$ 28.3 $ 2.603$ $(-)$ 4.16 $(-)$ $1,600$ $ 2.603$ $(-)$ 4.16 $(-)$ $1,600$ $ 2.603$ $(-)$ 4.16 $(-)$ $ 2.603$ $(-)$ 4.16 $(-)$ $ 2.603$ $(-)$ 4.16 $(-)$ $ 2.603$ $(-)$ 4.16 $(-)$ $ (-)$ $ (-)$ $ (-)$ $ (-)$ $ (-)$ $ (-)$ $ (-)$ $ (-)$ $ -$ <	So	ybean		8,000	4.097		4.097	32.78	
uts $3,200$ 1.805 1.805 5.78 5.78 $1,600$ 44.22 $ 44.22$ 70.75 500 46.22 12.020 34.20 17.10 $(-)$ $3,500$ 46.22 12.020 34.20 17.10 $(-)$ $3,500$ 28.3 $ 28.3$ 67.92 $(-)$ $1,600$ 28.3 $(-)$ 28.3 $(-)$ $(-)$ $1,600$ 28.3 $(-)$ 2.603 $(-)$ $(-)$ $1,600$ 28.3 $(-)$ 2.603 $(-)$ $(-)$ $1,600$ $ 2.603$ $(-)$ 2.603 $(-)$ $(-)$ $1,600$ $ 2.603$ $(-)$ 2.603 $(-)$ $(-)$ $ 2.603$ $(-)$ 2.603 $(-)$ 2.603 $(-)$ $(-)$ $ 2.603$ $(-)$ 2.603 $(-)$ $2.9.39$ $-$	Mt	ingbeea		3,200	1.059		1.059	3.39	
	હ	und nuts		3,200	1.805		1.805	5.78	
				1,600	44.22	1	44.22	70.75	
(-) 3,500 - 3,500 - <td< td=""><td>ว็</td><td>chard</td><td></td><td>500</td><td>46.22</td><td>12.020</td><td>34.20</td><td>17.10</td><td></td></td<>	ว็	chard		500	46.22	12.020	34.20	17.10	
le 2,400 28.3 - 28.3 67.92 vet) (-) 1,600 28.3 (-) 2.603 (-) 4.16 al 2.603 (-) 2.603 (-) 2.16 (193.56) al 239.39 239.39	Ca	ssava	(-)	3,500					
vet) (-) 1,600 2.603 (-) 4.16 .al (-) 2.603 (-) 4.16 .al (193.56) (193.56) (193.56)	Ve	getable		2,400	28.3	ľ	28.3	67.92	
al 239.39 =	Pac	ldy (wet)	(-)	1,600		2.603	(-) 2.603		
239.39	Dr	r. Total						(193.56)	
	and	Fotal						239.39	
			i			÷		•	•

Irrigation Block UPP

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Incremental NPV

(Unit) million Baht

									-													
									· ·		-				-							= 390
	Incremental	NPV	54.93	13.85		2.16	(-) 11.37	3.45	33.96	(-) 1.94	(95.04)		52.03	3.92	7.04	154.70			84.90	(-) 7.60	(294.99)	390.03
	0 Baht	Increment	2.080	2.237		0.470	2.472	6.9	28.3	(-) 1.617			4.097	1.059	1.805	44.200			28.3			
· •	per ha 1,000 Baht	w/o p	1.617	2.648		t	2.472	21.4	I,	1.617			1		1	•			1	1.617		
·	N.P.V	w.p	3.697	4.885		0.470	L	28.3	28.3				4.097	1.059	1.805	44.200			28.3			
	Cropped Area	(ha)	26,410	6,190	(32,600)	4,600	4,600	500	1,200	1,200			12,700	3,700	3,900	3,500		4,200	3,000	4,70		
	Cropi)	(T.P)	(B.C)	Total		(-)	(Exist)	(New)	(-)		(B.C)						(-)		(-)	-4	
		Crop	Dodder	r auuy		Maize	Cassava	7 7 7	v egetable	Paddy	Wets. Total	Paddy	Soybean	Mungbeea	Grund nuts	-	Urcnard	Cassava	Vegetable	Paddy	Dry. Total	Grand Total
<u></u>		Season					Wet		<u> </u>				1			, Drv						Gr

TABLE I-2-23 ALTERNATIVE DEVELOPMENT PLAN-4

Irrigation Block LBP

Θ

Incremental NPV

(Unit) million Baht

د																					•••	
																						= 501
	Incremental	NPV	10.78	15.18		1.03	(-) 8.43	50.37	36.79		(105.72)			1.06	1.81	149.47			243.38		(395.72)	501.44
) Baht	Increment	0.407	0.564		0.47	(-) 3.833	6.9	28.3					1.059	1.805	30.504			28.3			
	per ha 1,000 Baht	w/o p	3.290	4.321		•	3.833	21.4	1			1				15.716						
	N.P.V	w.p	3.697	4.885		0.470		28.3	28.3					1.059	1.805	46.220			28.3		-	
	Cropped Area	(ha)	(T.P) 26,480	(B.C) 26,920	Total (53,400)	2,200	(-) 2,200	(Exist) 7,300	(New) 1,300	(8,600)		(B.C) -		1,000	1,000	4,900		(-) 2,000	8,600			
		Crop	· · · · ·	raduy		Maize	Cassava		Vegetable		Wets. Total	Paddy	Soybean	Mungbeea	Grund nuts		Urchard	Cassava	Vegetable		Dry. Total	Grand Total
		Season				1	Wet								·	Drv	 }			· · ·		Gr

	(Unit) million Baht	Incremental		1.745 3.56	1.902		0.47 0.80	4.338 7.37				(-) (0.61)		4.097 4.10	1.059 0.32	1.805 0.54	43.82 87.64				(92.6)
ALTERNATIVE DEVELOPMENT PLAN-4	ncremental NPV	N.P.V per ha 1,000 Baht	w/o p Increment	1.952	2.983		•	4.338 (-) 4.						-			-				
ALTERNATIVE	Inci	Cropped Area N.	(ha) w.p	2,040 3.697	1,260 4.885	Total (3,300)	1,700 0.470	1,700 -	(1	1,000	300 1.059	300 1.805	2,000 43.82		1,600	-	
	Irrigation Block KTL ②		Crop	(T.P)	r auuy (B.C)	Tot	Maize	Cassava (-)	(Exist)	Vegetable (New)		Wets. Total	Paddy (B.C)	Soybean	Mungbeea	Grund nuts		Orchard	Cassava (-)	Vegetable	Dry. Total
	Irrigatio		Season					Vet		I	-57						Drv.			· · · · · · · · ·	

rrigatic	Irrigation Block MNN	(4)	Increm	cremental NPV			(Unit) million Baht
		Cropped Area	N.P.V	per ha 1,000 Baht	0 Baht	Incremental	
Season	Crop	(ha)	ď.w.	w/o p	Increment	NPV	
	E F	(T.P) 34,850	3.697	2.968	0.729	25.41	
	raddy	(B.C) 41,550	4.885	3.999	0.886	36.81	
		Total 76,400					
	Maize	1					
Wet	Cassava	1					
		(Exist)					
	Vegetable	(New) -		2 - 2 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1			
	Wets. Total					(62.22)	
	Paddy	(B.C)		1	1		
	Soybean	1					
-	Mungbeea	8					
	Grund nuts						
- 							
<u>,</u>	Urchard						
• -	Vegetable	F					
		· .					
	Dry. Total						
ບັ	Grand Total					62.22	= 62

										•												
		(Unit) million Baht																				= 382
			Incremental	NPV	129.28	148.74				3.45	T	-	(281.47)		4.10	1.16	1.81	79.20		14.15	(100.42)	381.89
NT PLAN-4) Baht	Increment	2.334	2.491				6.9				1	4.097	1.059	1.805	27.312		28.3		
DEVELOPMENT PLAN-4	· · · ·	Incremental NPV	per ha 1,000 Baht		1.363	2.394				21.4				1	I	I	1	18.908		1	 -	
ALTERNATIVE L		Increm	N.P.V	w.p	3.697	4.885			-	28.3	-				4.097	1.059	1.805	46.22		28.3		
ALTE		6	Cropped Area	(ha)	(T.P) 55,390	(B.C) 59,710	Total (115,100)		1	(Exist) 500	(New) -	(200)		(B.C) -	1,000	1,100	1,000	2,900		500		
· · ·		Irrigation Block UBP		Crop		rauuy		Maize	Cassava		Vegetable		Wets. Total	Paddy	Soybean	Mungbeea	Grund nuts		Urcnard	Vegetable	Dry. Total	Grand Total
		Irrigatio		Season				, , ,	Wet		T	-59						Drv.		 		Gr
											· 1 -	- มช										

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Irrigation Block MPP ⑤

Incremental NPV

(Unit) million Baht

0)		TENTIONIC INTI				(Unit) million Baht	
		Cropped Area	Area	N.P.V	per ha 1,000 Baht	0 Baht	Incremental		
Season	Crop	(ha)		w. p	w/o p	Increment	NPV		
	D-11	(T.P) 10	10,320	3.697	1.031	2.666	27.51		
	rauuy	(B.C) 5	5,180	4.885	2.062	2.823	14.62		
		Total (15	(15,500)						
	Maize		200	0.470		0.470	0.33		
Wet	Cassava	(-)	700	ŀ	2.479	(-) 2.479	(-) 1.74		
		(Exist)	500	28.3	21.4	6.9	3.45		
	Vegetable	(New)							
									•
	Wets. Total	-					(44.17)		
	Paddy	(B.C)							
	Soybean			•		-			
	Mungbeea		300	1.059		1.059	0.32		
	Grund nuts		300	1.805	-	1.805	0.54		* •
Drv	, ,		-						
2	Urchard								,
	Cassava	(-)	600						
	Vegetable		500	28.3	1	28.3	14.15		
		-							. :
	Dry. Total						(12.01)		
S	Grand Total						59.18	= 59	

Irrigation Block MPP

r G

Incremental NPV

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(IInit) million Baht

0)		A TAT TONTOTTOTOTOT	-		(Unit) million Baht
		Cropped Area	N.P.V	N.P.V per ha 1,000 Baht	Baht	Incremental	
Season	Crop	(ha)	w.p	d o/m	Increment	NPV	
		(T.P) 10,320	3.697	1.031	2.666	27.51	
	r auuy	(B.C) 5,180	4.885	2.062	2.823	14.62	
		Total (15,500)		-			
-	Maize	400	0.470	3	0.470	0.33	
Wet	Cassava	(-) 700	•	2.479	(-) 2.479	(-) 1.74	
		(Exist) 500	28.3	21.4	6.9	3.45	
	Vegetable	(New) -					
	Wets. Total					(44.17)	
	Paddy	(B.C) -					
	Soybean			-	-	•	
	Mungbeea	300	1.059	1	1.059	0.32	
	Grund nuts	300	1.805	1	1.805	0.54	
Dry	Orchard	ŝ					
	Cassava	1-) 000					
	Vegetable	500	28.3	1	28.3	14.15	
<u>. </u>							
	Dry. Total					(15.01)	
J	Grand Total					59.18	= 59

Irrigati	Irrigation Block MHN	9		Increm	Incremental NPV			(Unit) million Baht
		Cropped Area	Area	N.P.V	per ha 1,000 Baht) Baht	Incremental	
Season	Crop	(ha)		w. p	d o/m	Increment	NPV	
	רבייני סיילאיי	(T.P) 2	21,600	3.697	1.542	2.155	46.55	
	raduy	(B.C)]		1			
		Total (2	(21,600)					
	Maize		3,400	0.470	1	0.470	1.60	
Wet	Cassava	(-)	3,400	ſ	2.623	2.623	(-) 8.92	
		(Exist)	1					
	Vegetable	(New)	500	28.3	1	28.3	14.15	
	Wets. Total						(53.38)	
	Paddy	(B.C)	¥,					
	Soybean		1,000	4.097		4.097	4.10	
	Mungbeea		1,100	1.059		1.059	1.16	
	Grund nuts		1,000	1.805		1.805	1.81	
Drvv D			2,900	44.22		44.22	128.24	
	Urcnard	-						
-	Cassava	(-)	3,100					
	Vegetable		500	28.3	8	28.3	14.15	
• .	Paddy (wet)	(-)	2,900		1.542	(-) 1.542	(-) 4.47	
	Dry. Total						(144.99)	
G	Grand Total						198.37	= 198