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GOVERNMENT OF MALAYSIA

**NATIONAL WATER RESOURCES STUDY, MALAYSIA
PERLIS-KEDAH-PULAU PINANG
REGIONAL WATER RESOURCES STUDY
PART 2
BERIS DAM FEASIBILITY STUDY**

**VOL. 7
ANNEX**

- J. ECONOMIC ANALYSIS**
- K. LAND ACQUISITION COST AND ENVIRONMENTAL STUDIES**
- L. LEGAL AND INSTITUTIONAL ARRANGEMENT**

MARCH 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

NATIONAL WATER RESOURCES STUDY, MALAYSIA

PERLIS - KEDAH - PULAU PINANG

REGIONAL WATER RESOURCES STUDY

PART 2

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L. LEGAL AND INSTITUTIONAL ARRANGEMENT

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ABBREVIATIONS

(1) Organization/Plan

4MP (5MP)	:	Fourth (Fifth) Malaysia Plan
DID (JPT)	:	Drainage and Irrigation Department
EPU	:	Economic Planning Unit
FELCRA	:	Federal Land Consolidation and Rehabilitation Authority
FELDA	:	Federal Land Development Authority
IBRD	:	The World Bank
JICA	:	Japan International Cooperation Agency
MADA	:	Muda Agricultural Development Authority
MOH	:	Ministry of Health
MTR	:	Mid-Term Review of 4MP
NEB (LLN)	:	National Electricity Board
NWRS	:	National Water Resources Study
PWA	:	Pulau Pinang Water Authority
PWD (JKR)	:	Public Works Department
RESP	:	Rural Environmental Sanitation Program
RISDA	:	Rubber Industry Smallholders Development Authority
WHO	:	World Health Organization

(2) Others

B	:	Benefit
BOD	:	Biochemical Oxygen Demand
C	:	Cost
COD	:	Chemical Oxygen Demand
D & I	:	Domestic and Industrial
dia.	:	Diameter
EIRR	:	Economic Internal Rate of Return
El.	:	Elevation Above Mean Sea Level
Eq.	:	Equation
Fig.	:	Figure
GDP	:	Gross Domestic Product
GNP	:	Gross National Product
H	:	Height, or Water Head
HWL	:	Normal High Water Level
O & M	:	Operation and Maintenance
Q	:	Discharge
Ref.	:	Reference
SS	:	Suspended Solid
VA	:	Value Added

ABBREVIATIONS OF MEASUREMENT

Length

mm = millimeter
cm = centimeter
m = meter
km = kilometer
ft = foot
yd = yard

Area

cm² = square centimeter
m² = square meter
ha = hectare
km² = square kilometer

Volume

cm³ = cubic centimeter
l = lit = liter
kl = kiloliter
m³ = cubic meter
gal. = gallon

Weight

mg = milligram
g = gram
kg = kilogram
ton = metric ton
lb = pound

Time

s = second
min = minute
h = hour
d = day
y = year

Electrical Measures

V = Volt
A = Ampere
Hz = Hertz (cycle)
W = Watt
kW = Kilowatt
MW = Megawatt
GW = Gigawatt

Other Measures

% = percent
HP = horsepower
° = degree
' = minute
" = second
°C = degree in centigrade
10³ = thousand
10⁶ = million
10⁹ = billion (milliard)

Derived Measures

m³/s = cubic meter per second
cusec = cubic feet per second
mgd = million gallon per day
kWh = kilowatt hour
MWh = Megawatt hour
GWh = Gigawatt hour
kWh/y = kilowatt hour per year
kVA = kilovolt ampere
BTU = British thermal unit
psi = pound per square inch

Money

M\$ = Malaysian ringgit
US\$ = US dollar
¥ = Japanese Yen

CONVERSION FACTORS

	<u>From Metric System</u>	<u>To Metric System</u>
<u>Length</u>	1 cm = 0.394 inch 1 m = 3.28 ft = 1.094 yd 1 km = 0.621 mile	1 inch = 2.54 cm 1 ft = 30.48 cm 1 yd = 91.44 cm 1 mile = 1.609 km
<u>Area</u>	1 cm ² = 0.155 sq.in 1 m ² = 10.76 sq.ft 1 ha = 2.471 acres 1 km ² = 0.386 sq.mile	1 sq.ft = 0.0929 m ² 1 sq.yd = 0.835 m ² 1 acre = 0.4047 ha 1 sq.mile = 2.59 km ²
<u>Volume</u>	1 cm ³ = 0.0610 cu.in 1 lit = 0.220 gal.(imp.) 1 kl = 6.29 barrels 1 m ³ = 35.3 cu.ft 10 ⁶ m ³ = 811 acre-ft	1 cu.ft = 28.32 lit 1 cu.yd = 0.765 m ³ 1 gal.(imp.) = 4.55 lit 1 gal.(US) = 3.79 lit 1 acre-ft = 1,233.5 m ³
<u>Weight</u>	1 g = 0.0353 ounce 1 kg = 2.20 lb 1 ton = 0.984 long ton = 1.102 short ton	1 ounce = 28.35 g 1 lb = 0.4536 kg 1 long ton = 1.016 ton 1 short ton = 0.907 ton
<u>Energy</u>	1 kWh = 3,413 BTU	1 BTU = 0.293 Wh
<u>Temperature</u>	°C = (°F - 32) · 5/9	°F = 1.8°C + 32
<u>Derived Measures</u>	1 m ³ /s = 35.3 cusec 1 kg/cm ² = 14.2 psi 1 ton/ha = 891 lb/acre 10 ⁶ m ³ = 810.7 acre-ft 1 m ³ /s = 19.0 mgd	1 cusec = 0.0283 m ³ /s 1 psi = 0.703 kg/cm ² 1 lb/acre = 1.12 kg/ha 1 acre-ft = 1,233.5 m ³ 1 mgd = 0.0526 m ³ /s
<u>Local Measures</u>	1 lit = 0.220 gantang 1 kg = 1.65 kati 1 ton = 16.5 pikul	1 gantang = 4.55 lit 1 kati = 0.606 kg 1 pikul = 60.6 kg

Exchange Rate

(at the end of 1983)

US\$1 = M\$2.312
¥100 = M\$0.998

ANNEX J
ECONOMIC ANALYSIS

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1. INTRODUCTION

The water output of the Beris dam can be utilized in the major demand centres in the integrated Kedah-Muda-Perai river system. It will not have a specified service area whose demand just meet the net water output of the Beris dam, but it will contribute to augment the supply capacity of the controlled water in the integrated river system.

In this Annex, economic and financial analyses were conducted for the overall source development plans in the integrated river system as well as the proposed Beris dam project.

In economic evaluation of the Beris dam, a sensitivity analysis was carried out against variations in major parameters for the Beris dam evaluation.

On the other hand, the financial analysis included the fund requirement of the Beris dam project, allocation of the cost to beneficiaries of the project, financial statement of the project and unit water cost analysis. A farm budget analysis is carried out in Annex C "Agriculture".

Since the procedures applied for the economic analysis and cost allocation for the study were same as those used for the Part 1 Study, a general procedure and the updated and revised points are discussed in this Annex.

The major differences from Part 1 Study are;

- (1) The demands of irrigation, and domestic and industrial water supply were updated in this study, and a single projection of demand was applied instead of two alternative cases of projection for Part 1 Study.
- (2) Accordingly, the analysis of water deficit by cause by affected area was revised.
- (3) Net water output of source facilities were revised on the basis of the integrated operation study.
- (4) The prices of internationally marketable crops and farm inputs were updated by the latest forecasts of the World Bank.
- (5) The cost of the Beris dam was estimated on the basis of the design and construction planning for the feasibility study.
- (6) The estimate of the cost and benefit was based on the price level at the end of 1983.

2. ALLOCATION OF WATER OUTPUT

2.1 Water Demand and Deficit

The water demand and supply balance of the integrated Kedah-Muda-Perai river system was examined in Annex F, for three Alternatives of allocation of the Muda river water to the Kedah river basin at the Jeniang weir.

The major water uses in the integrated river system are classified into the following purposes in which it is defined that Main stream is a river stretch upstream of which a source project is assumed while no source project is assumed in Tributary.

(1) Kedah river

- (1-1) MADA main; the major irrigation scheme in the MADA area
- (1-2) Main minor; minor irrigation schemes depending on offtakes of the MADA canal and in the main stream
- (1-3) Tributary minor; minor irrigation schemes depending on tributaries
- (1-4) D&I; domestic and industrial water supply

(2) Muda-Perai river

- (2-1) Main minor; minor irrigation schemes in the main stream located both in the States of Kedah and Pulau Pinang
- (2-2) Tributary minor; minor irrigation schemes depending on tributaries which are located only in the State of Kedah
- (2-3) D&I; domestic and industrial water supply both for the States of Kedah and Pulau Pinang.

Annual water demand in the integrated river system is estimated for two cases of irrigation water development plan, i.e. Case A with new minor irrigation projects and Case B without new minor irrigation projects, while the D&I water demand of the State of Pulau Pinang is estimated under the condition that the water demand of intensive-industries will not grow after 1985. The annual water demand for 1983, 1990 and 2000 is summarized in Tables 1 and 2, which are based on Tables 71 and 72 of Annex F.

The Pinang Tungal irrigation scheme and public water supply system in the State of Pulau Pinang conjunctively utilize water in the Muda and Perai river. Their water demand is counted for only the portion which is supplied from the Muda river in estimating water demand in the main stream of the Muda-Perai river system.

The rate of river maintenance flow in Table 3 is a reproduction of Table 19 of Annex F.

Average annual water deficit is shown in Tables 4 and 5 for Case A and Case B by cause by affected area, which is a reproduction of Tables 84 and 85 of Annex F. The water deficits in affected area are those occurring in the main stream of the Kedah and Muda rivers on an average for 1961 to 1983 under the condition with existing and ongoing source facilities.

2.2 Water Output

The water demand and supply balance for various combinations of source facilities were evaluated by a simulation model under 1961-1983 hydrological condition in Annex F. The allocation of the water output to causes is estimated for 3 different operation rules of the Jeniang weir as discussed in Annex F "Study on Operation of Water Resources System". The alternatives are;

- Alternative 1 : Muda priority
- Alternative 2 : Even distribution
- Alternative 3 : Kedah priority

Tables 6 to 11 show the net water output of source facilities allocated by cause of water deficit.

3. ECONOMIC BENEFITS AND COSTS

3.1 Economic Benefit

(1) Irrigation benefit

The economic farm gate price was revised from M\$609/ton to M\$548/ton in 1983 constant price level, based on the latest projected price for 1990 - 1995 by IBRD for the standard 15% broken Thai grade, and assuming an average mill return of 65%. Table 12 shows the average paddy yield, gross production value, production cost and the resulting net production value, which are expressed as values per ha.

The net incremental production value which is the balance between the net production values with and without project conditions in 2003 onward is shown in Table 13.

Net production value streams with and without project conditions are prepared for the Kedah river basin as shown in Table 14 and for the Muda river basin as shown in Table 15.

(2) Domestic and industrial water supply benefit

The benefit arising from domestic and industrial water supply is estimated based on the least-costly alternative method.

The least-costly alternative dam of the Beris dam shall be a dam to be ranked next to the dam, and the Tawar-Muda dam was selected as the least costly alternative. The unit value of water is calculated to be the annual equivalent cost of the dam divided by the net water output to be developed by the dam assuming a discount rate of 8%. Table 16 shows the unit water value of the Beris dam and the Tawar-Muda dam. In the table different unit water value is calculated for the Kedah and Muda-Perai rivers because of difference in expected net water output between these rivers. The unit water values of the Tawar-Muda dam is applied for the evaluation of domestic and industrial water supply benefit.

(3) Hydropower benefit

The possibility of hydropower development is evaluated in Annex I "Design and Cost Estimate". The economic benefit for the hydropower development is calculated in the following consideration.

The energy benefit is counted for the benefit of hydropower generation of the Beris dam, while the capacity benefit cannot be claimed because the power generation is possible during only half a year. The energy value used in this Study is M\$0.145/kWh, which is the same as that estimated in Annex O of Part 1 Study.

(4) Adverse effect of tributary irrigation and D & I water supply

The adverse effect of tributary irrigation and D & I water supply is calculated as shown in Table 17 for Case A (with new minor irrigation projects). The calculation procedure is herein explained according to column number in Table 17.

- (a) Net production value in MADA with-project in Table 14,
- (b) Net production value in Main minor with-project in Table 14,
- (c) Percentage of water deficit caused by Tributary minor and affecting on MADA and Main minor in Table 4 to the water demand of MADA and Main minor in the Kedah river system in Table 1,
- (d) Percentage of water deficit caused by D & I water supply and affecting on MADA and Main minor in Table 4 to the water demand of MADA and Main minor in the Kedah river system in Table 1,
- (e) $(c) \times ((a) + (b))/100$,
- (f) $(d) \times ((a) + (b))/100$,
- (g) Net production value in Main minor with-project in Table 15,
- (h) Percentage of water deficit caused by Tributary minor and affecting on Main minor in the Muda-Perai river system in Table 4 to water demand of the Main minor in Table 1,
- (i) Percentage of water deficit caused by D & I water supply and affecting on Main minor in the Muda-Perai river system in Table 4 to water demand of the Main minor in Table 1,
- (j) $(g) \times (h)/100$, and
- (k) $(g) \times (i)/100$.

(5) River maintenance flow

No economic benefit is assumed for the river maintenance flow.

3.2 Economic Cost

The financial cost of the dam is converted to the economic cost by applying the national economic conversion factors prepared by EPU as shown in Table 18. The resulting economic cost of the Beris dam is shown in Table 19. The land acquisition cost in the financial cost was replaced by production forgone expected in the area to be flooded by the impoundment. Table 20 shows the breakdown of production forgone for economic evaluation.

The cost of Tawar-Muda dam is also revised by using the unit cost for the Beris dam. The costs of the other source facilities are the same as those estimated in Part 1 Study. Table 21 summarizes the cost of source facilities. The cost streams of these source facilities are shown in Table 22 assuming the year of commission to be 1990 for the Jeniang system and 1991 for the other source project.

A minor adjustment of cost for irrigation facilities are made as discussed in Annex D. The cost stream of the irrigation facilities is shown in Table 23.

4. ECONOMIC ANALYSIS OF OVERALL SOURCE DEVELOPMENT PLAN

The Beris dam is characterized as a source project for the Integrated Kedah-Muda-Perai river system.

The overall development plan of the integrated river system herein evaluated is based on the plan including the Jeniang system as a new source facility and irrigation development projects for Case A and domestic and industrial water supply projects in the integrated river system. A source project to be implemented following to the Jeniang system is economically justified if the incremental benefit is greater than the incremental cost, or incremental net benefit is positive. In this sense, the incremental net benefit of the overall plan was evaluated if the Beris dam and other potential dams are involved in the overall development plan for the following combinations of source projects.

- (1) Jeniang
- (2) Jeniang + Beris
- (3) Jeniang + Beris + Reman
- (4) Jeniang + Beris + Tawar-Muda
- (5) Jeniang + Beris + Khlong Thepha
- (6) Jeniang + Beris + Reman + Khlong Thepha
- (7) Jeniang + Beris + Reman + Merbok

Among these combinations (1), (2) and (3) are evaluated for three alternative operation rules of Jeniang system of Alternatives 1, 2 and 3, while the combinations (4) to (6) are for Alternatives 1 and 3. The case of (7) involving the Merbok storage is evaluated for Alternative 3, in which the storage is required to remove the deficit in the Muda-Perai river system.

A detailed breakdown of the present values of benefit and cost assuming variable discount rate is shown in Tables 24 to 31 for the above-mentioned combinations of source projects.

Table 24 shows the combination of Jeniang + Beris + Reman + Khlong Thepha for Alternative 1, Muda priority, assuming that these facilities are implemented in this order. The incremental net benefit is positive if the Beris and the Reman dams are involved for the discount rate up to 18%, but that of the Khlong Thepha dam is negative if the discount rate is higher than 10%. The same is found for Alternatives 2 and 3 as shown in Tables 25 and 26, though Tables 25 and 26 show the combination of Jeniang + Beris + Reman. Tables 27 and 28 show the combination of Jeniang + Beris + Tawar-Muda for Alternatives 1 and 3. The net incremental benefit is negative if the discount rate is higher than 6%. In case that the Khlong Thepha dam is implemented following to the Beris dam, the project is justified only for discount rate lower than 10% as shown in Tables 29 and 30. Table 31 shows that the net incremental benefit of the Merbok storage is negative for the discount rate higher than 6%.

Consequently, the Beris and Reman dam project are economically justified as new source facilities following to the Jeniang project in the integrated Kedah-Muda-Perai river system, while the other potential dams would not be economically justified.

The background of the above-mentioned tables are compiles as follows:

Tributary minor and D & I water supply have priority to take river water over Main minor and MADA and are not affected by water deficit in the main stream. Therefore it is assumed that the benefit arising from Tributary minor and D & I water supply is obtained under the condition without new source facilities.

The irrigation benefit of Tributary minor is calculated in Table 32.

The D & I benefit is calculated in Table 33. Column (a) in the table shows benefit for the Kedah river system: unit water cost of Tawar-Muda for the Kedah river system multiplied by the water deficit caused by D & I. In column (b), the D & I benefit for the Muda-Perai river system is calculated to be unit water cost of Tawar-Muda for the Muda-Perai river system multiplied by the water deficit caused by D & I.

The benefit of new source facilities will arise from the affected area i.e. MADA and Main minor in the Kedah river system and Main minor in the Muda river system. The benefit is calculated in Tables 34 to 39 by source facilities. The calculation procedure is described for these tables.

- (a) Total supply with Jeniang is total demand in Table 1 deducted by caused deficit in Table 4 and added by net water output of Jeniang in Table 6. Regarding MADA and Main minor in the Kedah river system, percentage of total supply with Jeniang to water demand in Table 1 is calculated.
- (b) Percentage of Beris net water output for the Kedah river system in Table 6 to MADA + Main minor water demand in the Kedah river system in Table 1.
- (c) Percentage of Reman output for the Kedah river system in Table 9 to MADA + Main minor water demand in the Kedah river system in Table 1.
- (d) Percentage of Tawar-Muda output for the Kedah river system in Table 9 to MADA + Main minor water demand in the Kedah river system in Table 1.
- (e) Percentage of Khlong Thepha output for the Kedah river system in Table 9 to MADA + Main minor water demand in the Kedah river system in Table 1.
- (f) Increase in incremental net production value by Jeniang; Net production value in MADA with-project in Table 14 multiplied by (a) less the same value for 1983.

- (g) - (o) Similar to (f)
- (p) Total supply with Jeniang is total demand in Table 1 deducted by caused deficit in Table 4. Regarding Main minor in the Muda-Perai river system, percentage of total supply with Jeniang to water demand in Table 1 is calculated.
- (q) Percentage of Beris output for the Muda-Perai river system in Table 6 to Main minor water demand in the Muda-Perai river system in Table 1.
- (r) Increase in incremental net production value by Jeniang; Net production value in Main minor with-project in Table 15 multiplied by (a) less the same value in Main minor without-project.
- (s) Net production value in Main minor in Table 15 multiplied by (q).

The same calculation assuming that the Khlong Thepha dam, Tawar-Muda dam and Merbok storage can be implemented among the potential dams is shown in Tables 36 to 39.

5. ECONOMIC ANALYSIS OF BERIS DAM

5.1 Economic Internal Rate of Return

The economic internal rate of return (EIRR) of the Beris dam project is calculated in this section. The net irrigation benefit of a purpose (MADA, minor or tributary irrigation) is given as the net production value less irrigation direct cost as shown in Table 40. It is assumed that the Beris dam can claim the net benefit in the affected area i.e. MADA and Main minor in the Kedah river system and Main minor in the Muda river system. The net water output allocated to causes in Tables 6 to 8 produces the benefit in the affected area in proportion to the water deficit in the affected area.

The EIRR of the project was calculated for Case A and Case B as follows:

<u>Alternatives</u>	<u>EIRR of Beris Dam Project</u>	
	<u>Case A</u>	<u>Case B</u>
1	14.8%	15.3%
2	14.8%	15.3%
3	14.6%	14.9%

Table 40, compiled from Tables 14, 15 and 23, shows the net irrigation benefit as the net production value less irrigation direct facilities cost.

The benefit stream of the Beris dam project is calculated in Tables 41 to 46 by Alternatives and Cases. Table 41 shows the benefit stream of the Beris dam project for Alternative 1, Case A. The calculation procedure for Table 41 is described hereunder:

- (a) Net water output allocated to MADA in Table 6.
- (b) - (e) Similar to (a)
- (f) Benefit obtained in the affected area by the net water output allocated to MADA:
$$(a) / (\text{total water deficit in the affected area in the Kedah river in Table 4}) \times (\text{net irrigation benefit of MADA plus Main minor irrigation in the Kedah river derived from Table 40}).$$
- (g) - (j) Similar to (f)
- (k) Total benefit in the Kedah river system: $(f) + (g) + (h) + (i) + (j)$.

- (l) Net water output allocated to Main minor of the State of Kedah in the Muda river in Table 6.
- (m) - (p) Similar to (l)
- (q) Benefit obtained in the affected area by the net water output allocated to Main minor:
- (l)/(total water demand of the Main minor in the Muda river in Table 1) x (net production value in Main minor with-project in Table 15 less the direct facility cost of Main minor in Table 23).
- (r) - (u) Similar to (q)
- (v) Total benefit in the Muda-Perai river system: (q) + (r) + (s) + (t) + (u).

The same calculation is shown in Tables 42 to 46.

5.2 Sensitivity Analysis

The calculation of the EIRR in the previous section was based on the most probable value of key factors. Sensitivity tests are carried out to evaluate the extent of changes in the EIRR if key factors change within a reasonable range.

The key factors and their percentage changes examined are:

- | | |
|-------------------------------------|--------------|
| (1) Investment costs | 10% increase |
| (2) Benefits | 25% decrease |
| (3) Delay in commissioning project | one year |
| (4) Combination of (1), (2) and (3) | |

Table 47 shows the resulting EIRR and the sensitivity indicator (SI), where SI is defined as the percentage change of EIRR due to percentage change in the factor tested.

6. FINANCIAL ANALYSIS

6.1 Fund Requirement

The financial cost of the Beris dam project is estimated in Annex I "Design and Cost Estimate", as shown in Table 48 which includes direct construction cost, compensation cost, engineering and government administration costs and contingencies.

The compensation cost is estimated in Annex K "Land Acquisition Cost and Environmental Studies" for variable reservoir water levels as shown in reservoir water level of El. 87.7 m.

The disbursement schedule of the project cost was prepared as shown in Table 50 according to the construction time schedule, in which it is assumed that the detailed investigation and design works are commenced in 1985 and all the construction works are completed at the end of 1989.

The disbursement schedule of the Jeniang system and the direct facilities of irrigation and domestic and industrial water supply facilities are shown in Table 51.

6.2 Financial Cost Allocation

The cost of the Beris dam is allocated to purposes which are the causes of water deficit to be met by the Beris dam project. The separable costs-remaining benefits method is applied as a cost allocation rule since it is the common practice for water resources development project as discussed in Part 1 Study.

The capital and O & M costs are allocated in terms of the present value at a discount rate of 8%. The results of the calculation are shown in Tables 52 to 57 for Alternatives 1, 2 and 3, and Cases A and B respectively. The sum of the separable costs is 66 to 77% of the total construction cost, indicating the allocation to be highly use-oriented.

The construction cost is allocated to the agencies concerned for reference as shown in Table 58, assuming the following relationship:

MADA	:	MADA main in the Kedah river
Kedah DID	:	All minor irrigation schemes including MADA minor, and river maintenance flow
Kedah PWD	:	D & I private and public in the Kedah river
Pulau Pinang DID	:	Main minor irrigation schemes in the Muda-Perai river
PWA	:	D & I private and public in the Muda river

6.3 Financial Farm Budget

In order to assess the capacity to pay by benefited farmers, a farm budget analysis is made for typical farmer operating an average farm size under with- and without-project conditions as shown in Table 59.

The annual net reserve or capacity to pay in the future under with-project condition would increase markedly as compared with the condition without project implementation. The increase in net reserve would also offer to be farmers incentives for further development and a substantial capacity to pay would be greatly in excess of irrigation fee.

6.4 Financial Statement

(1) Financial analysis for Federal Government

The financial statement for the Beris dam project is prepared from the viewpoint of the Federal Government assuming Alternative 2 for Case A.

The cost of the Beris dam is allocated to the MADA irrigation project, minor irrigation projects for the States of Kedah and Pulau Pinang, and domestic and industrial water supply for the States of Kedah and Pulau Pinang.

It is assumed that the cost allocated for these purposes are financed under the following conditions.

The foreign currency portion of the investment costs of the Beris dam is financed by an international financing agency. The repayment condition is assumed to be an annual interest rate of 4% and a term of 25 years including 7 years of grace period.

The investment cost allocated to MADA irrigation project is financed by own fund of the Federal Government.

The investment cost allocated to the minor irrigation projects is firstly paid by the State DID and then reimbursed by the Federal Government.

The investment cost allocated to urban water supply project is financed by the Federal loan, while the rural water supply projects are financed by the Federal grant.

The operation and maintenance costs are born by own funds of purposes.

Table 60 shows the financial cash flow from the view point of the Federal Government. The annual peak of the fund requirement of the Federal Government is estimated at M\$34.45 x 10⁶ at 1983 price level, which appears in 1987.

(2) Cash flow by purpose

From the view point of MADA, it is assumed that the investment cost is covered by the Federal fund and O&M cost of the Beris dam allocated to MADA is born by own fund of MADA as shown in Table 61.

The analyses for the Kedah and Pulau Pinang DID are shown in Tables 62 and 63 for minor irrigation projects respectively. It is assumed that the State DID will obtain the reimbursement from the Federal Government one year later.

From the viewpoint of PWA for domestic and industrial water supply, a cash flow table is shown in Table 64. Because of repayment on loan to the Federal Government, M\$0.42 x 10⁶ of the peak deficit appears in 1990.

Table 65 shows the cash flow for PWD of the State of Kedah. Since the proportion of the rural area is 65% in the State of Kedah, repayment amount is relatively small.

(3) Unit water cost

The unit water cost for irrigation project is calculated herein assuming that the irrigation projects bear only the operation and maintenance costs of source and direct facilities. The cost per unit water volume is estimated to be M\$0.024/m³ in 2000 for MADA and M\$0.025/m³ for minor irrigation projects. Since the increase in income from paddy production is estimated at M\$0.049/m³ to M\$0.059/m³, the farmers benefited by the project seem to be able to bear the O&M cost as water charge.

For domestic and industrial water supply, unit water cost is estimated for the cost including investment and O&M costs. The resulted unit water cost of the Beris dam for the domestic and industrial water supply is M\$0.26/m³ for PWA and M\$0.24/m³ for PWD respectively. These costs are in the order of the present water rate for domestic use.

TABLES

Table 1 ANNUAL WATER DEMAND FOR CASE A

Unit: 10⁶ m³

Description	1983	1990	2000
Kedah river system			
Tributary	32	41	67
MADA main	1,309	1,278	1,243
Main minor			
fringe	23	21	21
main stream	0	1	6
D & I	33	55	137
Total	1,397	1,396	1,474
Muda-Perai river system			
Tributary	49	85	136
Main minor			
Kedah	58	97	98
Pulau Pinang	300 (212)	261 (185)	261 (185)
D & I			
Kedah	10	21	59
Pulau Pinang	141 (37)	191 (41)	333 (153)
Total	558	655	887
Grand Total	1,955	2,051	2,361

Remark; Figures between parentheses show the withdrawals from the Muda river.

Table 2 ANNUAL WATER DEMAND FOR CASE B

Unit: 10⁶ m³

Description	1983	1990	2000
Kedah river system			
Tributary	32	32	33
MADA main	1,309	1,278	1,243
Main minor			
fringe	23	21	21
main stream	0	0	0
D & I	33	55	137
Total	1,397	1,386	1,434
Muda-Perai river system			
Tributary	49	50	59
Main minor			
Kedah	58	58	58
Pulau Pinang	300 (212)	261 (185)	261 (185)
D & I			
Kedah	10	21	59
Pulau Pinang	141 (37)	191 (41)	335 (152)
Total	558	581	770
Grand Total	1,955	1,967	2,204

Remark; Figures between parentheses show the withdrawals from the Muda river.

Table 3 RIVER MAINTENANCE FLOW

Unit: m³/s

River system	With sewerage development		Without sewerage development	
	1990	2000	1990	2000
Kedah	2.7	5.9	5.3	17.0
Muda	0	0	0	0
Perai (Kulim)	0.3	1.1	0.5	5.3

Source; Table 19 in Annex F.

Table 4 AVERAGE ANNUAL WATER DEFICIT BY CAUSE BY AFFECTED AREA (CASE A)

Unit: 10⁶ m³

Cause of Water Deficit	Affected Area by Water Deficit							
	Kedah River System				Muda-Perai River System			
	MADA main	Main minor	D&I	Total	Main minor Kedah	P.Pinang	D&I	Total
1983 Kedah System								
MADA main	383.3	6.7	0	390				
Main minor	6.9	0.1	0	7				
Tributary minor	6.9	0.1	0	7				
D&I	4.9	0.1	0	5				
Total	402.0	7.0	0	409				
Muda-Perai System								
. Kedah: Main minor					0.2	0.8	0	1
Tributary minor					0.2	0.8	0	1
D&I					0	0	0	0
. P.Pinang: Main minor					0.9	3.1	0	4
D&I					0.2	0.8	0	1
Total					1.5	5.5	0	7
1990 Kedah System								
MADA main	338.2	5.8	0	344				
Main minor	6.9	0.1	0	7				
Tributary minor	6.9	0.1	0	7				
D&I	0	0	0	0(+46)				
Total	352.0	6.0	0	358(404)				
Muda-Perai System								
. Kedah: Main minor					1.0	2.0	0	3
Tributary minor					1.4	2.6	0	4
D&I					0.7	1.3	0	2
. P.Pinang: Main minor					1.0	2.0	0	3
D&I					0	0	0	0(+5)
Total					4.1	7.9	0	12(17)
2000 Kedah System								
MADA main	332.8	7.2	0	340				
Main minor	8.8	0.2	0	9				
Tributary minor	19.6	0.4	0	20				
D&I	15.7	0.3	0	16(+45)				
Maintenance flow	13.7	0.3	0	14				
Total	390.6	8.4	0	399(444)				
Muda-Perai System								
. Kedah: Main minor					1.0	2.0	0	3
Tributary minor					3.5	6.5	0	10
D&I					0.7	1.3	0	2
. P. Pinang: Main minor					1.0	2.0	0	3
D&I					1.7	3.3	0	5(+12)
Total					8.0	15.0	0	23(35)

Remark; Figures between parentheses in row of D&I indicate supply from Ahning or Mengkuang dam, those in row of total indicate deficit if Ahning and Mengkuang dams are not operated.

Table 5 AVERAGE ANNUAL WATER DEFICIT BY CAUSE BY AFFECTED AREA (CASE B)

Unit: 10⁶ m³

Cause of Water Deficit	Affected Area by Water Deficit							
	Kedah River System				Muda-Perai River System			
	MADA main	Main minor	D&I	Total	Main minor		D&I	Total
				Kedah	P.Pinang			
1983	<u>Kedah System</u>							
MADA main	383.3	6.7	0	390				
Main minor	6.9	0.1	0	7				
Tributary minor	6.9	0.1	0	7				
D&I	4.9	0.1	0	5				
Total	402.0	7.0	0	409				
	<u>Muda-Perai System</u>							
. Kedah: Main minor					0.2	0.8	0	1
Tributary minor					0.2	0.8	0	1
D&I					0	0	0	0
. P.Pinang: Main minor					0.9	3.1	0	4
D&I					0.2	0.8	0	1
Total					1.5	5.5	0	7
1990	<u>Kedah System</u>							
MADA main	334.5	5.5	0	340				
Main minor	6.9	0.1	0	7				
Tributary minor	6.9	0.1	0	7				
D&I	0	0	0	0(+46)				
Total	348.3	5.7	0	354(400)				
	<u>Muda-Perai System</u>							
. Kedah: Main minor					0.2	0.8	0	1
Tributary minor					0.2	0.8	0	1
D&I					0.5	1.5	0	2
. P.Pinang: Main minor					0.7	2.3	0	3
D&I					0	0	0	0(+4)
Total					1.6	5.4	0	7(11)
2000	<u>Kedah System</u>							
MADA main	334.4	5.6	0	340				
Main minor	6.9	0.1	0	7				
Tributary minor	6.9	0.1	0	7				
D&I	15.7	0.3	0	16(+45)				
Maintenance flow	13.8	0.2	0	14				
Total	377.7	6.3	0	384(429)				
	<u>Muda-Perai System</u>							
. Kedah: Main minor					0.2	0.8	0	1
Tributary minor					0.2	0.8	0	1
D&I					0.5	1.5	0	2
. P.Pinang: Main minor					0.7	2.3	0	3
D&I					1.2	3.8	0	5(+9)
Total					2.8	9.2	0	12(21)

Remark; Figures between parentheses in row of D&I indicate supply from Ahning or Mengkuang dam, those in row of total indicate deficit if Ahning and Mengkuang dams are not operated.

Table 6 NET WATER OUTPUT OF SOURCE FACILITIES
BY CAUSE OF WATER DEFICIT
(ALTERNATIVE 1, MUDA PRIORITY) (1/6)

Unit: 10^6 m^3

Cause of Water Deficit	Jeniang System		Beris	
	Case A	Case B	Case A	Case B
<u>1990</u>				
Kedah System				
MADA	178.4	178.3	45.1	50.0
Main minor	3.6	3.7	0.9	1.0
Tributary minor			7.0	7.0
D & I				
Sub-total	182.0	182.0	53.0	58.0
Muda-Perai				
Kedah				
Main minor			3.0	1.0
Tributary minor			4.0	1.0
D & I			2.0	2.0
Pulau Pinang				
Main minor			3.0	3.0
D & I				
Sub-total			12.0	7.0
Total	182.0	182.0	65.0	65.0
<u>2000</u>				
Kedah System				
MADA	166.0	166.8	20.6	42.4
Main minor	4.4	3.4	0.6	0.9
Tributary minor			20.0	7.0
D & I	7.8	7.9	1.0	2.0
Maintenance flow	6.8	6.9	0.8	1.7
Sub-total	185.0	185.0	43.0	54.0
Muda-Perai System				
Kedah				
Main minor			3.0	1.0
Tributary minor			10.0	1.0
D & I			2.0	2.0
Pulau Pinang				
Main minor			3.0	3.0
D & I			5.0	5.0
Sub-total			23.0	12.0
Total	185.0	185.0	66.0	66.0

Table 7 NET WATER OUTPUT OF SOURCE FACILITIES
BY CAUSE OF WATER DEFICIT
(ALTERNATIVE 2, EVEN DISTRIBUTION) (2/6)

Unit: 10⁶ m³

Cause of Water Deficit	Jeniang System		Beris	
	Case A	Case B	Case A	Case B
<u>1990</u>				
Kedah System				
MADA	178.4	178.4	46.1	51.0
Main minor	3.6	3.6	0.9	1.0
Tributary minor			7.0	7.0
D & I				
Sub-total	182.0	182.0	54.0	59.0
Muda-Perai System				
Kedah				
Main minor			2.5	0.8
Tributary minor			4.0	1.0
D & I			2.0	2.0
Pulau Pinang				
Main minor			2.5	2.2
D & I				
Sub-total			11.0	6.0
Total	182.0	182.0	65.0	65.0
<u>2000</u>				
Kedah System				
MADA	166.0	166.8	23.3	45.1
Main minor	4.4	3.4	0.6	0.9
Tributary minor			20.0	7.0
D & I	7.8	7.9	1.1	2.1
Maintenance flow	6.8	6.9	1.0	1.9
Sub-total	185.0	185.0	46.0	57.0
Muda-Perai System				
Kedah				
Main minor			1.5	0.2
Tributary minor			10.0	1.0
D & I			2.0	2.0
Pulau Pinang				
Main minor			1.5	0.8
D & I			5.0	5.0
Sub-total			20.0	9.0
Total	185.0	185.0	66.0	66.0

Table 8 NET WATER OUTPUT OF SOURCE FACILITIES
 BY CAUSE OF WATER DEFICIT
 (ALTERNATIVE 3, KEDAH PRIORITY) (3/6)

Unit: 10⁶ m³

Cause of Water Deficit	Jeniang System		Beris	
	Case A	Case B	Case A	Case B
<u>1990</u>				
Kedah System				
MADA	178.4	178.4	53.9	53.9
Main minor	3.6	3.6	1.1	1.1
Tributary minor			7.0	7.0
D & I				
Sub-total	182.0	182.0	62.0	62.0
Muda-Perai System				
Kedah				
Main minor				
Tributary minor				
D & I				
Pulau Pinang				
Main minor				
D & I				
Sub-total			0.0	0.0
Total	182.0	182.0	62.0	62.0
<u>2000</u>				
Kedah System				
MADA	167.8	168.7	41.3	53.2
Main minor	4.4	3.5	1.1	1.1
Tributary minor			20.0	7.0
D & I	7.9	7.9	1.9	2.5
Maintenance flow	6.9	6.9	1.7	2.2
Sub-total	187.0	187.0	66.0	66.0
Muda-Perai System				
Kedah				
Main minor				
Tributary minor				
D & I				
Pulau Pinang				
Main minor				
D & I				
Sub-total			0.0	0.0
Total	187.0	187.0	66.0	66.0

Table 9 NET WATER OUTPUT OF SOURCE FACILITIES
BY CAUSE OF WATER DEFICIT
(ALTERNATIVE 1, MUDA PRIORITY) (4/6)

Unit: 10^6 m^3

Cause of Water Deficit	Reman		Tawar-Muda		Khlung Thepha		Merbok	
	Case A	Case B	Case A	Case B	Case A	Case B	Case A	Case B
<u>1990</u>								
Kedah System								
MADA	87.2	87.2	18.6	18.6	42.1	42.1		
Main minor	1.8	1.8	0.4	0.4	0.9	0.9		
Tributary minor								
D & I								
Sub-total	89.0	89.0	19.0	19.0	43.0	43.0		
Muda-Perai System								
Kedah								
Main minor								
Tributary minor								
D & I								
Pulau Pinang								
Main minor								
D & I								
Sub-total							0.0	0.0
Total	89.0	89.0	19.0	19.0	43.0	43.0	0.0	0.0
<u>2000</u>								
Kedah System								
MADA	87.0	87.4	20.6	20.7	38.6	38.8		
Main minor	2.3	1.8	0.5	0.4	1.0	0.8		
Tributary minor								
D & I	4.1	4.1	1.0	1.0	1.8	1.8		
Maintenance flow	3.6	3.6	0.9	0.9	1.6	1.6		
Sub-total	97.0	97.0	23.0	23.0	43.0	43.0		
Muda-Perai System								
Kedah								
Main minor								
Tributary minor								
D & I								
Pulau Pinang								
Main minor								
D & I								
Sub-total							0.0	0.0
Total	97.0	97.0	23.0	23.0	43.0	43.0	0.0	0.0

Table 10 NET WATER OUTPUT OF SOURCE FACILITIES
 BY CAUSE OF WATER DEFICIT
 (ALTERNATIVE 2, EVEN DISTRIBUTION) (5/6)

Unit: 10^6 m^3

Cause of Water Deficit	Reman		Merbok	
	Case A	Case B	Case A	Case B
<u>1990</u>				
Kedah System				
MADA	87.2	81.3		
Main minor	1.8	1.7		
Tributary minor				
D & I				
Sub-total	89.0	83.0		
Muda-Perai System				
Kedah				
Main minor				
Tributary minor				
D & I				
Pulau Pinang				
Main minor				
D & I				
Sub-total			0.0	0.0
Total	89.0	83.0	0.0	0.0
<u>2000</u>				
Kedah System				
MADA	74.4	74.8		
Main minor	2.6	1.6		
Tributary minor				
D & I	3.5	3.5		
Maintenance flow	3.1	3.1		
Sub-total	83.0	83.0		
Muda-Perai System				
Kedah				
Main minor				
Tributary minor				
D & I				
Pulau Pinang				
Main minor				
D & I				
Sub-total			0.0	0.0
Total	83.0	83.0	0.0	0.0

Table 11 NET WATER OUTPUT OF SOURCE FACILITIES
BY CAUSE OF WATER DEFICIT
(ALTERNATIVE 3, KEDAH PRIORITY) (6/6)

Unit: 10⁶ m³

Cause of Water Deficit	Reman		Tawar-Muda		Khlong Thepha		Merbok	
	Case A	Case B	Case A	Case B	Case A	Case B	Case A	Case B
<u>1990</u>								
Kedah System								
MADA	81.3	81.3	16.7	16.7	42.1	42.1		
Main minor	1.7	1.7	0.3	0.3	0.9	0.9		
Tributary minor								
D & I								
Sub-total	83.0	83.0	17.0	17.0	43.0	43.0		
Muda-Perai System								
Kedah								
Main minor							3.0	1.0
Tributary minor							4.0	1.0
D & I							2.0	2.0
Pulau Pinang								
Main minor							3.0	3.0
D & I								
Sub-total							12.0	7.0
Total	83.0	83.0	17.0	17.0	43.0	43.0	12.0	7.0
<u>2000</u>								
Kedah System								
MADA	74.4	74.8	17.0	17.1	32.3	32.5		
Main minor	2.0	1.6	0.5	0.4	0.9	0.7		
Tributary minor								
D & I	3.5	3.5	0.8	0.8	1.5	1.5		
Maintenance flow	3.1	3.1	0.7	0.7	1.3	1.3		
Sub-total	83.0	83.0	19.0	19.0	36.0	36.0		
Muda-Perai System								
Kedah								
Main minor							3.0	1.0
Tributary minor							10.0	1.0
D & I							2.0	2.0
Pulau Pinang								
Main minor							3.0	3.0
D & I							5.0	5.0
Sub-total							23.0	12.0
Total	83.0	83.0	19.0	19.0	36.0	36.0	23.0	12.0

Table 12 ESTIMATED AVERAGE PADDY YIELD AND ECONOMIC NET PRODUCTION VALUE

Scheme	Yield (ton/ha)	Gross Pro- duction value (M\$/ha)	Pro- duction Cost (M\$/ha)	Net Production Value (M\$/ha)
1. With Insufficient Irrigation Water Supply				
1.1 MADA				
- Without tertiary development	4.0	2,192	892	1,300
1.2 Rainfed	2.2	1,206	796	410
1.3 Existing minor irrigation	3.2	1,754	844	910
2. With Sufficient Irrigation Water Supply				
2.1 MADA				
- With tertiary development	5.0	2,740	938	1,802
- Without tertiary development	4.0	2,192	892	1,300
2.2 Minor irrigation				
- New projects	4.5	2,466	916	1,550

Remarks; Economic production value is projected to 1995 onward at 1983 constant price.

Table 13 TOTAL ECONOMIC NET PRODUCTION VALUE
IN 2003 ONWARD UNDER WITH- AND WITHOUT-
PROJECT CONDITIONS

Unit: M\$10⁶

	Without Project	With Project	Increment
Kedah River System			
MADA	210.3	331.6	121.3
Minor projects depending on MADA canal/main stream	6.0	9.7	3.7
Minor projects in tributaries	2.7	6.5	3.8
Muda River System			
Minor projects depending on main stream	29.5	50.5	21.0
Minor projects in tributaries	3.7	13.3	9.6

Remark; In 1983 constant price.

Table 14 FLOW OF NET PRODUCTION VALUE WITH- AND WITHOUT-
PROJECT CONDITION FOR THE KEDAH RIVER BASIN

Unit: M\$10⁶

Year	MADA			Main Minor			Tributary Minor		
	W/O	W/P	I/B	W/O	W/P	I/B	W/O	W/P	I/B
1982	210.34	210.34	-	6.02	6.02	-	2.70	2.70	-
1983	210.34	210.34	-	6.02	6.02	-	2.70	2.70	-
1984	210.34	210.34	-	6.02	6.02	-	2.70	2.70	-
1985	210.34	210.34	-	6.02	6.02	-	2.70	2.82	0.12
1986	210.34	210.34	-	6.02	6.02	-	2.70	3.14	0.44
1987	210.34	210.34	-	6.02	6.02	-	2.70	3.19	0.49
1988	210.34	210.34	-	6.02	6.02	-	2.70	3.24	0.54
1989	210.34	210.34	-	6.02	6.02	-	2.70	3.45	0.75
1990	210.34	252.40	42.06	6.02	8.80	2.78	2.70	3.70	1.00
1991	210.34	271.57	61.23	6.02	8.86	2.84	2.70	4.51	1.81
1992	210.34	276.96	66.62	6.02	8.91	2.89	2.70	4.62	1.92
1993	210.34	281.75	71.41	6.02	8.95	2.93	2.70	4.72	2.02
1994	210.34	287.14	76.80	6.02	8.95	2.93	2.70	5.05	2.35
1995	210.34	292.53	82.19	6.02	9.05	3.03	2.70	5.24	2.54
1996	210.34	297.48	87.14	6.02	9.25	3.23	2.70	5.52	2.82
1997	210.34	303.03	92.69	6.02	9.29	3.27	2.70	5.60	2.90
1998	210.34	308.92	98.58	6.02	9.38	3.36	2.70	5.65	2.95
1999	210.34	317.99	107.65	6.02	9.48	3.46	2.70	5.84	3.14
2000	210.34	324.65	114.31	6.02	9.63	3.61	2.70	6.31	3.61
2001	210.34	328.49	118.15	6.02	9.67	3.65	2.70	6.37	3.67
2002	210.34	330.79	120.45	6.02	9.72	3.70	2.70	6.43	3.73
2003	210.34	331.56	121.22	6.02	9.73	3.71	2.70	6.47	3.77
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2032	210.34	331.56	121.22	6.02	9.73	3.71	2.70	6.47	3.77

Remarks; (1) W/O : Without project
W/P : With project
I/B : Incremental net production value
(2) In 1983 constant price.

Table 15 FLOW OF NET PRODUCTION VALUE WITH- AND WITHOUT-
PROJECT CONDITION FOR THE MUDA RIVER BASIN

Unit: M\$10⁶

Year	Main Minor			Tributary Minor		
	W/O	W/P	I/B	W/O	W/P	I/B
1982	30.79	30.79	-	4.20	4.20	-
1983	30.79	30.79	-	4.20	4.20	-
1984	30.79	30.79	-	3.70	3.70	-
1985	30.64	37.69	7.05	3.66	4.48	0.82
1986	30.48	41.61	11.13	3.66	5.30	1.64
1987	30.44	44.21	13.77	3.66	5.47	1.81
1988	30.44	46.86	16.42	3.66	5.65	1.99
1989	29.60	46.11	16.51	3.66	6.90	3.24
1990	29.54	45.80	16.26	3.66	8.29	4.63
1991	29.54	49.74	20.20	3.66	8.58	4.92
1992	29.54	49.81	20.27	3.66	8.85	5.19
1993	29.54	49.85	20.31	3.66	8.99	5.33
1994	29.54	49.86	20.32	3.66	9.54	5.88
1995	29.54	49.92	20.38	3.66	10.12	6.46
1996	29.54	50.02	20.48	3.66	10.90	7.24
1997	29.54	50.04	20.50	3.66	11.10	7.44
1998	29.54	50.06	20.52	3.66	11.23	7.57
1999	29.54	50.19	20.65	3.66	12.31	8.65
2000	29.54	50.37	20.83	3.66	12.77	9.11
2001	29.54	50.51	20.97	3.66	12.98	9.32
2002	29.54	50.55	21.01	3.66	13.18	9.52
2003	29.54	50.57	21.03	3.66	13.28	9.62
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2032	29.54	50.57	21.03	3.66	13.28	9.62

Remarks; (1) W/O : Without project
W/P : With project
I/B : Incremental net production value
(2) In 1983 constant price.

Table 16 DOMESTIC AND INDUSTRIAL WATER SUPPLY BENEFIT
BASED ON ALTERNATIVE FACILITIES COST

Alternative Facilities	Annual Equivalent of Cost (M\$10 ⁶)	For Kedah System		Annual Equivalent of Cost (M\$10 ⁶)	For Muda-Perai System	
		Net Water Output (10 ⁶ m ³)	Benefit (M\$/m ³)		Net Water Output (10 ⁶ m ³)	Benefit (M\$/m ³)
Beris	5.46	66.0	0.08	6.00	24.8	0.24
Tawar-Muda	8.77	37.0	0.24	9.66	16.8	0.58

- Remarks; (1) Benefit is not unit value of raw water but unit value of water deficit met for the purpose of domestic and industrial water supply.
- (2) Based on alternative facilities cost of the source projects.
- (3) In 1983 constant price.

Table 17 CASH FLOW AND PRESENT WORTH OF ADVERSE EFFECT DUE TO TRIBUTARY IRRIGATION AND D & I WATER SUPPLY

YEAR	KEDAH SYSTEM						MUDA-PERAI SYSTEM						TOTAL ADVERSE EFFECT (M\$10 ⁶)
	NET PRODUCTION		PROPORTION OF DE-FIGIT TO DEMAND		ADVERSE EFFECT		NET PRODUCTION		PROPORTION OF DE-FIGIT TO DEMAND		ADVERSE EFFECT		
	MAIN	MINOR	TRIBUTARY	D&I	MINOR	D&I	IN MAIN	MINOR	TRIBUTARY	D&I	MINOR	D&I	
	(M\$10 ⁶) (a)	(M\$10 ⁶) (b)	(%) (c)	(%) (d)	(M\$10 ⁶) (e)	(M\$10 ⁶) (f)	(M\$10 ⁶) (g)	(%) (h)	(%) (i)	(M\$10 ⁶) (j)	(M\$10 ⁶) (k)		
1984	210.34	6.02	0.53	0.33	1.15	0.70	30.79	0.52	0.42	0.16	0.13	2.14	
1985	210.34	6.02	0.53	0.27	1.15	0.59	37.69	0.67	0.47	0.25	0.18	2.17	
1986	210.34	6.02	0.53	0.22	1.16	0.47	41.61	0.82	0.52	0.34	0.21	2.18	
1987	210.34	6.02	0.54	0.16	1.16	0.35	44.21	0.97	0.56	0.43	0.25	2.19	
1988	210.34	6.02	0.54	0.11	1.16	0.23	46.86	1.12	0.61	0.52	0.29	2.21	
1989	210.34	6.02	0.54	0.05	1.17	0.12	46.11	1.27	0.66	0.59	0.30	2.17	
1990	252.40	8.80	0.54	0.00	1.41	0.00	45.80	1.42	0.71	0.65	0.33	2.39	
1991	271.57	8.86	0.64	0.13	1.80	0.35	49.74	1.63	0.89	0.81	0.44	3.41	
1992	276.96	8.91	0.75	0.25	2.13	0.72	49.81	1.84	1.06	0.92	0.53	4.30	
1993	281.75	8.95	0.85	0.38	2.47	1.10	49.85	2.05	1.24	1.02	0.62	5.21	
1994	287.14	8.95	0.95	0.50	2.82	1.49	49.86	2.26	1.41	1.13	0.71	6.14	
1995	292.53	9.05	1.05	0.63	3.18	1.90	49.92	2.48	1.59	1.24	0.79	7.11	
1996	297.48	9.25	1.16	0.76	3.55	2.32	50.02	2.69	1.77	1.34	0.88	8.10	
1997	303.03	9.29	1.26	0.88	3.94	2.75	50.04	2.90	1.94	1.45	0.97	9.11	
1998	308.92	9.38	1.36	1.01	4.34	3.21	50.06	3.11	2.12	1.56	1.06	10.17	
1999	317.99	9.48	1.47	1.13	4.80	3.71	50.19	3.32	2.29	1.67	1.15	11.33	
2000	324.65	9.63	1.57	1.26	5.25	4.21	50.37	3.53	2.47	1.78	1.24	12.48	
2001	328.49	9.67	1.57	1.26	5.31	4.26	50.51	3.53	2.47	1.78	1.25	12.60	
2002	330.79	9.72	1.57	1.26	5.35	4.29	50.55	3.53	2.47	1.78	1.25	12.67	
2003	331.56	9.73	1.57	1.26	5.36	4.30	50.57	3.53	2.47	1.79	1.25	12.69	
2010	331.56	9.73	1.57	1.26	5.36	4.30	50.57	3.53	2.47	1.79	1.25	12.69	
2011	331.56	9.73	1.57	1.26	5.36	4.30	50.57	3.53	2.47	1.79	1.25	12.69	
2032	331.56	9.73	1.57	1.26	5.36	4.30	50.57	3.53	2.47	1.79	1.25	12.69	
2033	331.56	9.73	1.57	1.26	5.36	4.30	50.57	3.53	2.47	1.79	1.25	12.69	
NPV(6%)	4389.43	131.56			50.82	34.49	742.28			17.74	11.80	114.85	
NPV(8%)	3296.06	98.94			35.32	22.87	566.93			12.40	8.16	78.75	
NPV(10%)	2592.64	77.87			25.78	15.89	452.42			9.08	5.91	56.67	
NPV(12%)	2115.01	63.50			19.61	11.51	373.45			6.91	4.45	42.49	
NPV(14%)	1775.32	53.25			15.45	8.65	316.40			5.43	3.46	32.99	
NPV(16%)	1524.09	45.65			12.52	6.71	273.59			4.38	2.77	26.38	
NPV(18%)	1332.14	39.83			10.40	5.35	240.42			3.61	2.27	21.64	

Table 18 NATIONAL ECONOMIC CONVERSION FACTORS

Category	Factor
Opportunity Cost of Capital	0.10
General Conversion Factor	0.89
Rubber	1.22
Agricultural inputs	0.86
Port handling	0.72
Transport services	0.66
Construction services	0.77
Construction materials	0.88
Transport equipment	0.76
Power and fuel	0.97
Public services	0.89

Source: National Parameters for Project Appraisal in Malaysia Vol. 1 to Vol. V; The Opportunity Cost of Labour (in Peninsular Malaysia) Vol. III; Conversion Factors for Tradeable and Non-tradeable Goods and Services, Economic Planning Unit, Prime Minister's Department.

Table 19 ECONOMIC COST OF BERIS DAM

Items	Financial Cost (M\$10 ³)	Conversion Factor	Economic Cost (M\$10 ³)
1. Investment Cost			
River Diversion	2,150	0.88	1,890
Main Dam			
Excavation and concrete	8,480	0.88	7,460
Grouting	1,520	0.77	1,170
Sub total	10,000		8,630
Stilling Basin	710	0.88	620
River Outlet			
Concrete	105	0.88	90
Mechanical works			
Equipment	1,165	0.88	1,030
Sub total	1,400		1,220
Saddle Dam			
Excavation and embankment	2,802	0.88	2,470
	1,568	0.77	
Sub total	4,370		3,680
Relocation Road	7,230	0.89	6,440
Preparatory Works	4,040	0.88	3,560
Compensation ^{/1}	4,360	0.89	3,880
Engineering Services and Government Administration (Design and Supervision)	8,400	0.77	6,470
Contingency ^{/2}	8,530		7,280
Total	51,190		43,670
2. Annual Operation and Maintenance (O & M) Cost			
Personnel expenses	95	0.77	73
Administration and maintenance	65	0.88	57
Total	160		130

Remarks; /1 : Excluding land acquisition cost
/2 : Excluding price escalation

Table 20 ESTIMATED PRODUCTION FORGONE IN
THE PROPOSED BERIS RESERVOIR AREA

Unit: M\$10³

Item	Maximum Water Level (El. m)			
	79.5	85.5	87.7	90.5
1. Paddy	12	21	24	29
2. Rubber	310	558	639	771
3. Mixed Horticulture	12	22	26	30
4. Alienated Forest	20	79	91	109
5. Unalienated Forest	8	16	19	22
Total	362	696	799	961

Remark;

NET PRODUCTION VALUE

Unit: M\$/ha

Item	Amount
Paddy	170
Rubber	1,300
Mixed Horticulture	100
Forest : Alienated	650
Unalienated	33

Table 21

ECONOMIC INVESTMENT COST, ANNUAL COST
AND PRODUCTION FORGONE OF JENIANG
SYSTEM, PROPOSED DAMS AND POTENTIAL DAMS

	Investment Cost (M\$10 ⁶)	Annual Cost + Production Forgone (M\$10 ⁶ /y)
Jeniang system	60.13	0.66
Beris dam	43.67	0.93
Tawar-Muda dam	78.68	0.89
Khlong Thepha dam	72.00	1.40
Reman dam	65.10	4.75
Merbok scheme (High)	99.77	1.40
(Low)	79.82	1.12

Remarks; (1): Values at the optimum scale

(2): In 1983 constant price

Table 22 COST STREAM AND PRESENT WORTH OF SOURCE FACILITY

Unit: M\$10⁶

YEAR	JENIANG SYSTEM	BERIS DAM	T-MUDA DAM	KHLONG- THEPHA DAM	REMAN DAM	MERBOK RESERVOIR (HIGH)	(LOW)
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.70	0.70	0.00	0.00	0.00	0.00
1986	1.73	1.50	1.50	3.60	2.31	0.00	0.00
1987	22.88	15.26	18.33	7.20	1.54	14.97	11.98
1988	20.42	12.17	33.23	21.60	12.98	29.93	23.94
1989	15.10	14.04	20.50	21.60	26.68	29.93	23.94
1990	0.67	0.93	4.42	18.00	21.59	24.94	19.95
1991	0.64	0.93	0.89	1.40	4.75	1.40	1.12
1992	0.64	0.93	0.89	1.40	4.75	1.40	1.12
1993	0.64	0.93	0.89	1.40	4.75	1.40	1.12
1994	0.66	0.93	0.89	1.40	4.75	1.40	1.12
1995	0.65	0.93	0.89	1.40	4.75	1.40	1.12
1996	0.65	0.93	0.89	1.40	4.75	1.40	1.12
1997	0.65	0.93	0.89	1.40	4.75	1.40	1.12
1998	0.69	0.93	0.89	1.40	4.75	1.40	1.12
1999	0.67	0.93	0.89	1.40	4.75	1.40	1.12
2000	0.66	0.93	0.89	1.40	4.75	1.40	1.12
2001	0.66	0.93	0.89	1.40	4.75	1.40	1.12
2002	0.66	0.93	0.89	1.40	4.75	1.40	1.12
2003	0.66	0.93	0.89	1.40	4.75	1.40	1.12
2010	0.66	1.73	2.77	1.40	4.75	2.21	1.77
2011	0.66	0.93	0.89	1.40	4.75	1.40	1.12
2032	0.66	0.93	0.89	1.40	4.75	1.40	1.12
2033	0.66	0.93	0.89	1.40	4.75	1.40	1.12
NPV(6%)	52.61	43.21	68.07	66.32	94.38	86.33	69.06
NPV(8%)	46.60	37.32	59.87	56.80	74.59	74.73	59.78
NPV(10%)	41.78	32.84	53.33	49.53	60.96	65.63	52.50
NPV(12%)	37.76	29.28	47.93	43.72	51.04	58.22	46.57
NPV(14%)	34.33	26.34	43.35	38.93	43.51	52.02	41.61
NPV(16%)	31.34	23.86	39.40	34.89	37.59	46.73	37.38
NPV(18%)	28.72	21.73	35.95	31.44	32.81	42.17	33.73

Table 23 COST STREAM AND PRESENT WORTH OF IRRIGATION DIRECT FACILITY

Unit: M\$10⁶

YEAR	KEDAH			MUDA	
	MADA MAIN	MAIN MINOR	TRIBU- TARY MINOR	MAIN MINOR	TRIBU- TARY MINOR
1984	20.88	0.00	0.81	2.45	3.94
1985	21.17	0.00	0.30	1.14	2.19
1986	24.45	0.25	0.30	1.58	0.36
1987	31.82	0.34	0.76	3.96	0.66
1988	39.16	0.25	0.79	4.09	0.66
1989	42.65	0.01	0.41	2.07	0.40
1990	43.24	0.01	0.05	0.27	0.18
1991	43.83	0.01	0.44	1.22	0.18
1992	44.42	0.15	0.86	2.66	0.18
1993	47.47	0.46	1.27	3.89	0.18
1994	51.01	0.50	0.95	3.01	0.18
1995	54.54	0.29	0.54	1.54	0.18
1996	57.67	0.44	0.41	1.92	0.24
1997	50.03	0.72	1.10	3.93	0.33
1998	33.99	0.64	1.20	3.93	0.33
1999	17.95	0.20	0.72	2.01	0.26
2000	9.94	0.06	0.15	0.58	0.19
2001	9.94	0.06	0.15	0.58	0.19
2002	9.94	0.06	0.15	0.58	0.19
2003	9.94	0.06	0.15	0.58	0.19
2010	9.94	0.06	0.15	0.58	0.19
2011	9.94	0.06	0.15	0.58	0.19
2032	9.94	0.06	0.15	0.58	0.19
2033	9.94	0.06	0.15	0.58	0.19
NPV(6%)	433.27	2.65	7.37	27.70	9.46
NPV(8%)	358.28	2.12	6.13	23.18	8.55
NPV(10%)	302.71	1.74	5.21	19.83	7.88
NPV(12%)	260.02	1.45	4.50	17.26	7.37
NPV(14%)	226.30	1.22	3.95	15.22	6.96
NPV(16%)	199.11	1.04	3.50	13.57	6.62
NPV(18%)	176.81	0.90	3.14	12.21	6.32

Table 24 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT
PLAN ASSUMING JENIANG OPERATION OF ALTERNATIVE 1 (1/8)

Unit: M\$10⁶

	6%	NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE					
		8%	10%	12%	14%	16%	18%
** JENIANG **							
BENEFIT							
KEDAH: TRIBUTARY MINOR	34.66	23.66	16.91	12.53	9.57	7.51	6.01
D & I	32.83	22.22	15.81	11.75	9.06	7.23	5.93
ADVERSE LOSS DUE TO TRIBUTARY	-50.82	-35.32	-25.78	-19.61	-15.45	-12.52	-10.40
ADVERSE LOSS DUE TO D & I	-34.49	-22.87	-15.89	-11.51	-8.65	-6.71	-5.35
MADA MAIN	537.22	355.06	244.54	174.32	127.87	96.07	73.64
MAIN MINOR	20.41	14.08	10.12	7.52	5.75	4.49	3.57
MUDA: TRIBUTARY MINOR	93.17	64.65	46.95	35.41	27.54	21.98	17.92
D & I	39.24	27.32	19.95	15.16	11.92	9.63	7.97
ADVERSE LOSS DUE TO TRIBUTARY	-17.74	-12.40	-9.08	-6.91	-5.43	-4.38	-3.61
ADVERSE LOSS DUE TO D & I	-11.80	-8.16	-5.91	-4.45	-3.46	-2.77	-2.27
MAIN MINOR	234.10	175.44	137.20	110.90	91.97	77.83	66.93
*TOTAL BENEFIT	876.78	603.70	434.82	325.11	250.69	198.36	160.34
COST							
JENIANG SYSTEM	52.61	46.60	41.78	37.76	34.33	31.34	28.72
KEDAH: TRIBUTARY MINOR	7.37	6.13	5.21	4.50	3.95	3.50	3.14
MADA MAIN	433.27	358.28	302.71	260.02	226.30	199.11	176.81
MAIN MINOR	2.65	2.12	1.74	1.45	1.22	1.04	0.90
MUDA: TRIBUTARY MINOR	9.46	8.55	7.88	7.37	6.96	6.62	6.32
MAIN MINOR	27.70	23.18	19.83	17.26	15.22	13.57	12.21
*TOTAL COST	533.06	444.86	379.15	328.36	287.98	255.18	228.10
**TOTAL B-C	343.72	158.84	55.67	-3.25	-37.29	-56.82	-67.76
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	876.78	603.70	434.82	325.11	250.69	198.36	160.34
KEDAH: BERIS MADA MAIN	112.83	77.71	55.70	41.21	31.29	24.26	19.13
BERIS MAIN MINOR	3.41	2.36	1.70	1.26	0.96	0.75	0.59
MUDA: BERIS MAIN MINOR	36.90	24.82	17.38	12.58	9.35	7.11	5.51
*TOTAL BENEFIT	1029.92	708.59	509.60	380.16	292.29	230.48	185.57
COST							
COST FOR JENIANG	533.06	444.86	379.15	328.36	287.98	255.18	228.10
COST FOR BERIS DAM	43.21	37.32	32.84	29.28	26.34	23.86	21.73
*TOTAL COST	576.27	482.18	411.99	357.64	314.32	279.04	249.83
**TOTAL B-C	453.65	226.41	97.61	22.52	-22.03	-48.56	-64.26
** JENIANG + BERIS + REMAN **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1029.92	708.59	509.60	380.16	292.29	230.48	185.57
KEDAH: REMAN MADA MAIN	238.04	161.78	114.47	83.70	62.85	48.24	37.69
REMAN MAIN MINOR	7.17	4.90	3.48	2.56	1.93	1.49	1.17
*TOTAL BENEFIT	1275.13	875.27	627.55	466.42	357.07	280.21	224.43
COST							
COST FOR JENIANG & BERIS	576.27	482.18	411.99	357.64	314.32	279.04	249.83
COST FOR REMAN DAM	94.38	74.59	60.96	51.04	43.51	37.59	32.81
*TOTAL COST	670.65	556.77	472.95	408.68	357.83	316.63	282.64
**TOTAL B-C	604.48	318.50	154.60	57.74	-0.76	-36.42	-58.21
** JENIANG + BERIS + REMAN + KILONG THEPHA **							
BENEFIT							
BENEFIT OF JENIANG, BERIS & REMAN	1275.13	875.27	627.55	466.42	357.07	280.21	224.43
KEDAH: K.THEPHA MADA MAIN	107.49	73.32	52.07	38.20	28.77	22.15	17.35
K.THEPHA MAIN MINOR	3.24	2.22	1.59	1.17	0.86	0.68	0.08
*TOTAL BENEFIT	1385.86	950.81	681.21	505.79	386.72	303.04	241.86
COST							
COST FOR JENIANG, BERIS & REMAN	670.65	556.77	472.95	408.68	357.83	316.63	282.64
COST FOR K.THEPHA	66.32	56.80	49.53	43.72	38.93	34.89	31.44
*TOTAL COST	736.97	613.57	522.48	452.40	396.76	351.52	314.08
**TOTAL B-C	648.89	337.24	158.73	53.39	-10.04	-48.48	-72.22

REMARKS: IN 1983 CONSTANT PRICE.

Table 25 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT
PLAN ASSUMING JENIANG OPERATION OF ALTERNATIVE 2 (2/8)

Unit: M\$10⁶

** JENIANG **	NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE						
	6%	8%	10%	12%	14%	16%	18%
BENEFIT							
KEDAH: TRIBUTARY MINOR	34.66	23.68	16.91	12.53	9.57	7.51	6.01
D & I	32.83	22.22	15.81	11.75	9.06	7.23	5.93
ADVERSE LOSS DUE TO TRIBUTARY	-30.82	-35.32	-25.78	-19.61	-15.45	-12.52	-10.40
ADVERSE LOSS DUE TO D & I	-34.49	-22.87	-15.89	-11.51	-8.65	-6.71	-5.35
MADA MAIN	537.22	355.06	244.54	174.32	127.87	96.07	73.64
MAIN MINOR	20.41	14.08	10.12	7.52	5.75	4.49	3.57
MUDA: TRIBUTARY MINOR	93.17	64.65	46.95	35.41	27.54	21.98	17.92
D & I	39.24	27.32	19.95	15.16	11.92	9.63	7.97
ADVERSE LOSS DUE TO TRIBUTARY	-17.74	-12.40	-9.08	-6.91	-5.43	-4.38	-3.61
ADVERSE LOSS DUE TO D & I	-11.80	-8.16	-5.91	-4.45	-3.46	-2.77	-2.27
MAIN MINOR	234.10	175.44	137.20	110.90	91.97	77.83	66.93
*TOTAL BENEFIT	876.78	603.70	434.82	325.11	250.69	198.36	160.34
COST							
JENIANG SYSTEM	52.61	46.60	41.28	37.26	34.33	31.34	28.72
KEDAH: TRIBUTARY MINOR	7.37	6.13	5.21	4.50	3.95	3.50	3.14
MADA MAIN	433.27	358.28	302.71	260.02	226.30	199.11	176.81
MAIN MINOR	2.65	2.12	1.74	1.45	1.22	1.04	0.90
MUDA: TRIBUTARY MINOR	9.46	8.55	7.88	7.37	6.96	6.62	6.32
MAIN MINOR	27.70	23.18	19.83	17.26	15.22	13.57	12.21
*TOTAL COST	533.06	444.86	379.15	328.36	287.98	255.18	228.10
**TOTAL B-C	343.72	158.84	55.67	-3.25	-37.29	-56.82	-67.76
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	876.78	603.70	434.82	325.11	250.69	198.36	160.34
KEDAH: BERIS MADA MAIN	119.05	81.81	58.50	43.20	32.74	25.34	19.95
BERIS MAIN MINOR	3.60	2.48	1.79	1.32	1.01	0.78	0.62
MUDA: BERIS MAIN MINOR	32.33	21.78	15.27	11.07	8.25	6.28	4.87
*TOTAL BENEFIT	1031.76	709.77	510.38	380.70	292.69	230.76	185.78
COST							
COST FOR JENIANG	533.06	444.86	379.15	328.36	287.98	255.18	228.10
COST FOR BERIS DAM	43.21	37.32	32.84	29.28	26.34	23.86	21.73
*TOTAL COST	576.27	482.18	411.99	357.64	314.32	279.04	249.83
**TOTAL B-C	455.49	227.59	98.39	23.06	-21.63	-48.28	-64.05
** JENIANG + BERIS + REMAN **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1031.76	709.77	510.38	380.70	292.69	230.76	185.78
KEDAH: REMAN MADA MAIN	210.59	144.10	102.64	75.51	57.03	44.00	34.54
REMAN MAIN MINOR	6.35	4.37	3.13	2.31	1.75	1.36	1.07
*TOTAL BENEFIT	1248.70	858.24	616.15	458.52	351.47	276.12	221.39
COST							
COST FOR JENIANG & BERIS	576.27	482.18	411.99	357.64	314.32	279.04	249.83
COST FOR REMAN DAM	94.38	74.59	60.96	51.04	43.51	37.59	32.81
*TOTAL COST	670.65	556.77	472.95	408.68	357.83	316.63	282.64
**TOTAL B-C	578.05	301.47	143.20	49.84	-6.36	-40.51	-61.25

REMARKS: IN 1983 CONSTANT PRICE.

Table 26 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT
PLAN ASSUMING JENIANG OPERATION OF ALTERNATIVE 3 (3/8)

Unit: M\$106

	NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE						
	6%	8%	10%	12%	14%	16%	18%
** JENIANG **							
BENEFIT							
KEDAH: TRIBUTARY MINOR	34.66	23.68	16.91	12.53	9.57	7.51	6.01
D & I	32.83	22.22	15.81	11.75	9.06	7.23	5.93
ADVERSE LOSS DUE TO TRIBUTARY	-50.82	-35.32	-25.78	-19.61	-15.45	-12.52	-10.40
ADVERSE LOSS DUE TO D & I	-34.49	-22.87	-15.89	-11.51	-8.65	-6.71	-5.35
MADA MAIN	541.21	357.63	246.26	175.51	128.72	96.69	74.10
MAIN MINOR	20.53	14.16	10.17	7.56	5.77	4.51	3.58
MUDA: TRIBUTARY MINOR	33.17	22.32	15.95	11.92	9.63	7.97	6.51
D & I	39.24	27.32	19.95	15.16	11.92	9.63	7.97
ADVERSE LOSS DUE TO TRIBUTARY	-17.74	-12.40	-9.08	-6.91	-5.43	-4.38	-3.61
ADVERSE LOSS DUE TO D & I	-11.80	-8.16	-5.91	-4.45	-3.46	-2.77	-2.27
MAIN MINOR	234.10	175.44	137.20	110.90	91.97	77.83	66.93
*TOTAL BENEFIT	880.89	606.35	436.59	326.34	251.56	199.00	160.81
COST							
JENIANG SYSTEM	52.61	46.60	41.78	37.76	34.33	31.34	28.72
KEDAH: TRIBUTARY MINOR	7.37	6.13	5.21	4.50	3.95	3.50	3.14
MADA MAIN	433.27	358.28	302.71	260.02	226.30	199.11	176.81
MAIN MINOR	2.65	2.12	1.74	1.45	1.22	1.04	0.90
MUDA: TRIBUTARY MINOR	9.46	8.55	7.88	7.37	6.96	6.62	6.32
MAIN MINOR	27.70	23.18	19.83	17.26	15.22	13.57	12.21
*TOTAL COST	533.06	444.86	379.15	328.36	287.98	255.18	228.10
**TOTAL B-C	347.83	161.49	57.44	-2.02	-36.42	-56.18	-67.29
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	880.89	606.35	436.59	326.34	251.56	199.00	160.81
KEDAH: BERIS MADA MAIN	162.76	110.72	78.42	57.39	43.13	33.13	25.90
BERIS MAIN MINOR	4.90	3.35	2.39	1.75	1.32	1.02	0.80
MUDA: BERIS MAIN MINOR	0.90	0.90	0.90	0.90	0.90	0.90	0.90
*TOTAL BENEFIT	1048.55	720.42	517.40	385.48	296.01	233.15	187.51
COST							
COST FOR JENIANG	533.06	444.86	379.15	328.36	287.98	255.18	228.10
COST FOR BERIS DAM	43.21	37.32	32.84	29.28	26.34	23.66	21.73
*TOTAL COST	576.27	482.18	411.99	357.64	314.32	279.04	249.83
**TOTAL B-C	472.28	238.24	105.41	27.84	-18.31	-45.89	-62.32
** JENIANG + BERIS + REMAN **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1048.55	720.42	517.40	385.48	296.01	233.15	187.51
KEDAH: REMAN MADA MAIN	207.34	141.43	100.42	73.67	55.49	42.71	33.46
REMAN MAIN MINOR	6.25	4.29	3.06	2.25	1.71	1.32	1.04
*TOTAL BENEFIT	1262.14	866.14	620.88	461.40	353.21	277.18	222.01
COST							
COST FOR JENIANG & BERIS	576.27	482.18	411.99	357.64	314.32	279.04	249.83
COST FOR REMAN DAM	94.38	74.59	60.96	51.04	43.51	37.59	32.81
*TOTAL COST	670.65	556.77	472.95	408.68	357.83	316.63	282.64
**TOTAL B-C	591.49	309.37	147.93	52.72	-4.62	-39.45	-60.63

REMARKS: IN 1983 CONSTANT PRICE.

Table 27 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT
PLAN ASSUMING JENIANG OPERATION OF ALTERNATIVE 1 (4/8)

Unit: M\$10⁶

		NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE						
		6%	8%	10%	12%	14%	16%	18%
** JENIANG **								
BENEFIT								
KEDAH: TRIBUTARY MINOR		34.66	23.68	16.91	12.53	9.57	7.51	6.01
D & I		32.83	22.22	15.81	11.75	9.06	7.23	5.93
ADVERSE LOSS DUE TO TRIBUTARY		-50.82	-35.52	-25.78	-19.61	-15.45	-12.52	-10.40
ADVERSE LOSS DUE TO D & I		-34.49	-22.87	-15.89	-11.51	-8.65	-6.71	-5.35
MADA MAIN		537.22	355.06	244.54	174.32	127.87	96.07	73.64
MAIN MINOR		20.41	14.08	10.12	7.52	5.75	4.49	3.57
MUDA: TRIBUTARY MINOR		93.17	64.65	46.95	35.41	27.54	21.98	17.92
D & I		39.24	27.32	19.95	15.16	11.92	9.63	7.97
ADVERSE LOSS DUE TO TRIBUTARY		-17.74	-12.40	-9.08	-6.91	-5.43	-4.38	-3.61
ADVERSE LOSS DUE TO D & I		-11.80	-8.16	-5.91	-4.45	-3.46	-2.77	-2.27
MAIN MINOR		234.10	175.44	137.20	110.90	91.97	77.83	66.93
*TOTAL BENEFIT		876.78	603.70	434.82	325.11	250.69	198.36	160.34
COST								
JENIANG SYSTEM		52.61	46.60	41.78	37.76	34.33	31.34	28.72
KEDAH: TRIBUTARY MINOR		7.37	6.13	5.21	4.50	3.95	3.50	3.14
MADA MAIN		433.27	358.28	302.71	260.02	226.30	199.11	176.81
MAIN MINOR		2.65	2.12	1.74	1.45	1.22	1.04	0.90
MUDA: TRIBUTARY MINOR		9.46	8.55	7.88	7.37	6.96	6.62	6.32
MAIN MINOR		27.70	23.18	19.83	17.26	15.22	13.57	12.21
*TOTAL COST		533.06	444.86	379.15	328.36	287.98	255.18	228.10
**TOTAL B-C		343.72	158.84	55.67	-3.25	-37.29	-56.82	-67.76
** JENIANG + BERIS **								
BENEFIT								
BENEFIT OF JENIANG		876.78	603.70	434.82	325.11	250.69	198.36	160.34
KEDAH: BERIS MADA MAIN		112.83	77.71	55.70	41.21	31.29	24.26	19.13
BERIS MAIN MINOR		3.41	2.36	1.70	1.26	0.96	0.75	0.59
MUDA: BERIS MAIN MINOR		36.90	24.82	17.38	12.58	9.35	7.11	5.51
*TOTAL BENEFIT		1029.92	708.59	509.60	380.16	292.29	230.48	185.57
COST								
COST FOR JENIANG		533.06	444.86	379.15	328.36	287.98	255.18	228.10
COST FOR BERIS DAM		43.21	37.32	32.84	29.28	26.34	23.86	21.73
*TOTAL COST		576.27	482.18	411.99	357.64	314.32	279.04	249.83
**TOTAL B-C		453.65	226.41	97.61	22.52	-22.03	-48.56	-64.26
** JENIANG + BERIS + T.MUDA **								
BENEFIT								
BENEFIT OF JENIANG & BERIS		1029.92	708.59	509.60	380.16	292.29	230.48	185.57
KEDAH: T.MUDA MADA MAIN		55.27	37.40	26.35	19.19	14.36	10.98	8.55
T.MUDA MAIN MINOR		1.66	1.13	0.80	0.59	0.44	0.34	0.26
*TOTAL BENEFIT		1086.85	747.12	536.75	399.94	307.09	241.80	194.38
COST								
COST FOR JENIANG & BERIS		576.27	482.18	411.99	357.64	314.32	279.04	249.83
COST FOR T.MUDA DAM		68.07	59.87	53.33	47.93	43.35	39.40	35.95
*TOTAL COST		644.34	542.05	465.32	405.57	357.67	318.44	285.78
**TOTAL B-C		442.51	205.07	71.43	-5.63	-50.58	-76.64	-91.40

REMARKS: IN 1983 CONSTANT PRICE.

Table 28 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT
PLAN ASSUMING JENIANG OPERATION OF ALTERNATIVE 3 (5/8)

Unit: M\$10⁶

	NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE						
	6%	8%	10%	12%	14%	16%	18%
** JENIANG **							
BENEFIT							
KEDAH: TRIBUTARY MINOR	34.66	23.68	16.91	12.53	9.57	7.51	6.01
D & I	32.83	22.22	15.81	11.75	9.06	7.23	5.93
ADVERSE LOSS DUE TO TRIBUTARY	-50.82	-35.32	-25.78	-19.61	-15.45	-12.52	-10.40
ADVERSE LOSS DUE TO D & I	-34.49	-22.87	-15.89	-11.51	-8.65	-6.71	-5.35
MADA MAIN	541.21	357.63	246.26	175.51	128.72	96.69	74.10
MAIN MINOR	20.53	14.16	10.17	7.56	5.77	4.51	3.58
MUDA: TRIBUTARY MINOR	93.17	64.65	46.95	35.41	27.54	21.98	17.92
D & I	39.24	27.32	19.95	15.16	11.92	9.63	7.97
ADVERSE LOSS DUE TO TRIBUTARY	-17.74	-12.40	-9.08	-6.91	-5.43	-4.38	-3.61
ADVERSE LOSS DUE TO D & I	-11.80	-8.16	-5.91	-4.45	-3.46	-2.77	-2.27
MAIN MINOR	234.10	175.44	137.20	110.90	91.97	77.83	66.93
*TOTAL BENEFIT	880.89	606.35	436.59	326.34	251.56	199.00	160.81
COST							
JENIANG SYSTEM	52.61	46.60	41.78	37.76	34.33	31.34	28.72
KEDAH: TRIBUTARY MINOR	7.37	6.13	5.21	4.50	3.95	3.50	3.14
MADA MAIN	433.27	358.28	302.71	260.02	226.30	199.11	176.81
MAIN MINOR	2.65	2.12	1.74	1.45	1.22	1.04	0.90
MUDA: TRIBUTARY MINOR	9.46	8.55	7.88	7.37	6.96	6.62	6.32
MAIN MINOR	27.70	23.18	19.83	17.26	15.22	13.57	12.21
*TOTAL COST	533.06	444.86	379.15	328.36	287.98	255.18	228.10
**TOTAL B-C	347.83	161.49	57.44	-2.02	-36.42	-56.18	-67.29
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	880.89	606.35	436.59	326.34	251.56	199.00	160.81
KEDAH: BERIS MADA MAIN	162.76	110.72	78.42	57.39	43.13	33.13	25.90
BERIS MAIN MINOR	4.90	3.35	2.39	1.75	1.32	1.02	0.80
MUDA: BERIS MAIN MINOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
*TOTAL BENEFIT	1048.55	720.42	517.40	385.48	296.01	233.15	187.51
COST							
COST FOR JENIANG	533.06	444.86	379.15	328.36	287.98	255.18	228.10
COST FOR BERIS DAM	43.21	37.32	32.84	29.28	26.34	23.86	21.73
*TOTAL COST	576.27	482.18	411.99	357.64	314.32	279.04	249.83
**TOTAL B-C	472.28	238.24	105.41	27.84	-18.31	-45.89	-62.32
** JENIANG + BERIS + T.MUDA **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1048.55	720.42	517.40	385.48	296.01	233.15	187.51
KEDAH: T.MUDA MADA MAIN	46.49	31.56	22.31	16.30	12.23	9.38	7.32
T.MUDA MAIN MINOR	1.40	0.96	0.68	0.50	0.38	0.29	0.23
*TOTAL BENEFIT	1096.44	752.94	540.39	402.28	308.62	242.82	195.06
COST							
COST FOR JENIANG & BERIS	576.27	482.18	411.99	357.64	314.32	279.04	249.83
COST FOR T.MUDA DAM	68.07	59.87	53.33	47.93	43.35	39.40	35.95
*TOTAL COST	644.34	542.05	465.32	405.57	357.67	318.44	285.78
**TOTAL B-C	452.10	210.89	75.07	-3.29	-49.05	-75.62	-90.72

REMARKS: IN 1983 CONSTANT PRICE.

Table 29 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT
PLAN ASSUMING JENIANG OPERATION OF ALTERNATIVE 1 (6/8)

Unit: M\$10⁶

		NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE						
		6%	8%	10%	12%	14%	16%	18%
** JENIANG **								
BENEFIT								
KEDAH: TRIBUTARY MINOR		34.66	23.68	16.91	12.53	9.57	7.51	6.01
D & I		32.83	22.22	15.81	11.75	9.06	7.23	5.93
ADVERSE LOSS DUE TO TRIBUTARY		-50.82	-35.32	-25.78	-19.61	-15.45	-12.52	-10.40
ADVERSE LOSS DUE TO D & I		-34.49	-22.87	-15.89	-11.51	-8.65	-6.71	-5.35
MADA MAIN		537.22	355.06	244.54	174.32	127.87	96.07	73.64
MAIN MINOR		20.41	14.08	10.12	7.52	5.75	4.49	3.57
MUDA: TRIBUTARY MINOR		93.17	64.65	46.95	35.41	27.54	21.98	17.92
D & I		39.24	27.32	19.95	15.16	11.92	9.63	7.97
ADVERSE LOSS DUE TO TRIBUTARY		-17.74	-12.40	-9.08	-6.91	-5.43	-4.38	-3.61
ADVERSE LOSS DUE TO D & I		-11.80	-8.16	-5.91	-4.45	-3.46	-2.77	-2.27
MAIN MINOR		234.10	175.44	137.20	110.90	91.97	77.83	66.93
*TOTAL BENEFIT		876.78	603.70	434.82	325.11	250.69	198.36	160.34
COST								
JENIANG SYSTEM		52.61	46.60	41.78	37.76	34.33	31.34	28.72
KEDAH: TRIBUTARY MINOR		7.37	6.13	5.21	4.50	3.95	3.50	3.14
MADA MAIN		433.27	358.28	302.71	260.02	226.30	199.11	176.81
MAIN MINOR		2.65	2.12	1.74	1.45	1.22	1.04	0.90
MUDA: TRIBUTARY MINOR		9.46	8.55	7.88	7.37	6.96	6.62	6.32
MAIN MINOR		27.70	23.18	19.83	17.26	15.22	13.57	12.21
*TOTAL COST		533.06	444.86	379.15	328.36	287.98	255.18	228.10
**TOTAL B-C		343.72	158.84	55.67	-3.25	-37.29	-56.82	-67.76
** JENIANG + BERIS **								
BENEFIT								
BENEFIT OF JENIANG		876.78	603.70	434.82	325.11	250.69	198.36	160.34
KEDAH: BERIS MADA MAIN		112.83	77.71	55.70	41.21	31.29	24.26	19.13
BERIS MAIN MINOR		3.41	2.36	1.70	1.26	0.96	0.75	0.59
MUDA: BERIS MAIN MINOR		36.90	24.82	17.38	12.58	9.35	7.11	5.51
*TOTAL BENEFIT		1029.92	708.59	509.60	380.16	292.29	230.48	185.57
COST								
COST FOR JENIANG		533.06	444.86	379.15	328.36	287.98	255.18	228.10
COST FOR BERIS DAM		43.21	37.32	32.84	29.28	26.34	23.86	21.73
*TOTAL COST		576.27	482.18	411.99	357.64	314.32	279.04	249.83
**TOTAL B-C		453.65	226.41	97.61	22.52	-22.03	-48.56	-64.26
** JENIANG + BERIS + K.THEPBA **								
BENEFIT								
BENEFIT OF JENIANG & BERIS		1029.92	708.59	509.60	380.16	292.29	230.48	185.57
KEDAH: K.THEPBA MADA MAIN		107.49	73.32	52.07	38.20	28.77	22.15	17.35
K.THEPBA MAIN MINOR		3.24	2.22	1.59	1.17	0.88	0.68	0.08
*TOTAL BENEFIT		1140.65	784.13	563.26	419.53	321.94	253.31	203.00
COST								
COST FOR JENIANG & BERIS		576.27	482.18	411.99	357.64	314.32	279.04	249.83
COST FOR K.THEPBA DAM		66.32	56.80	49.53	43.72	38.93	34.89	31.44
*TOTAL COST		642.59	538.98	461.52	401.36	353.25	313.93	281.27
**TOTAL B-C		498.06	245.15	101.74	18.17	-31.31	-60.62	-78.27

REMARKS: IN 1983 CONSTANT PRICE.

Table 30 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT
PLAN ASSUMING JENIANG OPERATION OF ALTERNATIVE 3 (7/8)

Unit: M\$10⁶

	NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE						
	6%	8%	10%	12%	14%	16%	18%
** JENIANG **							
BENEFIT							
KEDAH: TRIBUTARY MINOR	34.66	23.68	16.91	12.53	9.57	7.51	6.01
D & I	32.83	22.22	15.61	11.75	9.06	7.23	5.93
ADVERSE LOSS DUE TO TRIBUTARY	-50.82	-35.32	-25.78	-19.61	-15.45	-12.52	-10.40
ADVERSE LOSS DUE TO D & I	-34.49	-22.87	-15.89	-11.51	-8.65	-6.71	-5.35
MADA MAIN	541.21	357.63	246.26	175.51	128.72	96.69	74.10
MAIN MINOR	20.53	14.16	10.17	7.56	5.77	4.51	3.58
MUDA: TRIBUTARY MINOR	93.17	64.65	46.95	35.41	27.54	21.98	17.92
D & I	39.74	27.32	19.95	15.16	11.92	9.63	7.97
ADVERSE LOSS DUE TO TRIBUTARY	-17.74	-12.40	-9.08	-6.91	-5.43	-4.38	-3.61
ADVERSE LOSS DUE TO D & I	-11.80	-8.16	-5.91	-4.45	-3.46	-2.77	-2.27
MAIN MINOR	234.10	175.44	137.20	110.90	91.97	77.83	66.93
*TOTAL BENEFIT	880.89	606.35	436.59	326.34	251.56	199.00	160.81
COST							
JENIANG SYSTEM	52.61	46.60	41.78	37.76	34.33	31.34	28.72
KEDAH: TRIBUTARY MINOR	7.37	6.13	5.21	4.50	3.95	3.50	3.14
MADA MAIN	433.27	358.29	302.71	260.02	226.30	199.11	176.81
MAIN MINOR	2.65	2.12	1.74	1.45	1.22	1.04	0.90
MUDA: TRIBUTARY MINOR	9.46	8.55	7.88	7.37	6.96	6.62	6.32
MAIN MINOR	27.70	23.18	19.83	17.26	15.22	13.57	12.21
*TOTAL COST	533.06	444.86	379.15	328.36	287.98	255.18	228.10
**TOTAL B-C	347.83	161.49	57.44	-2.02	-36.42	-56.18	-67.29
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	880.89	606.35	436.59	326.34	251.56	199.00	160.81
KEDAH: BERIS MADA MAIN	162.76	110.72	78.42	57.39	43.13	33.13	25.90
BERIS MAIN MINOR	4.90	3.35	2.39	1.75	1.32	1.02	0.80
MUDA: BERIS MAIN MINOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
*TOTAL BENEFIT	1048.55	720.42	517.40	385.48	296.01	233.15	187.51
COST							
COST FOR JENIANG	533.06	444.86	379.15	328.36	287.98	255.18	228.10
COST FOR BERIS DAM	43.21	37.32	32.84	29.28	26.34	23.86	21.73
*TOTAL COST	576.27	482.18	411.99	357.64	314.32	279.04	249.83
**TOTAL B-C	472.28	238.24	105.41	27.84	-18.31	-45.89	-62.32
** JENIANG + BERIS + K.THEPBA **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1048.55	720.42	517.40	385.48	296.01	233.15	187.51
KEDAH: K.THEPBA MADA MAIN	93.52	64.33	46.04	34.03	25.81	19.99	15.75
K.THEPBA MAIN MINOR	2.82	1.95	1.41	1.04	0.79	0.62	0.50
*TOTAL BENEFIT	1144.89	786.70	564.85	420.55	322.61	253.76	203.76
COST							
COST FOR JENIANG & BERIS	576.27	482.18	411.99	357.64	314.32	279.04	249.83
COST FOR K.THEPBA DAM	66.32	56.80	49.53	43.72	38.93	34.89	31.44
*TOTAL COST	642.59	538.98	461.52	401.36	353.25	313.93	281.27
**TOTAL B-C	502.30	247.72	103.33	19.19	-30.64	-60.17	-77.93

REMARKS: IN 1983 CONSTANT PRICE.

Table 31 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT
PLAN ASSUMING JENIANG OPERATION OF ALTERNATIVE 3 (8/8)

Unit: M\$10⁶

	NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE						
	6%	8%	10%	12%	14%	16%	18%
** JENIANG **							
BENEFIT							
KEDAH: TRIBUTARY MINOR	34.66	23.68	16.91	12.53	9.57	7.51	6.01
D & I	32.83	22.22	15.81	11.75	9.06	7.23	5.93
ADVERSE LOSS DUE TO TRIBUTARY	-50.82	-35.32	-25.78	-19.61	-15.45	-12.52	-10.40
ADVERSE LOSS DUE TO D & I	-34.49	-22.87	-15.89	-11.51	-8.65	-6.71	-5.35
MADA MAIN	541.21	357.63	246.26	175.51	128.72	96.69	74.10
MAIN MINOR	20.53	14.16	10.17	7.56	5.77	4.51	3.58
MUDA: TRIBUTARY MINOR	93.17	64.65	46.95	35.41	27.54	21.98	17.92
D & I	39.24	27.32	19.95	15.16	11.92	9.63	7.97
ADVERSE LOSS DUE TO TRIBUTARY	-17.74	-12.40	-9.08	-6.91	-5.43	-4.38	-3.61
ADVERSE LOSS DUE TO D & I	-11.80	-8.16	-5.91	-4.45	-3.46	-2.77	-2.27
MAIN MINOR	234.10	175.44	137.20	110.90	91.97	77.83	66.93
*TOTAL BENEFIT	880.89	606.35	436.59	326.34	251.56	199.00	160.81
COST							
JENIANG SYSTEM	52.61	46.60	41.78	37.76	34.33	31.34	28.72
KEDAH: TRIBUTARY MINOR	7.37	6.13	5.21	4.50	3.95	3.50	3.14
MADA MAIN	433.27	358.28	302.71	260.02	226.30	199.11	176.81
MAIN MINOR	2.65	2.12	1.74	1.45	1.22	1.04	0.90
MUDA: TRIBUTARY MINOR	9.46	8.55	7.88	7.37	6.96	6.62	6.32
MAIN MINOR	27.70	23.18	19.83	17.26	15.22	13.57	12.21
*TOTAL COST	533.06	444.86	379.15	328.36	287.98	255.18	228.10
**TOTAL B-C	347.83	161.49	57.44	-2.02	-36.42	-56.18	-67.29
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	880.89	606.35	436.59	326.34	251.56	199.00	160.81
KEDAH: BERIS MADA MAIN	162.76	110.72	78.42	57.39	43.13	33.13	25.90
BERIS MAIN MINOR	4.90	3.35	2.39	1.75	1.32	1.02	0.80
MUDA: BERIS MAIN MINOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
*TOTAL BENEFIT	1048.55	720.42	517.40	385.48	296.01	233.15	187.51
COST							
COST FOR JENIANG	533.06	444.86	379.15	328.36	287.98	255.18	228.10
COST FOR BERIS DAN	43.21	37.32	32.84	29.28	26.34	23.86	21.73
*TOTAL COST	576.27	482.18	411.99	357.64	314.32	279.04	249.83
**TOTAL B-C	472.28	238.24	105.41	27.84	-18.31	-45.89	-62.32
** JENIANG + BERIS + REMAN **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1048.55	720.42	517.40	385.48	296.01	233.15	187.51
KEDAH: REMAN MADA MAIN	207.34	141.43	100.42	73.67	55.49	42.71	33.46
REMAN MAIN MINOR	6.25	4.29	3.06	2.25	1.71	1.32	1.04
*TOTAL BENEFIT	1262.14	866.14	620.88	461.40	353.21	277.18	222.01
COST							
COST FOR JENIANG & BERIS	576.27	482.18	411.99	357.64	314.32	279.04	249.83
COST FOR REMAN DAN	94.38	74.59	60.96	51.04	43.51	37.59	32.81
*TOTAL COST	670.65	556.77	472.95	408.68	357.83	316.63	282.64
**TOTAL B-C	591.49	309.37	147.93	52.72	-4.62	-39.45	-60.63
** JENIANG + BERIS + REMAN + MERBOK **							
BENEFIT							
BENEFIT OF JENIANG, BERIS & REMAN	1262.14	866.14	620.88	461.40	353.21	277.18	222.01
MUDA: MERBOK MAIN MINOR	36.90	24.82	17.38	12.58	9.35	7.11	5.51
*TOTAL BENEFIT	1299.04	890.96	638.26	473.98	362.56	284.29	227.52
COST							
COST FOR JENIANG, BERIS & REMAN	670.65	556.77	472.95	408.68	357.83	316.63	282.64
COST FOR MERBOK	69.06	59.78	52.50	46.57	41.61	37.38	33.73
*TOTAL COST	739.71	616.55	525.45	455.25	399.44	354.01	316.37
**TOTAL B-C	559.33	274.41	112.81	18.73	-36.88	-69.72	-88.85

REMARKS: IN 1983 CONSTANT PRICE.

Table 32 INCREMENTAL NET PRODUCTION VALUE

Unit: M\$10⁶

YEAR	KEDAH			MUDA	
	MADA MAIN	MAIN MINOR	TRIBU- TARY MINOR	MAIN MINOR	TRIBU- TARY MINOR
1984	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.12	7.05	0.82
1986	0.00	0.00	0.44	11.13	1.64
1987	0.00	0.00	0.49	13.77	1.81
1988	0.00	0.00	0.54	16.42	1.99
1989	0.00	0.00	0.75	16.51	3.24
1990	42.06	2.78	1.01	16.26	4.63
1991	61.23	2.84	1.81	20.20	4.92
1992	66.62	2.89	1.92	20.27	5.19
1993	71.41	2.93	2.02	20.31	5.33
1994	76.80	2.93	2.35	20.32	5.88
1995	82.19	3.03	2.54	20.38	6.46
1996	87.14	3.23	2.82	20.48	7.24
1997	92.69	3.27	2.90	20.50	7.44
1998	98.58	3.36	2.95	20.52	7.57
1999	107.65	3.46	3.14	20.65	8.65
2000	114.31	3.61	3.61	20.83	9.11
2001	118.15	3.65	3.67	20.97	9.32
2002	120.45	3.70	3.73	21.01	9.52
2003	121.22	3.71	3.77	21.03	9.62
2010	121.22	3.71	3.77	21.03	9.62
2011	121.22	3.71	3.77	21.03	9.62
2032	121.22	3.71	3.77	21.03	9.62
2033	121.22	3.71	3.77	21.03	9.62
NPV(6%)	1074.08	36.67	34.66	272.30	93.17
NPV(8%)	722.87	25.29	23.68	201.40	64.65
NPV(10%)	507.15	18.18	16.91	155.58	46.95
NPV(12%)	368.24	13.51	12.53	124.36	35.41
NPV(14%)	275.03	10.32	9.57	102.10	27.54
NPV(16%)	210.26	8.05	7.51	85.63	21.98
NPV(18%)	163.88	6.40	6.01	73.05	17.92

Table 33 D & I WATER SUPPLY BENEFIT

Unit: M\$10⁶

D&I BENEFIT		
YEAR	KEDAH	MUDA-
	RIVER	PERAI
	SYSTEM	RIVER
	(a)	SYSTEM
		(b)
1984	1.03	0.66
1985	0.86	0.75
1986	0.69	0.83
1987	0.51	0.91
1988	0.34	0.99
1989	0.17	1.08
1990	0.00	1.16
1991	0.38	1.45
1992	0.77	1.74
1993	1.15	2.03
1994	1.54	2.32
1995	1.92	2.61
1996	2.30	2.90
1997	2.69	3.19
1998	3.07	3.48
1999	3.46	3.77
2000	3.84	4.06
2001	3.84	4.06
2002	3.84	4.06
2003	3.84	4.06
2010	3.84	4.06
2011	3.84	4.06
2032	3.84	4.06
2033	3.84	4.06
NPV(6%)	32.83	39.24
NPV(8%)	22.22	27.32
NPV(10%)	15.81	19.95
NPV(12%)	11.75	15.16
NPV(14%)	9.06	11.92
NPV(16%)	7.23	9.63
NPV(18%)	5.93	7.97

Table 34 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN KEDAH RIVER FOR OVERALL PLAN, ALTERNATIVE 1 (1/6)

YEAR	PROPORTION OF N.W.O. TO DEMAND					MADA MAIN					MAIN MINOR					
	JENIANG SYSTEM	BERIS DAM	REMAN DAM	T.MUDA K.THEPHA DAM	T.MUDA K.THEPHA DAM	JENIANG SYSTEM	BERIS DAM	REMAN DAM	T.MUDA K.THEPHA DAM	T.MUDA K.THEPHA DAM	JENIANG SYSTEM	BERIS DAM	REMAN DAM	T.MUDA K.THEPHA DAM	T.MUDA K.THEPHA DAM	
	(x) (a)	(x) (b)	(x) (c)	(x) (d)	(x) (e)	(x) (f)	(x) (g)	(x) (h)	(x) (i)	(x) (j)	(x) (k)	(x) (l)	(x) (m)	(x) (n)	(x) (o)	
1984	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1985	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1986	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1987	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1988	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1989	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1990	86.46	0.00	0.00	0.00	0.00	7.89	0.00	0.00	0.00	0.00	1.59	0.00	0.00	0.00	0.00	
1991	86.13	4.01	6.93	1.50	3.32	23.56	10.89	18.82	4.06	9.01	1.61	0.36	0.61	0.13	0.29	
1992	85.80	3.94	7.01	1.53	3.33	27.29	10.92	19.41	4.24	9.21	1.62	0.35	0.62	0.14	0.30	
1993	85.47	3.87	7.09	1.57	3.33	30.46	10.91	19.97	4.41	9.39	1.63	0.35	0.63	0.14	0.30	
1994	85.14	3.80	7.17	1.60	3.34	34.12	10.92	20.58	4.59	9.60	1.60	0.34	0.64	0.14	0.30	
1995	84.81	3.74	7.25	1.64	3.35	37.74	10.93	21.19	4.78	9.80	1.65	0.34	0.66	0.15	0.30	
1996	84.47	3.67	7.32	1.67	3.36	40.95	10.91	21.79	4.97	9.99	1.79	0.34	0.68	0.15	0.31	
1997	84.14	3.60	7.40	1.71	3.37	44.64	10.90	22.43	5.17	10.20	1.80	0.33	0.69	0.16	0.31	
1998	83.81	3.53	7.48	1.74	3.37	48.57	10.90	23.11	5.38	10.42	1.84	0.33	0.70	0.16	0.32	
1999	83.48	3.46	7.56	1.78	3.38	55.12	11.00	24.04	5.64	10.75	1.89	0.33	0.72	0.17	0.32	
2000	83.15	3.39	7.64	1.81	3.39	59.61	11.01	24.80	5.88	11.01	1.99	0.33	0.74	0.17	0.33	
2001	83.15	3.39	7.64	1.81	3.39	62.80	11.14	25.10	5.95	11.14	2.02	0.33	0.74	0.18	0.33	
2002	83.15	3.39	7.64	1.81	3.39	64.71	11.21	25.27	5.99	11.21	2.06	0.33	0.74	0.18	0.33	
2003	83.15	3.39	7.64	1.81	3.39	65.35	11.24	25.33	6.00	11.24	2.07	0.33	0.74	0.18	0.33	
2010	83.15	3.39	7.64	1.81	3.39	65.35	11.24	25.33	6.00	11.24	2.07	0.33	0.74	0.18	0.33	
2011	83.15	3.39	7.64	1.81	3.39	65.35	11.24	25.33	6.00	11.24	2.07	0.33	0.74	0.18	0.33	
2032	83.15	3.39	7.64	1.81	3.39	65.35	11.24	25.33	6.00	11.24	2.07	0.33	0.74	0.18	0.33	
2033	83.15	3.39	7.64	1.81	3.39	65.35	11.24	25.33	6.00	11.24	2.07	0.33	0.74	0.18	0.33	
						NPV(6%)	537.22	112.83	238.04	55.27	107.49	20.41	3.41	7.17	1.66	3.24
						NPV(8%)	355.06	77.71	161.78	37.40	73.32	14.08	2.36	4.90	1.13	2.22
						NPV(10%)	244.54	55.70	114.47	26.35	52.07	10.12	1.70	3.48	0.80	1.59
						NPV(12%)	174.32	41.21	83.70	19.19	38.20	7.52	1.26	2.56	0.59	1.17
						NPV(14%)	127.87	31.29	62.85	14.36	28.77	5.75	0.96	1.93	0.44	0.88
						NPV(16%)	96.07	24.26	48.24	10.98	22.15	4.49	0.75	1.49	0.34	0.68
						NPV(18%)	73.64	19.13	37.69	8.55	17.35	3.57	0.59	1.17	0.26	0.08

Table 35 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN MUDA RIVER FOR OVERALL PLAN, ALTERNATIVE 1 (2/6)

YEAR	PROPORTION OF N.W.O. TO DEMAND		MAIN MINOR	
	JENIANG SYSTEM (%) (p)	BERIS DAM (%) (q)	JENIANG SYSTEM (M\$10 ⁶) (r)	BERIS DAM (M\$10 ⁶) (s)
1984	100.00	0.00	0.00	0.00
1985	100.00	0.00	7.05	0.00
1986	100.00	0.00	11.13	0.00
1987	100.00	0.00	13.77	0.00
1988	100.00	0.00	16.42	0.00
1989	100.00	0.00	16.51	0.00
1990	95.74	0.00	14.31	0.00
1991	95.35	4.65	17.89	2.31
1992	94.97	5.03	17.76	2.51
1993	94.58	5.42	17.61	2.70
1994	94.19	5.81	17.42	2.90
1995	93.81	6.20	17.29	3.09
1996	93.42	6.58	17.19	3.29
1997	93.03	6.97	17.01	3.49
1998	92.64	7.36	16.84	3.68
1999	92.26	7.74	16.76	3.89
2000	91.87	8.13	16.73	4.10
2001	91.87	8.13	16.86	4.11
2002	91.87	8.13	16.90	4.11
2003	91.87	8.13	16.92	4.11
2010	91.87	8.13	16.92	4.11
2011	91.87	8.13	16.92	4.11
2032	91.87	8.13	16.92	4.11
2033	91.87	8.13	16.92	4.11
NPV(6%)			234.10	36.90
NPV(8%)			175.44	24.82
NPV(10%)			137.20	17.38
NPV(12%)			110.90	12.58
NPV(14%)			91.97	9.35
NPV(16%)			77.83	7.11
NPV(18%)			66.93	5.51

Table 36 BENEFIT CASH FLOW AND PRESENT WORTH
OF IRRIGATION IN KEDAH RIVER FOR
OVERALL PLAN, ALTERNATIVE 2 (3/6)

YEAR	PROPORTION OF N.W.O TO DEMAND			MADA MAIN			MAIN MINOR		
	JENIANG	BERIS	REMAN	JENIANG	BERIS	REMAN	JENIANG	BERIS	REMAN
	SYSTEM (%)	DAM (%)	DAM (%)	SYSTEM (M\$10 ⁶)	DAM (M\$10 ⁶)	DAM (M\$10 ⁶)	SYSTEM (M\$10 ⁶)	DAM (M\$10 ⁶)	DAM (M\$10 ⁶)
1984	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1986	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1988	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	86.46	0.00	0.00	7.89	0.00	0.00	1.59	0.00	0.00
1991	86.13	4.10	6.82	23.56	11.13	18.52	1.61	0.36	0.60
1992	85.80	4.04	6.79	27.29	11.20	18.80	1.62	0.36	0.60
1993	85.47	3.99	6.76	30.46	11.24	19.04	1.63	0.36	0.60
1994	85.14	3.94	6.73	34.12	11.31	19.31	1.60	0.35	0.60
1995	84.81	3.89	6.70	37.74	11.36	19.58	1.65	0.35	0.61
1996	84.47	3.83	6.66	40.95	11.40	19.82	1.79	0.35	0.62
1997	84.14	3.78	6.63	44.64	11.45	20.10	1.80	0.35	0.62
1998	83.81	3.73	6.60	48.57	11.51	20.39	1.84	0.35	0.62
1999	83.48	3.67	6.57	55.12	11.68	20.90	1.89	0.35	0.62
2000	83.15	3.62	6.54	59.61	11.75	21.23	1.99	0.35	0.63
2001	83.15	3.62	6.54	62.80	11.89	21.48	2.02	0.35	0.63
2002	83.15	3.62	6.54	64.71	11.97	21.63	2.06	0.35	0.64
2003	83.15	3.62	6.54	65.35	12.00	21.68	2.07	0.35	0.64
2010	83.15	3.62	6.54	65.35	12.00	21.68	2.07	0.35	0.64
2011	83.15	3.62	6.54	65.35	12.00	21.68	2.07	0.35	0.64
2032	83.15	3.62	6.54	65.35	12.00	21.68	2.07	0.35	0.64
2033	83.15	3.62	6.54	65.35	12.00	21.68	2.07	0.35	0.64
			NPV(6%)	537.22	119.05	210.59	20.41	3.60	6.35
			NPV(8%)	355.06	81.81	144.10	14.08	2.48	4.37
			NPV(10%)	244.54	58.50	102.64	10.12	1.79	3.13
			NPV(12%)	174.32	43.20	75.51	7.52	1.32	2.31
			NPV(14%)	127.87	32.74	57.03	5.75	1.01	1.75
			NPV(16%)	96.07	25.34	44.00	4.49	0.78	1.36
			NPV(18%)	73.64	19.95	34.54	3.57	0.62	1.07

Table 37 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN MUDA RIVER FOR OVERALL PLAN, ALTERNATIVE 2 (4/6)

YEAR	PROPORTION OF N.W.O. TO DEMAND		MAIN MINOR	
	JENIANG SYSTEM (%)	BERIS DAM (%)	JENIANG SYSTEM (M\$10 ⁶)	BERIS DAM (M\$10 ⁶)
	1984	100.00	0.00	0.00
1985	100.00	0.00	7.05	0.00
1986	100.00	0.00	11.13	0.00
1987	100.00	0.00	13.77	0.00
1988	100.00	0.00	16.42	0.00
1989	100.00	0.00	16.51	0.00
1990	95.74	0.00	14.31	0.00
1991	95.35	4.22	17.89	2.10
1992	94.97	4.53	17.76	2.26
1993	94.58	4.85	17.61	2.42
1994	94.19	5.17	17.42	2.58
1995	93.81	5.49	17.29	2.74
1996	93.42	5.80	17.19	2.90
1997	93.03	6.12	17.01	3.06
1998	92.64	6.44	16.84	3.22
1999	92.26	6.75	16.76	3.39
2000	91.87	7.07	16.73	3.56
2001	91.87	7.07	16.86	3.57
2002	91.87	7.07	16.90	3.57
2003	91.87	7.07	16.92	3.58
2010	91.87	7.07	16.92	3.58
2011	91.87	7.07	16.92	3.58
2032	91.87	7.07	16.92	3.58
2033	91.87	7.07	16.92	3.58
NPV(6%)			234.10	32.33
NPV(8%)			175.44	21.78
NPV(10%)			137.20	15.27
NPV(12%)			110.90	11.07
NPV(14%)			91.97	8.25
NPV(16%)			77.83	6.28
NPV(18%)			66.93	4.87

Table 38 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN KEDAH RIVER FOR OVERALL PLAN, ALTERNATIVE 3 (5/6)

YEAR	PROPORTION OF N.M.O. TO DEMAND					MADA MAIN					MAIN HIROR					
	JENIANG SYSTEM (X)	BERIS DAM (X)	REMAN DAM (X)	T.MUDA K.THEPHA DAM (X)	K.THEPHA DAM (X)	JENIANG SYSTEM (M\$10 ⁶)	BERIS DAM (M\$10 ⁶)	REMAN DAM (M\$10 ⁶)	T.MUDA K.THEPHA DAM (M\$10 ⁶)	K.THEPHA DAM (M\$10 ⁶)	JENIANG SYSTEM (M\$10 ⁶)	BERIS DAM (M\$10 ⁶)	REMAN DAM (M\$10 ⁶)	T.MUDA K.THEPHA DAM (M\$10 ⁶)	K.THEPHA DAM (M\$10 ⁶)	
	1984	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1986	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1987	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1988	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1989	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1990	86.46	0.00	0.00	0.00	0.00	7.89	0.00	0.00	0.00	0.00	1.59	0.00	0.00	0.00	0.00	
1991	86.15	4.81	6.40	1.33	1.26	23.60	13.07	17.37	3.61	8.88	1.61	0.43	0.57	0.12	0.29	
1992	85.83	4.86	6.41	1.35	1.21	27.37	13.45	17.76	3.73	8.90	1.63	0.43	0.57	0.12	0.29	
1993	85.52	4.90	6.43	1.37	1.17	30.60	13.80	18.11	3.85	8.92	1.63	0.44	0.58	0.12	0.28	
1994	85.20	4.94	6.44	1.39	1.12	34.30	14.19	18.50	3.98	8.95	1.61	0.44	0.58	0.12	0.28	
1995	84.89	4.99	6.46	1.41	1.07	37.97	14.58	18.90	4.11	8.98	1.66	0.45	0.58	0.13	0.28	
1996	84.57	5.03	6.48	1.42	1.02	41.24	14.96	19.26	4.24	8.99	1.80	0.47	0.60	0.13	0.28	
1997	84.26	5.07	6.49	1.44	0.97	44.98	15.37	19.67	4.37	9.01	1.81	0.47	0.60	0.13	0.28	
1998	83.94	5.11	6.51	1.46	0.93	48.97	15.80	20.10	4.52	9.04	1.85	0.48	0.61	0.14	0.27	
1999	83.63	5.16	6.52	1.48	0.88	53.56	16.40	20.75	4.71	9.15	1.91	0.49	0.62	0.14	0.27	
2000	83.31	5.20	6.54	1.50	0.83	60.13	16.88	21.23	4.87	9.19	2.00	0.50	0.63	0.14	0.27	
2001	83.31	5.20	6.54	1.50	0.83	63.33	17.08	21.48	4.93	9.30	2.04	0.50	0.63	0.15	0.27	
2002	83.31	5.20	6.54	1.50	0.83	65.24	17.20	21.63	4.96	9.36	2.08	0.51	0.64	0.15	0.28	
2003	83.31	5.20	6.54	1.50	0.83	65.88	17.24	21.68	4.97	9.38	2.09	0.51	0.64	0.15	0.28	
2010	83.31	5.20	6.54	1.50	0.83	65.88	17.24	21.68	4.97	9.38	2.09	0.51	0.64	0.15	0.28	
2011	83.31	5.20	6.54	1.50	0.83	65.88	17.24	21.68	4.97	9.38	2.09	0.51	0.64	0.15	0.28	
2032	83.31	5.20	6.54	1.50	0.83	65.88	17.24	21.68	4.97	9.38	2.09	0.51	0.64	0.15	0.28	
2033	83.31	5.20	6.54	1.50	0.83	65.88	17.24	21.68	4.97	9.38	2.09	0.51	0.64	0.15	0.28	
						NPV (6%)	541.21	162.76	207.34	46.49	93.52	20.53	4.90	6.25	1.40	2.82
						NPV (8%)	357.63	110.72	141.43	31.56	64.33	14.16	3.35	4.29	0.96	1.95
						NPV (10%)	246.26	78.42	109.42	22.31	46.04	10.17	2.39	3.06	0.68	1.41
						NPV (12%)	175.51	57.39	73.67	16.30	34.03	7.56	1.75	2.25	0.50	1.04
						NPV (14%)	128.72	43.13	55.49	12.23	25.81	5.77	1.32	1.71	0.38	0.79
						NPV (16%)	96.69	33.13	42.71	9.38	19.99	4.51	1.02	1.32	0.29	0.62
						NPV (18%)	74.10	25.90	33.46	7.32	15.75	3.58	0.80	1.04	0.23	0.48

Table 39 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN MUDA RIVER FOR OVERALL PLAN, ALTERNATIVE 3 (6/6)

YEAR	PROPORTION OF N.W.O. TO DEMAND		MAIN MINOR	
	JENIANG SYSTEM (%)	MERBOK (%)	JENIANG SYSTEM (M\$10 ⁶)	MERBOK (M\$10 ⁶)
1984	100.00	0.00	0.00	0.00
1985	100.00	0.00	7.05	0.00
1986	100.00	0.00	11.13	0.00
1987	100.00	0.00	13.77	0.00
1988	100.00	0.00	16.42	0.00
1989	100.00	0.00	16.51	0.00
1990	95.74	0.00	14.31	0.00
1991	95.35	4.65	17.89	2.31
1992	94.97	5.03	17.76	2.51
1993	94.58	5.42	17.61	2.70
1994	94.19	5.81	17.42	2.90
1995	93.81	6.20	17.29	3.09
1996	93.42	6.58	17.19	3.29
1997	93.03	6.97	17.01	3.49
1998	92.64	7.36	16.84	3.68
1999	92.26	7.74	16.76	3.89
2000	91.87	8.13	16.73	4.10
2001	91.87	8.13	16.86	4.11
2002	91.87	8.13	16.90	4.11
2003	91.87	8.13	16.92	4.11
2010	91.87	8.13	16.92	4.11
2011	91.87	8.13	16.92	4.11
2032	91.87	8.13	16.92	4.11
2033	91.87	8.13	16.92	4.11
NPV(6%)			234.10	36.90
NPV(8%)			175.44	24.82
NPV(10%)			137.20	17.38
NPV(12%)			110.90	12.58
NPV(14%)			91.97	9.35
NPV(16%)			77.83	7.11
NPV(18%)			66.93	5.51

Table 40 ESTIMATE OF NET IRRIGATION BENEFIT

Unit: M\$10⁶

YEAR	INCREMENTAL NET PRODUCTION VALUE					IRRIGATION DIRECT FACILITY COST				
	KEDAH			MUDA		KEDAH			MUDA	
	MADA MAIN	MAIN MINOR	TRIBU-TARY MINOR	MAIN MINOR	TRIBU-TARY MINOR	MADA MAIN	MAIN MINOR	TRIBU-TARY MINOR	MAIN MINOR	TRIBU-TARY MINOR
1984	0.00	0.00	0.00	0.00	0.00	20.88	0.00	0.81	2.45	3.94
1985	0.00	0.00	0.12	7.05	0.82	21.17	0.00	0.30	1.14	2.19
1986	0.00	0.00	0.44	11.13	1.64	24.45	0.25	0.30	1.58	0.36
1987	0.00	0.00	0.49	13.77	1.81	31.82	0.34	0.76	3.96	0.66
1988	0.00	0.00	0.54	16.42	1.99	39.16	0.25	0.79	4.09	0.66
1989	0.00	0.00	0.75	16.51	3.24	42.65	0.01	0.41	2.07	0.40
1990	42.06	2.78	1.01	16.26	4.63	43.24	0.01	0.05	0.27	0.18
1991	61.23	2.84	1.81	20.20	4.92	43.83	0.01	0.44	1.22	0.18
1992	66.62	2.89	1.92	20.27	5.19	44.42	0.15	0.86	2.66	0.18
1993	71.41	2.93	2.02	20.31	5.33	47.47	0.46	1.27	3.89	0.18
1994	76.80	2.93	2.35	20.32	5.88	51.01	0.50	0.95	3.01	0.18
1995	82.19	3.03	2.54	20.38	6.46	54.54	0.29	0.54	1.54	0.18
1996	87.14	3.23	2.82	20.48	7.24	57.67	0.44	0.41	1.92	0.24
1997	92.69	3.27	2.90	20.50	7.44	50.03	0.72	1.10	3.93	0.33
1998	98.58	3.36	2.95	20.52	7.57	33.99	0.64	1.20	3.93	0.33
1999	107.65	3.46	3.14	20.65	8.65	17.95	0.20	0.72	2.01	0.26
2000	114.31	3.61	3.61	20.83	9.11	9.94	0.06	0.15	0.58	0.19
2001	118.15	3.65	3.67	20.97	9.32	9.94	0.06	0.15	0.58	0.19
2002	120.45	3.70	3.73	21.01	9.52	9.94	0.06	0.15	0.58	0.19
2003	121.22	3.71	3.77	21.03	9.62	9.94	0.06	0.15	0.58	0.19
2010	121.22	3.71	3.77	21.03	9.62	9.94	0.06	0.15	0.58	0.19
2011	121.22	3.71	3.77	21.03	9.62	9.94	0.06	0.15	0.58	0.19
2032	121.22	3.71	3.77	21.03	9.62	9.94	0.06	0.15	0.58	0.19
2033	121.22	3.71	3.77	21.03	9.62	9.94	0.06	0.15	0.58	0.19
NPV(6%)	1074.08	36.67	34.66	272.30	93.17	433.27	2.65	7.37	27.70	9.46
NPV(8%)	722.87	25.29	23.68	201.40	64.65	358.28	2.12	6.13	23.18	8.55
NPV(10%)	507.15	18.18	15.91	155.58	46.95	302.71	1.74	5.21	19.83	7.88
NPV(12%)	368.24	13.51	12.53	124.36	35.41	260.02	1.45	4.50	17.26	7.37
NPV(14%)	275.03	10.32	9.57	102.10	27.54	226.30	1.22	3.95	15.22	6.96
NPV(16%)	210.26	8.05	7.51	85.63	21.98	199.11	1.04	3.50	13.57	6.62
NPV(18%)	163.88	6.40	6.01	73.05	17.92	176.81	0.90	3.14	12.21	6.32

NET IRRIGATION BENEFIT

YEAR	NET IRRIGATION BENEFIT				
	KEDAH			MUDA	
	MADA MAIN	MAIN MINOR	TRIBU-TARY MINOR	MAIN MINOR	TRIBU-TARY MINOR
1984	-20.88	0.00	-0.81	-2.45	-3.94
1985	-21.17	0.00	-0.18	5.91	-1.37
1986	-24.45	-0.25	0.14	9.55	1.28
1987	-31.82	-0.34	-0.27	9.81	1.15
1988	-39.16	-0.25	-0.25	12.33	1.33
1989	-42.65	-0.01	0.34	14.44	2.84
1990	-1.18	2.77	0.96	15.99	4.45
1991	17.40	2.83	1.37	18.98	4.74
1992	22.20	2.74	1.06	17.61	5.01
1993	23.94	2.47	0.75	16.42	5.15
1994	25.79	2.43	1.40	17.31	5.70
1995	27.65	2.74	2.00	18.84	6.28
1996	29.47	2.79	2.41	18.56	7.00
1997	42.66	2.55	1.80	16.57	7.11
1998	64.59	2.72	1.75	16.59	7.24
1999	89.70	3.26	2.42	18.64	8.39
2000	104.37	3.55	3.46	20.25	8.92
2001	108.21	3.59	3.52	20.39	9.13
2002	110.51	3.64	3.58	20.43	9.33
2003	111.28	3.65	3.62	20.45	9.43
2010	111.28	3.65	3.62	20.45	9.43
2011	111.28	3.65	3.62	20.45	9.43
2032	111.28	3.65	3.62	20.45	9.43
2033	111.28	3.65	3.62	20.45	9.43
NPV(6%)	640.81	34.02	27.28	244.60	83.70
NPV(8%)	364.59	23.17	17.55	178.21	56.10
NPV(10%)	204.44	16.44	11.70	135.75	39.07
NPV(12%)	108.23	12.06	8.09	107.10	28.04
NPV(14%)	48.73	9.09	5.63	86.88	20.59
NPV(16%)	11.15	7.01	4.00	72.06	15.37
NPV(18%)	-12.93	5.50	2.87	60.84	11.60

Table 41 BENEFIT CASH FLOW AND NET PRESENT WORTH OF BERIS DAM, ALTERNATIVE 1, CASE A (1/6)

KEDAH SYSTEM											
YEAR	NET WATER OUTPUT BY CAUSE				IRRIGATION BENEFIT IN AFFECTED AREA					KEDAH TOTAL BENEFIT (M\$10 ⁶)	
	MADA MAIN	MADA MINOR	TRIBUTA- RY MINOR	D&I	MAINTENANCE FLOW	MADA MAIN	MADA MINOR	TRIBUTA- RY MINOR	D&I		MAINTENANCE FLOW
	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(M\$10 ⁶)	(M\$10 ⁶)	(M\$10 ⁶)	(M\$10 ⁶)		(M\$10 ⁶)
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1991	42.65	0.87	8.30	0.10	0.08	2.60	0.05	0.45	0.01	0.00	
1992	40.20	0.84	9.60	0.20	0.16	2.77	0.06	0.64	0.01	0.01	
1993	37.75	0.81	10.90	0.30	0.24	2.74	0.08	0.76	0.02	0.02	
1994	35.30	0.78	12.20	0.40	0.32	2.72	0.06	0.90	0.03	0.03	
1995	32.85	0.75	13.50	0.50	0.40	2.70	0.06	1.06	0.04	0.04	
1996	30.40	0.72	14.80	0.60	0.48	2.62	0.06	1.22	0.05	0.04	
1997	27.95	0.69	16.10	0.70	0.56	2.54	0.08	1.41	0.06	0.06	
1998	25.50	0.66	17.40	0.80	0.64	2.47	0.11	1.61	0.08	0.08	
1999	23.05	0.63	18.70	0.90	0.72	2.49	0.15	1.82	0.11	0.11	
2000	20.60	0.60	20.00	1.00	0.80	2.57	0.16	2.04	0.14	0.14	
2001	20.60	0.60	20.00	1.00	0.80	2.57	0.17	2.27	0.16	0.16	
2002	20.60	0.60	20.00	1.00	0.80	2.58	0.17	2.51	0.18	0.18	
2003	20.60	0.60	20.00	1.00	0.80	2.59	0.17	2.76	0.20	0.20	
2010	20.60	0.60	20.00	1.00	0.80	2.59	0.17	2.76	0.20	0.20	
2011	20.60	0.60	20.00	1.00	0.80	2.59	0.17	2.76	0.20	0.20	
2032	20.60	0.60	20.00	1.00	0.80	2.59	0.17	2.76	0.20	0.20	
2033	20.60	0.60	20.00	1.00	0.80	2.59	0.17	2.76	0.20	0.20	
NPV (8%)						47.52	1.29	38.81	1.87	1.49	
NPV (10%)						31.21	0.84	24.35	1.14	0.93	
NPV (12%)						21.36	0.56	15.87	0.75	0.60	
NPV (14%)						15.13	0.39	10.69	0.50	0.40	
NPV (16%)						11.03	0.28	7.41	0.34	0.27	
NPV (18%)						8.24	0.21	5.26	0.24	0.19	
NPV (18%)						6.28	0.16	3.81	0.17	0.13	

MUDA-PERAI SYSTEM											
YEAR	NET WATER OUTPUT BY CAUSE					IRRIGATION BENEFIT IN AFFECTED AREA					MUDA-PERAI TOTAL BENEFIT (M\$10 ⁶)
	KEDAH STATE			P-PINANG STATE		KEDAH STATE			P-PINANG STATE		
	MADA MAIN	TRIBUTA- RY MINOR	D&I	MADA MAIN	D&I	MADA MAIN	TRIBUTA- RY MINOR	D&I	MADA MAIN	D&I	
	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(10 ⁶ m ³)	(M\$10 ⁶)	(M\$10 ⁶)	(M\$10 ⁶)	(M\$10 ⁶)	(M\$10 ⁶)	
(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	
1984	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00	
1985	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00	
1986	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00	
1987	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00	
1988	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00	
1989	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00	
1990	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00	
1991	3.00	4.60	2.00	3.00	0.50	0.51	0.79	0.34	0.51	0.09	
1992	3.00	5.20	2.00	3.00	1.00	0.50	0.87	0.33	0.50	0.17	
1993	3.00	5.80	2.00	3.00	1.50	0.49	0.94	0.33	0.49	0.24	
1994	3.00	6.40	2.00	3.00	2.00	0.50	1.06	0.33	0.50	0.33	
1995	3.00	7.00	2.00	3.00	2.50	0.51	1.20	0.34	0.51	0.43	
1996	3.00	7.60	2.00	3.00	3.00	0.51	1.35	0.34	0.51	0.51	
1997	3.00	8.20	2.00	3.00	3.50	0.49	1.54	0.33	0.49	0.57	
1998	3.00	8.80	2.00	3.00	4.00	0.49	1.73	0.33	0.49	0.65	
1999	3.00	9.40	2.00	3.00	4.50	0.51	1.90	0.34	0.51	0.77	
2000	3.00	10.00	2.00	3.00	5.00	0.53	2.16	0.35	0.53	0.88	
2001	3.00	10.00	2.00	3.00	5.00	0.53	1.76	0.35	0.53	0.88	
2002	3.00	10.00	2.00	3.00	5.00	0.53	1.76	0.35	0.53	0.88	
2003	3.00	10.00	2.00	3.00	5.00	0.53	1.76	0.35	0.53	0.88	
2010	3.00	10.00	2.00	3.00	5.00	0.53	1.76	0.35	0.53	0.88	
2011	3.00	10.00	2.00	3.00	5.00	0.53	1.76	0.35	0.53	0.88	
2032	3.00	10.00	2.00	3.00	5.00	0.53	1.76	0.35	0.53	0.88	
2033	3.00	10.00	2.00	3.00	5.00	0.53	1.76	0.35	0.53	0.88	
NPV (8%)						5.76	15.09	3.53	5.26	6.75	
NPV (10%)						3.62	10.04	2.42	3.62	4.36	
NPV (12%)						2.59	6.96	1.73	2.59	2.93	
NPV (14%)						1.91	4.99	1.28	1.91	2.03	
NPV (16%)						1.45	3.67	0.97	1.45	1.45	
NPV (18%)						1.12	2.77	0.75	1.12	1.06	
NPV (18%)						0.89	2.13	0.59	0.89	0.79	

	<u>Benefit</u>	<u>Cost</u>	<u>B-C</u>	
NPV (8%)	82.54	37.32	45.22	
NPV (10%)	55.94	32.84	23.10	
NPV (12%)	39.24	29.28	9.96	
NPV (14%)	28.33	26.34	1.99	
NPV (16%)	20.96	23.86	-2.90	EIRR = 14.8

Table 43 BENEFIT CASH FLOW AND NET PRESENT WORTH OF BERIS DAM, ALTERNATIVE 3, CASE A (3/6)

KEDAH SYSTEM											
YEAR	NET WATER OUTPUT BY CAUSE					IRRIGATION BENEFIT IN AFFECTED AREA					KEDAH TOTAL BENEFIT (M\$10 ⁶)
	MADA MAIN (10 ⁶ m ³)	MAIN MINOR (10 ⁶ m ³)	TRIBUTARY MINOR (10 ⁶ m ³)	D&I (10 ⁶ m ³)	MAINTENANCE FLOW (10 ⁶ m ³)	MADA MAIN (M\$10 ⁶)	MAIN MINOR (M\$10 ⁶)	TRIBUTARY MINOR (M\$10 ⁶)	D&I (M\$10 ⁶)	MAINTENANCE FLOW (M\$10 ⁶)	
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991	52.64	1.10	8.30	0.19	0.17	2.95	0.06	0.46	0.01	0.01	3.49
1992	51.38	1.10	9.60	0.38	0.34	3.52	0.08	0.64	0.02	0.02	4.28
1993	50.12	1.10	10.90	0.57	0.51	3.60	0.08	0.76	0.04	0.03	4.52
1994	48.86	1.10	12.20	0.76	0.68	3.72	0.08	0.90	0.05	0.05	4.80
1995	47.60	1.10	13.50	0.95	0.85	3.86	0.09	1.06	0.07	0.07	5.15
1996	46.34	1.10	14.80	1.14	1.02	3.95	0.09	1.22	0.09	0.08	5.44
1997	45.08	1.10	16.10	1.33	1.19	5.32	0.13	1.85	0.15	0.14	7.59
1998	43.82	1.10	17.40	1.52	1.36	7.60	0.19	2.96	0.26	0.23	11.24
1999	42.56	1.10	18.70	1.71	1.53	10.06	0.26	4.37	0.40	0.36	15.46
2000	41.30	1.10	20.00	1.90	1.70	11.17	0.30	5.41	0.52	0.46	17.86
2001	41.30	1.10	20.00	1.90	1.70	11.57	0.31	5.60	0.54	0.48	18.50
2002	41.30	1.10	20.00	1.90	1.70	11.81	0.32	5.72	0.55	0.49	18.89
2003	41.30	1.10	20.00	1.90	1.70	11.90	0.32	5.76	0.55	0.49	19.02
2010	41.30	1.10	20.00	1.90	1.70	11.90	0.32	5.76	0.55	0.49	19.02
2011	41.30	1.10	20.00	1.90	1.70	11.90	0.32	5.76	0.55	0.49	19.02
2032	41.30	1.10	20.00	1.90	1.70	11.90	0.32	5.76	0.55	0.49	19.02
2033	41.30	1.10	20.00	1.90	1.70	11.90	0.32	5.76	0.55	0.49	19.02
NPV (6%)						88.03	2.31	38.81	3.58	3.21	135.94
NPV (8%)						56.68	1.48	24.35	2.22	1.99	86.72
NPV (10%)						38.00	0.98	15.87	1.43	1.28	57.57
NPV (12%)						26.37	0.68	10.69	0.95	0.85	39.54
NPV (14%)						18.84	0.48	7.41	0.65	0.58	27.96
NPV (16%)						13.80	0.35	5.26	0.45	0.41	20.26
NPV (18%)						10.33	0.26	3.81	0.32	0.29	15.01

	<u>Benefit</u>	<u>Cost</u>	<u>B-C</u>	
NPV (8%)	86.72	37.32	49.40	
NPV (10%)	57.57	32.84	24.73	
NPV (12%)	39.54	29.28	10.26	
NPV (14%)	27.96	26.34	1.62	
NPV (16%)	20.26	23.86	-3.60	EIRR = 14.6

Table 46 BENEFIT CASH FLOW AND NET PRESENT WORTH OF BERIS DAM, ALTERNATIVE 3, CASE B (6/6)

KEDAH SYSTEM												
YEAR	NET WATER OUTPUT BY CAUSE					IRRIGATION BENEFIT IN AFFECTED AREA					KEDAH TOTAL BENEFIT (MS10 ⁶)	
	MADA MAIN (10 ⁶ m ³)	MAIN MINOR (10 ⁶ m ³)	TRIBUTARY MINOR (10 ⁶ m ³)	DSI (10 ⁶ m ³)	MAINTENANCE FLOW (10 ⁶ m ³)	MADA MAIN (MS10 ⁶)	MAIN MINOR (MS10 ⁶)	TRIBUTARY MINOR (MS10 ⁶)	DSI (MS10 ⁶)	MAINTENANCE FLOW (MS10 ⁶)		
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991	53.83	1.10	7.00	0.25	0.22	3.05	0.06	0.40	0.01	0.01	0.01	3.54
1992	53.76	1.10	7.00	0.50	0.44	3.73	0.08	0.49	0.03	0.03	0.03	4.35
1993	53.69	1.10	7.00	0.75	0.66	3.91	0.08	0.51	0.05	0.05	0.05	4.60
1994	53.62	1.10	7.00	1.00	0.88	4.14	0.09	0.54	0.07	0.06	0.06	4.91
1995	53.55	1.10	7.00	1.25	1.10	4.42	0.09	0.58	0.10	0.09	0.09	5.27
1996	53.48	1.10	7.00	1.50	1.32	4.65	0.10	0.61	0.13	0.11	0.11	5.59
1997	53.41	1.10	7.00	1.75	1.54	6.45	0.13	0.84	0.21	0.16	0.16	7.81
1998	53.34	1.10	7.00	2.00	1.76	9.51	0.20	1.25	0.35	0.31	0.31	11.61
1999	53.27	1.10	7.00	2.25	1.98	13.00	0.27	1.71	0.54	0.48	0.48	16.00
2000	53.20	1.10	7.00	2.50	2.20	14.95	0.31	1.96	0.70	0.62	0.62	18.54
2001	53.20	1.10	7.00	2.50	2.20	15.48	0.32	2.03	0.73	0.64	0.64	19.21
2002	53.20	1.10	7.00	2.50	2.20	15.81	0.33	2.08	0.74	0.65	0.65	19.61
2003	53.20	1.10	7.00	2.50	2.20	15.92	0.33	2.09	0.75	0.66	0.66	19.74
2010	53.20	1.10	7.00	2.50	2.20	15.92	0.33	2.09	0.75	0.66	0.66	19.74
2011	53.20	1.10	7.00	2.50	2.20	15.92	0.33	2.09	0.75	0.66	0.66	19.74
2032	53.20	1.10	7.00	2.50	2.20	15.92	0.33	2.09	0.75	0.66	0.66	19.74
2033	53.20	1.10	7.00	2.50	2.20	15.92	0.33	2.09	0.75	0.66	0.66	19.74
NPV(6%)						114.29	2.39	15.00	4.85	4.26		140.78
NPV(8%)						73.00	1.52	9.58	3.01	2.64		89.75
NPV(10%)						48.52	1.01	6.37	1.96	1.70		59.54
NPV(12%)						33.37	0.70	4.38	1.29	1.13		40.86
NPV(14%)						23.63	0.49	3.10	0.88	0.77		28.87
NPV(16%)						17.15	0.36	2.25	0.61	0.54		20.91
NPV(18%)						12.72	0.26	1.67	0.44	0.38		15.47

	Benefit	Cost	B-C	
NPV (8%)	89.75	37.32	52.43	
NPV (10%)	59.54	32.84	26.70	
NPV (12%)	40.86	29.28	11.58	
NPV (14%)	28.87	26.34	2.53	
NPV (16%)	20.91	23.86	-2.95	EIRR = 14.9

Table 47 SENSITIVITY ANALYSIS

	Change in (%)	EIRR (%)			Sensitivity Indicator		
		Alternative			Alternative		
		1	2	3	1	2	3
<u>Case A</u>							
Base Case	-	14.8	14.8	14.6	-	-	-
(1) Investment costs and O & M costs	+10	13.8	13.9	13.8	0.68	0.61	0.55
(2) Benefits	-25	12.1	12.1	12.1	0.73	0.73	0.68
(3) Delay in commissioning project	one year	14.1	14.1	14.2	-	-	-
(4) Combination of (1), (2) and (3)		11.0	11.0	11.2	-	-	-
<u>Case B</u>							
Base Case	-	15.3	15.3	14.9	-	-	-
(1) Investment costs and O & M costs	+10	14.4	14.3	14.0	0.59	0.65	0.60
(2) Benefits	-25	12.7	12.7	12.5	0.68	0.68	0.64
(3) Delay in commissioning project	one year	14.7	14.7	14.5	-	-	-
(4) Combination of (1), (2) and (3)		11.5	11.5	11.5	-	-	-

Table 48 SUMMARY OF CONSTRUCTION COST

Unit: M\$10³

Items	Foreign Component	Local Component	Total
1. River Diversion Works	790	1,360	2,150
2. Main Dam	1,800	8,200	10,000
3. Stilling Basin	90	620	710
4. River Outlet	1,200	200	1,400
5. Saddle Dam	1,100	3,270	4,370
6. Relocation Road	1,520	5,710	7,230
7. Preparatory Works	1,000	3,040	4,040
8. Compensation	-	25,700	25,700
9. Engineering Services and Government Administration (Design and Supervision)	5,900	2,500	8,400
10. Contingencies			
Physical contingencies	2,680	10,120	12,800
Price escalation	4,370	15,420	19,790
Sub-total	7,050	25,540	32,590
Total	20,450	76,140	96,590

Remark: At 1983 price level

Table 49 ESTIMATED LAND ACQUISITION COST FOR
THE PROPOSED BERIS RESERVOIR AREA

Land Use	Maximum Water Level (El. m)			
	79.7	85.7	87.7	90.7
A. Land				
1. Rubber	4.77	8.59	9.84	11.87
2. Paddy	1.73	3.12	3.57	4.31
3. Residential and Mixed Cultivation Land	3.08	5.60	6.53	7.62
4. Alienated Forest	0.80	1.22	1.40	1.68
Sub-total	10.38	18.53	21.34	25.48
B. Houses				
1. Batu Seketul Village	0.12	0.47	0.61	0.62
2. Sg. Batang Village	0.99	2.12	2.52	2.71
3. Terenas Village	0.42	0.52	0.54	0.59
Sub-total	1.53	3.11	3.67	3.92
C. Public Facilities				
1. Mosque	0.12	0.12	0.12	0.12
2. School	0.29	0.29	0.29	0.29
3. Place of Worship	0.06	0.06	0.06	0.06
4. Storehouse	0.80	0.80	0.80	0.80
5. Public House	0.40	0.40	0.40	0.40
6. RISDA Hospital	0.40	0.40	0.40	0.40
7. Small Public House	0.01	0.01	0.01	0.01
8. Cemetery	0.05	0.05	0.05	0.05
Sub-total	0.69	0.69	0.69	0.69
Total: A to C	12.60	22.33	25.70	30.09

Table 50 DISBURSEMENT SCHEDULE OF BERIS DAM PROJECT

Unit: M\$10³

		Unit: M\$10 ³				
Total Amount		1st year (1985)	2nd year (1986)	3rd year (1987)	4th year (1988)	5th year (1989)
1. River Diversion Works	F.C.	790		290	330	170
	L.C.	1,360		490	570	300
	Sub-total	2,150		780	900	470
2. Main Dam	F.C.	1,800			950	850
	L.C.	8,200			4,300	3,900
	Sub-total	10,000			5,250	4,750
3. Stilling Basin	F.C.	90			90	
	L.C.	620			520	
	Sub-total	710			710	
4. River Outlet	F.C.	1,200		120	960	120
	L.C.	200				200
	Sub-total	1,400		120	960	320
5. Saddle Dam	F.C.	1,100			140	760
	L.C.	3,270			1,030	2,240
	Sub-total	4,370			1,370	3,000
6. Relocation Road	F.C.	1,520			450	1,070
	L.C.	5,710			1,690	4,020
	Sub-total	7,230			2,140	5,090
7. Preparatory Works	F.C.	1,000		820	90	90
	L.C.	3,040		2,480	280	280
	Sub-total	4,040		3,300	370	370
8. Advance Payment	F.C.	-		5,000	-2,000	-3,000
	L.C.	-				
	Sub-total	-				
9. Compensation	F.C.	-				
	L.C.	25,700		25,700		
	Sub-total	25,700		25,700		
10. Engineering Services and Government Administration (Design and Supervision)	F.C.	5,900	700	1,200	700	1,400
	L.C.	2,500	300	500	300	600
	Sub-total	8,400	1,000	1,700	1,000	2,000
11. Contingencies						
	Physical Contingencies	F.C. 2,680	140	240	390	920
		L.C. 10,120	60	100	5,790	1,820
	Sub-total	12,800	200	340	6,180	2,740
Price Escalation	F.C.	4,370	90	230	500	2,020
	L.C.	15,420	30	90	7,490	3,020
	Sub-total	19,790	120	320	7,990	4,550
Total	F.C.	20,450	930	1,670	7,820	5,060
	L.C.	76,140	390	690	42,250	13,930
Grand Total		96,590	1,320	2,360	50,070	18,990

Remarks: (1) At 1983 price level
 (2) F.C. : Foreign currency portion
 (3) L.C. : Local currency portion

Table 51 INVESTMENT COST DISBURSEMENT SCHEDULE OF
WATER DEMAND AND SUPPLY BALANCE PLAN

Unit: M\$10⁶

Year	Irrigation			D & I	Source Development	Total
	MADA Main	MADA Minor	Tributary Minor Schemes	Water Supply Public	Jeniang System	
1984	20.7	4.92	4.07	45.7	0.00	75.39
1985	12.2	2.67	1.72	166.6	2.25	185.44
1986	7.8	0.79	1.99	166.6	25.78	202.96
1987	13.7	1.57	5.22	166.6	26.36	213.45
1988	23.2	1.48	5.42	166.6	19.54	216.24
1989	49.5	0.52	2.58	166.6	0	219.20
1990	52.8	0	0	192.5	0	245.30
1991	60.6	0	1.68	192.5	0	254.78
1992	68.4	0.27	3.91	192.5	0	265.08
1993	76.2	0.87	5.76	192.5	0	275.33
1994	70.5	0.93	4.14	192.5	0	268.07
1995	64.7	0.50	1.86	77.5	0	144.56
1996	63.0	0.74	2.10	77.5	0	143.34
1997	28.9	1.60	5.07	77.5	0	113.07
1998	17.3	1.56	5.13	77.5	0	101.49
1999	5.7	0.62	2.27	77.5	0	86.09
2000	0	0	0	0	0	0
Total	635.2	19.04	52.92	2,228.7	73.93	3,009.79

Remark; In 1983 constant price.

Table 52 JOINT COST ALLOCATION OF BERIS DAM,
ALTERNATIVE 1, CASE A (1/6)

ITEM	JOINT COST ALLOCATION										TOTAL
	KEDAH RIVER SYSTEM					MUDA-PERAI SYSTEM					
	MADA	MAIN	TRIBUTARY	D & I	RIVER	MAIN	MINOR	TRIBUTARY	D & I		
	MAIN	MINOR	MINOR		MAINTENANCE NARCE FLOW	KEDAH	P. PINANG	MINOR	KEDAH	P. PINANG	
1.1 PROJECT COST TO BE ALLOCATED											
CONSTRUCTION											67.76
O&M											1.22
TOTAL											68.98
1.2 BENEFIT	31.21	0.84	24.35	1.16	0.93	3.62	3.62	10.04	2.42	4.36	82.55
1.3 ALTERNATIVE COST											
CONSTRUCTION	39.28	28.06	38.86	28.27	28.07	29.39	29.39	33.32	28.90	30.52	314.06
ANNUAL O&M	.1434	.1378	.1431	.1379	.1378	.1385	.1385	.1404	.1383	.139	1.3947
O&M	1.09	1.05	1.09	1.05	1.05	1.06	1.06	1.07	1.05	1.06	10.63
SUB TOTAL	40.37	29.11	39.95	29.32	29.12	30.45	30.45	34.39	29.95	31.58	324.69
1.4 JUSTIFIABLE EXPENDITURE	31.21	0.84	24.35	1.16	0.93	3.62	3.62	10.04	2.42	4.36	82.55
1.5 SEPARABLE COST											
CONSTRUCTION	14.59	0.77	14.17	1.05	0.91	2.87	2.87	8.34	2.03	4.62	52.22
ANNUAL O&M	.0166	.0005	.0089	.0006	.0005	.0019	.0019	.0053	.0014	.003	.0406
O&M	0.13	0.00	0.07	0.00	0.00	0.01	0.01	0.04	0.01	0.02	0.31
SUB TOTAL	14.72	0.77	14.24	1.05	0.91	2.88	2.88	8.38	2.04	4.64	52.53
1.6 REMAINING JUSTIFIABLE EXPENDITURE	16.49	0.07	10.11	0.11	0.02	0.74	0.74	1.66	0.38	0.00	30.30
1.7 PERCENTAGE DISTRIBUTION OF 1.6	54.43	0.22	33.37	0.35	0.05	2.43	2.43	5.48	1.25	0.00	100.00
*** TOTAL REMAINING JOINT COST (CON)											15.54
TOTAL REMAINING JOINT COST (O&M)											0.91
1.8 REMAINING JOINT COST											
CONSTRUCTION	8.46	0.03	5.19	0.05	0.01	0.38	0.38	0.85	0.19	0.00	15.54
O&M	0.50	0.00	0.30	0.00	0.00	0.02	0.02	0.05	0.01	0.00	0.91
SUB TOTAL	8.95	0.04	5.49	0.06	0.01	0.40	0.40	0.90	0.21	0.00	16.45
1.9 TOTAL ALLOCATED COST											
CONSTRUCTION	23.05	0.80	19.36	1.10	0.92	3.25	3.25	9.19	2.22	4.62	67.76
O&M	0.62	0.01	0.37	0.01	0.00	0.04	0.04	0.09	0.02	0.02	1.22
TOTAL	23.67	0.81	19.73	1.11	0.92	3.28	3.28	9.28	2.25	4.64	68.98
PERCENTAGE OF DISTRIBUTION	34.31	1.17	28.60	1.61	1.34	4.76	4.76	13.46	3.26	6.73	100.00
2.1 ANNUAL COST											
CONSTRUCTION	3.02	0.11	2.54	0.14	0.12	0.43	0.43	1.20	0.29	0.61	8.88
O&M	.082	.001	.049	.001	.001	.005	.005	.012	.003	.003	.162

REMARKS: AT 1983 CONSTANT PRICE

Table 53 JOINT COST ALLOCATION OF BERIS DAM,
ALTERNATIVE 2, CASE A (2/6)

ITEM	KEDAH RIVER SYSTEM					MUDA-PERAI SYSTEM				TOTAL	
	HADA MAIN	MAIN MINOR	TRIBUTARY MINOR	D & I	RIVER MAINTENANCE FLOW	MAIN MINOR		TRIBUTARY MINOR	D & I		
						KEDAH	P. PINANG		KEDAH		P. PINANG
1.1 PROJECT COST TO BE ALLOCATED											
CONSTRUCTION											67.76
O&M											1.22
TOTAL											68.98
1.2 BENEFIT	34.52	0.84	24.35	1.30	1.16	2.15	2.15	10.04	2.42	4.36	83.29
1.3 ALTERNATIVE COST											
CONSTRUCTION	40.69	28.06	38.86	28.41	28.27	28.48	28.48	33.32	28.90	30.52	313.99
ANNUAL O&M	.164	.1378	.1431	.138	.1379	.138	.138	.1404	.1383	.139	1.3945
O&M	1.10	1.05	1.09	1.05	1.05	1.05	1.05	1.07	1.05	1.06	10.63
SUB TOTAL	41.79	29.11	39.95	29.46	29.32	29.53	29.53	34.39	29.95	31.58	324.62
1.4 JUSTIFIABLE EXPENDITURE	34.52	0.84	24.35	1.30	1.16	2.15	2.15	10.04	2.42	4.36	83.29
1.5 SEPARABLE COST											
CONSTRUCTION	16.13	0.77	14.17	1.12	1.05	1.47	1.47	8.34	2.03	4.62	51.17
ANNUAL O&M	.01	.0005	.0089	.0007	.0006	.001	.001	.0053	.0014	.003	.0324
O&M	0.08	0.00	0.07	0.01	0.00	0.01	0.01	0.04	0.01	0.02	0.25
SUB TOTAL	16.21	0.77	14.24	1.13	1.05	1.48	1.48	8.38	2.04	4.64	51.42
1.6 REMAINING JUSTIFIABLE EXPENDITURE	18.31	0.07	10.11	0.17	0.11	0.67	0.67	1.66	0.38	0.00	32.16
1.7 PERCENTAGE DISTRIBUTION OF 1.6	56.95	0.21	31.45	0.54	0.33	2.09	2.09	5.16	1.18	0.00	100.00
*** TOTAL REMAINING JOINT COST (CON)											16.59
TOTAL REMAINING JOINT COST (O&M)											0.97
1.8 REMAINING JOINT COST											
CONSTRUCTION	9.45	0.03	5.22	0.09	0.05	0.35	0.35	0.86	0.20	0.00	16.59
O&M	0.55	0.00	0.31	0.01	0.00	0.02	0.02	0.05	0.01	0.00	0.97
SUB TOTAL	10.00	0.04	5.52	0.10	0.06	0.37	0.37	0.91	0.21	0.00	17.56
1.9 TOTAL ALLOCATED COST											
CONSTRUCTION	25.58	0.80	19.39	1.21	1.10	1.82	1.82	9.20	2.23	4.62	67.76
O&M	0.63	0.01	0.37	0.01	0.01	0.03	0.03	0.09	0.02	0.02	1.22
TOTAL	26.21	0.81	19.76	1.22	1.11	1.84	1.84	9.29	2.25	4.64	68.98
PERCENTAGE OF DISTRIBUTION	37.99	1.17	28.65	1.77	1.61	2.67	2.67	13.46	3.26	6.73	100.00
2.1 ANNUAL COST											
CONSTRUCTION	3.35	0.11	2.54	0.16	0.14	0.24	0.24	1.21	0.29	0.61	8.88
O&M	.083	.001	.049	.001	.001	.004	.004	.012	.003	.003	.161

REMARKS: AT 1983 CONSTANT PRICE

Table 54 JOINT COST ALLOCATION OF BERIS DAM,
ALTERNATIVE 3, CASE A (3/6)

JOINT COST ALLOCATION												
ITEM	KEDAH RIVER SYSTEM					MUDA-PERAI SYSTEM				TOTAL		
	HADA MAIN	MAIN MINOR	TRIBUTARY MINOR	D & I	RIVER MAINTENANCE FLOW	MAIN MINOR		TRIBUTARY MINOR			D & I	
						KEDAH	P.PINANG	KEDAH	P.PINANG		KEDAH	P.PINANG
1.1 PROJECT COST TO BE ALLOCATED												
CONSTRUCTION											67.76	
O&M											1.22	
TOTAL											68.98	
1.2 BENEFIT	56.68	1.48	24.35	2.22	1.99	0.00	0.00	0.00	0.00	0.00	86.72	
1.3 ALTERNATIVE COST												
CONSTRUCTION	50.86	28.41	38.86	28.83	28.76	0.00	0.00	0.00	0.00	0.00	175.72	
ANNUAL O&M	.1496	.138	.1431	.1382	.1381	0	0	0	0	0	.707	
O&M	1.14	1.05	1.09	1.05	1.05	0.00	0.00	0.00	0.00	0.00	5.39	
SUB TOTAL	52.00	29.46	39.95	29.88	29.81	0.00	0.00	0.00	0.00	0.00	181.11	
1.4 JUSTIFIABLE EXPENDITURE	52.00	1.48	24.35	2.22	1.99	0.00	0.00	0.00	0.00	0.00	86.72	
1.5 SEPARABLE COST												
CONSTRUCTION	26.37	1.12	14.17	1.82	1.75	0.00	0.00	0.00	0.00	0.00	45.23	
ANNUAL O&M	.0155	.0007	.0089	.0012	.0011	0	0	0	0	0	.0274	
O&M	0.12	0.01	0.07	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.21	
SUB TOTAL	26.49	1.13	14.24	1.83	1.76	0.00	0.00	0.00	0.00	0.00	45.44	
1.6 REMAINING JUSTIFIABLE EXPENDITURE	25.51	0.35	10.11	0.39	0.23	0.00	0.00	0.00	0.00	0.00	36.60	
1.7 PERCENTAGE DISTRIBUTION OF 1.6	69.70	0.97	27.63	1.07	0.63	0.00	0.00	0.00	0.00	0.00	100.00	
*** TOTAL REMAINING JOINT COST (CON)											22.53	
TOTAL REMAINING JOINT COST (O&M)											1.01	
1.8 REMAINING JOINT COST												
CONSTRUCTION	15.70	0.22	6.22	0.24	0.14	0.00	0.00	0.00	0.00	0.00	22.53	
O&M	0.70	0.01	0.28	0.01	0.01	0.00	0.00	0.00	0.00	0.00	1.01	
SUB TOTAL	16.41	0.23	6.50	0.25	0.15	0.00	0.00	0.00	0.00	0.00	23.54	
1.9 TOTAL ALLOCATED COST												
CONSTRUCTION	42.07	1.34	20.39	2.06	1.89	0.00	0.00	0.00	0.00	0.00	67.76	
O&M	0.82	0.02	0.35	0.02	0.01	0.00	0.00	0.00	0.00	0.00	1.22	
TOTAL	42.90	1.35	20.74	2.08	1.91	0.00	0.00	0.00	0.00	0.00	68.98	
PERCENTAGE OF DISTRIBUTION	62.19	1.96	30.07	3.02	2.77	0.00	0.00	0.00	0.00	0.00	100.00	
2.1 ANNUAL COST												
CONSTRUCTION	5.52	0.18	2.67	0.27	0.25	0.00	0.00	0.00	0.00	0.00	8.88	
O&M	.108	.002	.046	.003	.002	0	0	0	0	0	.161	

REMARKS; AT 1983 CONSTANT PRICE

Table 55 JOINT COST ALLOCATION OF BERIS DAM,
ALTERNATIVE 1, CASE B (4/6)

JOINT COST ALLOCATION											
ITEM	KEDAH RIVER SYSTEM					MUDA-PERAI SYSTEM					TOTAL
	MADA	MAIN	TRIBUTARY	D & I	RIVER	MAIN	MINOR	TRIBUTARY	D & I		
	MAIN	MINOR	MINOR		MAINTENANCE FLOW	KEDAH	P. PINANG	MINOR	KEDAH	P. PINANG	
1.1 PROJECT COST TO BE ALLOCATED											
CONSTRUCTION											67.76
O&M											1.22
TOTAL											68.98
1.2 BENEFIT	59.33	1.23	9.58	2.41	2.04	1.40	4.20	1.40	2.80	5.07	89.46
1.3 ALTERNATIVE COST											
CONSTRUCTION	51.35	28.20	31.64	28.90	28.76	28.27	29.39	28.27	28.90	30.52	314.20
ANNUAL O&M	.1499	.1375	.1395	.1383	.1381	.1379	.1385	.1379	.1383	.139	1.3949
O&M	1.14	1.05	1.06	1.05	1.05	1.05	1.06	1.05	1.05	1.06	10.64
SUB TOTAL	52.49	29.25	32.70	29.95	29.81	29.32	30.45	29.32	29.95	31.58	324.84
1.4 JUSTIFIABLE EXPENDITURE	52.49	1.23	9.58	2.41	2.04	1.40	4.20	1.40	2.80	5.07	89.46
1.5 SEPARABLE COST											
CONSTRUCTION	26.79	0.98	6.17	2.03	1.75	1.05	2.87	1.05	2.03	4.62	49.34
ANNUAL O&M	.0158	.0005	.004	.0014	.0011	.0006	.0019	.0006	.0014	.003	.0303
O&M	0.12	0.00	0.03	0.01	0.01	0.00	0.01	0.00	0.01	0.02	0.23
SUB TOTAL	26.91	0.98	6.20	2.04	1.76	1.05	2.88	1.05	2.04	4.64	49.57
1.6 REMAINING JUSTIFIABLE EXPENDITURE	25.58	0.25	3.38	0.37	0.28	0.35	1.32	0.35	0.76	0.43	33.05
1.7 PERCENTAGE DISTRIBUTION OF 1.6	77.40	0.74	10.22	1.12	0.85	1.05	3.98	1.05	2.30	1.29	100.00
*** TOTAL REMAINING JOINT COST (CON)											18.42
TOTAL REMAINING JOINT COST (O&M)											6.99
1.8 REMAINING JOINT COST											
CONSTRUCTION	14.26	0.14	1.88	0.21	0.16	0.19	0.73	0.19	0.42	0.24	18.42
O&M	0.77	0.01	0.10	0.01	0.01	0.01	0.04	0.01	0.02	0.01	0.99
SUB TOTAL	15.02	0.14	1.98	0.22	0.17	0.20	0.77	0.20	0.45	0.25	19.43
1.9 TOTAL ALLOCATED COST											
CONSTRUCTION	41.05	1.12	8.05	2.24	1.91	1.24	3.60	1.24	2.45	4.86	67.76
O&M	0.89	0.01	0.13	0.02	0.02	0.01	0.05	0.01	0.03	0.04	1.22
TOTAL	41.93	1.13	8.19	2.26	1.92	1.26	3.66	1.26	2.49	4.89	68.98
PERCENTAGE OF DISTRIBUTION	60.79	1.64	11.87	3.27	2.79	1.82	5.30	1.82	3.60	7.09	100.00
2.1 ANNUAL COST											
CONSTRUCTION	5.38	0.15	1.06	0.29	0.25	0.16	0.47	0.16	0.32	0.64	8.88
O&M	.116	.001	.017	.003	.002	.002	.007	.002	.004	.005	.159

REMARKS: AT 1983 CONSTANT PRICE

Table 56 JOINT COST ALLOCATION OF BERIS DAM,
ALTERNATIVE 2, CASE B (5/6)

ITEM	JOINT COST ALLOCATION										TOTAL
	KEDAH RIVER SYSTEM					MUDA-PERAI SYSTEM					
	MUDA MAIN	MAIN MINOR	TRIBUTARY MINOR	D & I	RIVER MAIN- MINOR	MUDA- MINOR	MINOR	TRIBUTARY MINOR	D & I		
									KEDAH	P. PINANG	
1.1 PROJECT COST TO BE ALLOCATED											67.76
CONSTRUCTION											1.22
OSM											68.98
TOTAL											
1.2 BENEFIT	62.75	1.23	9.58	2.55	2.27	0.51	1.68	1.40	2.80	5.07	89.84
1.3 ALTERNATIVE COST											
CONSTRUCTION	53.17	28.20	31.64	28.94	28.83	28.06	28.07	28.27	28.90	30.52	314.60
ANNUAL O&M	.151	.1375	.1395	.1383	.1382	.1377	.1378	.1379	.1383	.139	1.3952
OSM	1.15	1.05	1.06	1.05	1.05	1.05	1.05	1.05	1.05	1.06	10.64
SUB TOTAL	54.32	29.25	32.70	29.99	29.88	29.11	29.12	29.32	29.95	31.58	325.24
1.4 JUSTIFIABLE EXPENDITURE	54.32	1.23	9.58	2.55	2.27	0.51	1.68	1.40	2.80	5.07	89.84
1.5 SEPARABLE COST											
CONSTRUCTION	28.41	0.98	6.17	2.10	1.82	0.14	0.91	1.05	2.03	4.62	48.23
ANNUAL O&M	.0166	.0005	.004	.0014	.0012	.0001	.0005	.0006	.0014	.003	.0293
OSM	0.13	0.00	0.03	0.01	0.01	0.00	0.00	0.00	0.01	0.02	0.22
SUB TOTAL	28.54	0.98	6.20	2.11	1.83	0.14	0.91	1.05	2.04	4.64	48.45
1.6 REMAINING JUSTI- FIABLE EXPENDITURE	25.78	0.25	3.38	0.44	0.44	0.37	0.77	0.35	0.76	0.43	32.96
1.7 PERCENTAGE DIS- TRIBUTION OF 1.6	78.24	0.75	10.25	1.33	1.34	1.12	2.32	1.05	2.30	1.30	100.00
*** TOTAL REMAINING JOINT COST (CON)											19.53
TOTAL REMAINING JOINT COST (O&M)											1.00
1.8 REMAINING JOINT COST											
CONSTRUCTION	15.28	0.15	2.00	0.26	0.26	0.22	0.45	0.20	0.45	0.25	19.53
OSM	0.78	0.01	0.10	0.01	0.01	0.01	0.02	0.01	0.02	0.01	1.00
SUB TOTAL	16.06	0.15	2.10	0.27	0.27	0.23	0.48	0.22	0.47	0.27	20.53
1.9 TOTAL ALLOCATED COST											
CONSTRUCTION	43.69	1.13	8.17	2.36	2.08	0.36	1.36	1.25	2.48	4.87	67.76
OSM	0.91	0.01	0.13	0.02	0.02	0.01	0.03	0.02	0.03	0.04	1.22
TOTAL	44.60	1.14	8.31	2.38	2.10	0.37	1.39	1.27	2.51	4.91	68.98
PERCENTAGE OF DIS- TRIBUTION	64.65	1.65	12.04	3.46	3.05	0.54	2.02	1.84	3.64	7.12	100.00
2.1 ANNUAL COST											
CONSTRUCTION	5.73	0.15	1.07	0.51	0.27	0.05	0.18	0.16	0.33	0.64	8.88
OSM	.119	.001	.017	.003	.003	.002	.004	.002	.004	.005	.16

REMARKS; AT 1983 CONSTANT PRICE