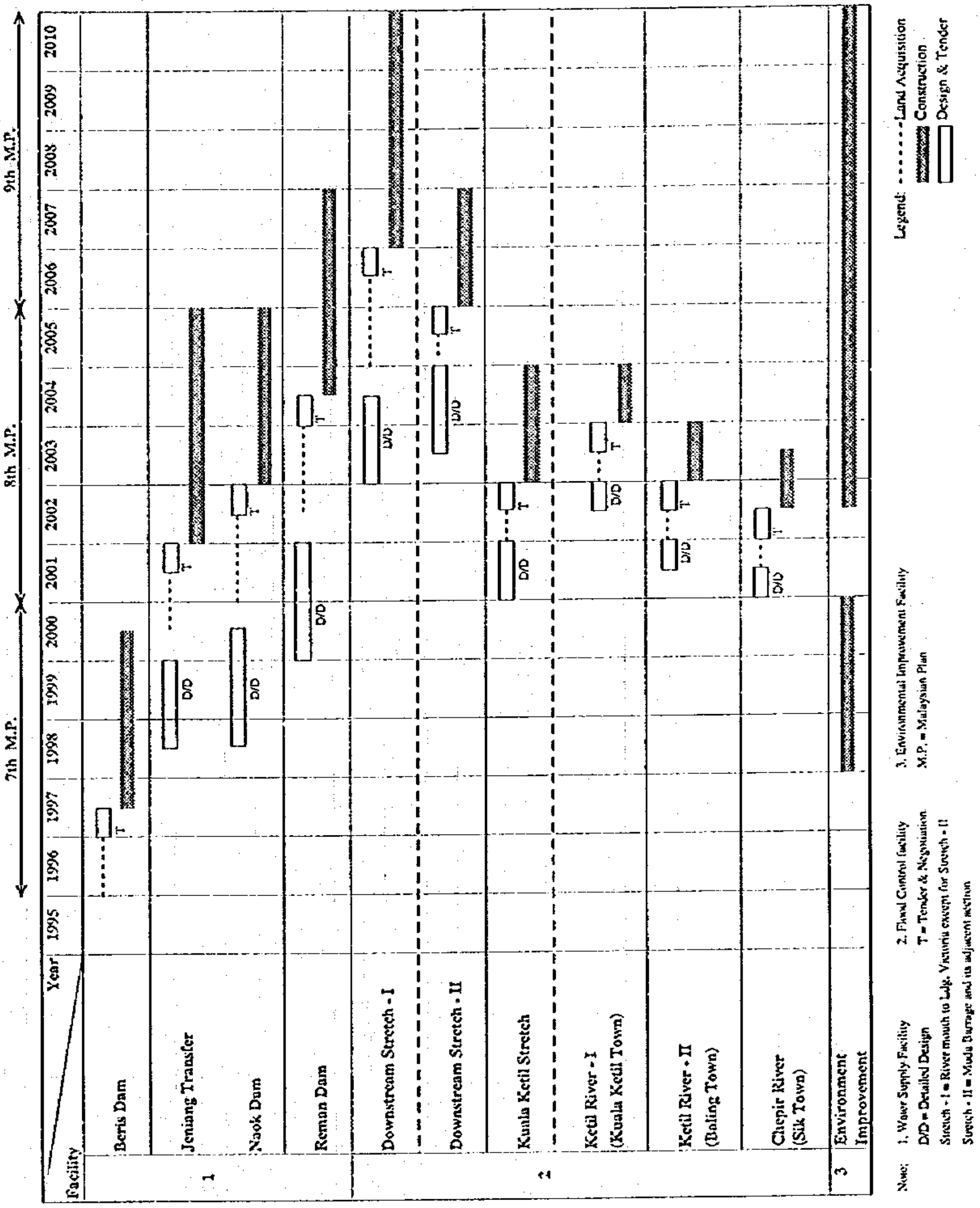
FIGURES

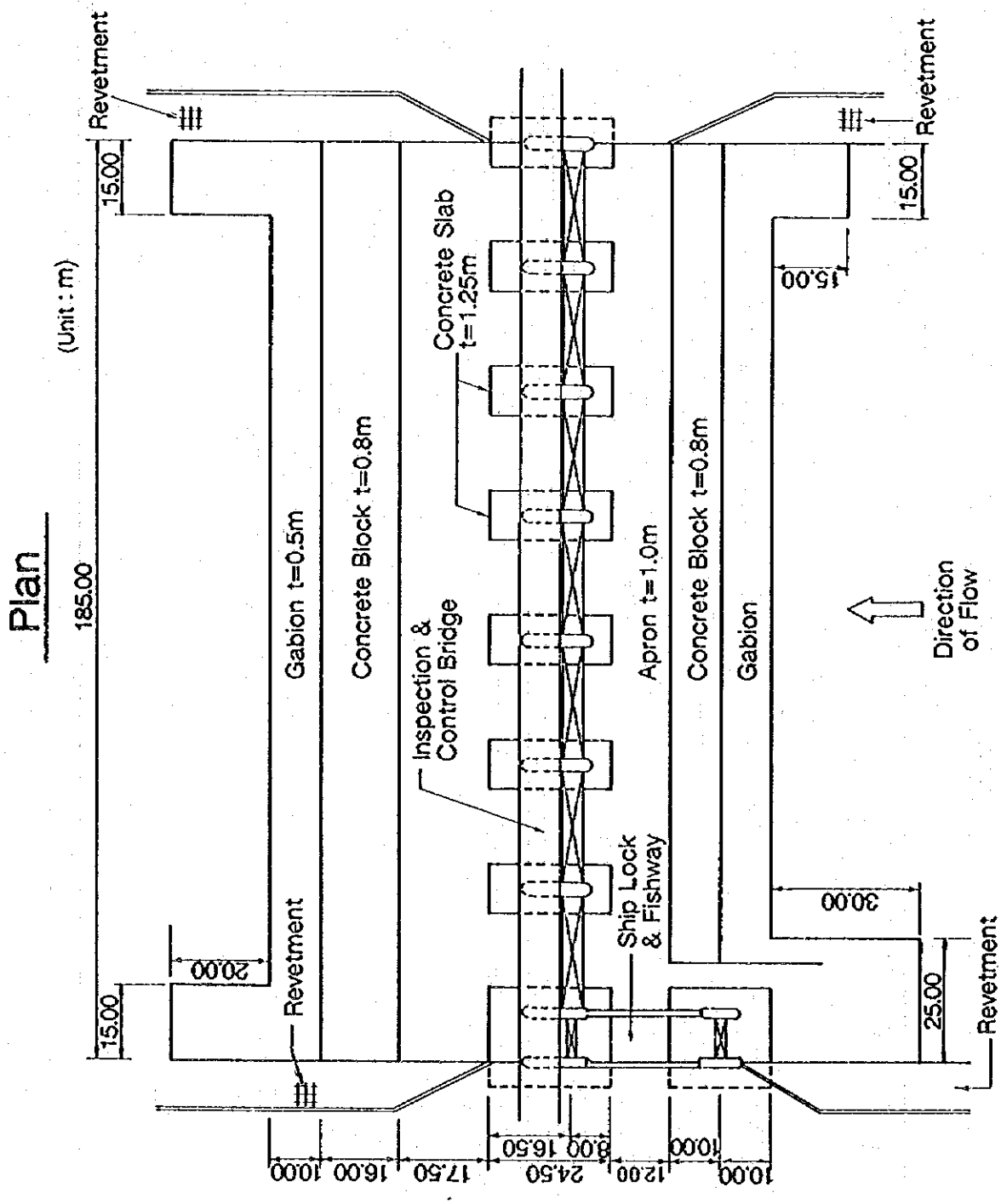
SECTOR VI

CONSTRUCTION PLAN AND COST ESTIMATE

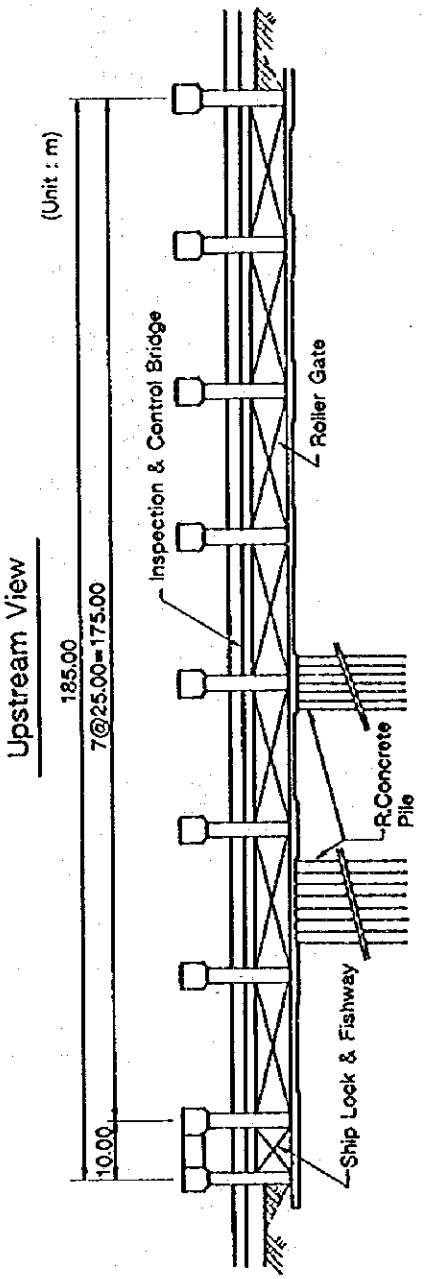
IMPLEMENTATION SCHEDULE

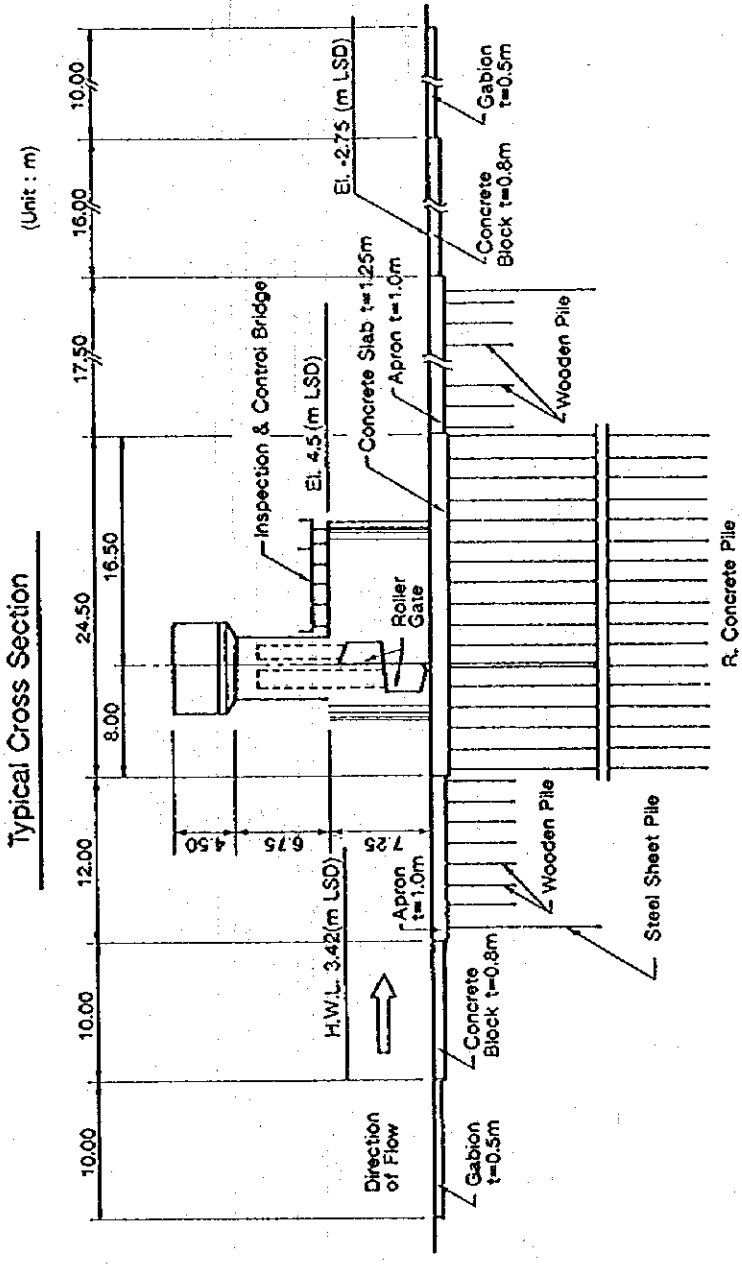


COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG.VI.1.4.1
JAPAN INTERNATIONAL COOPERATION AGENCY	Implementation Schedule

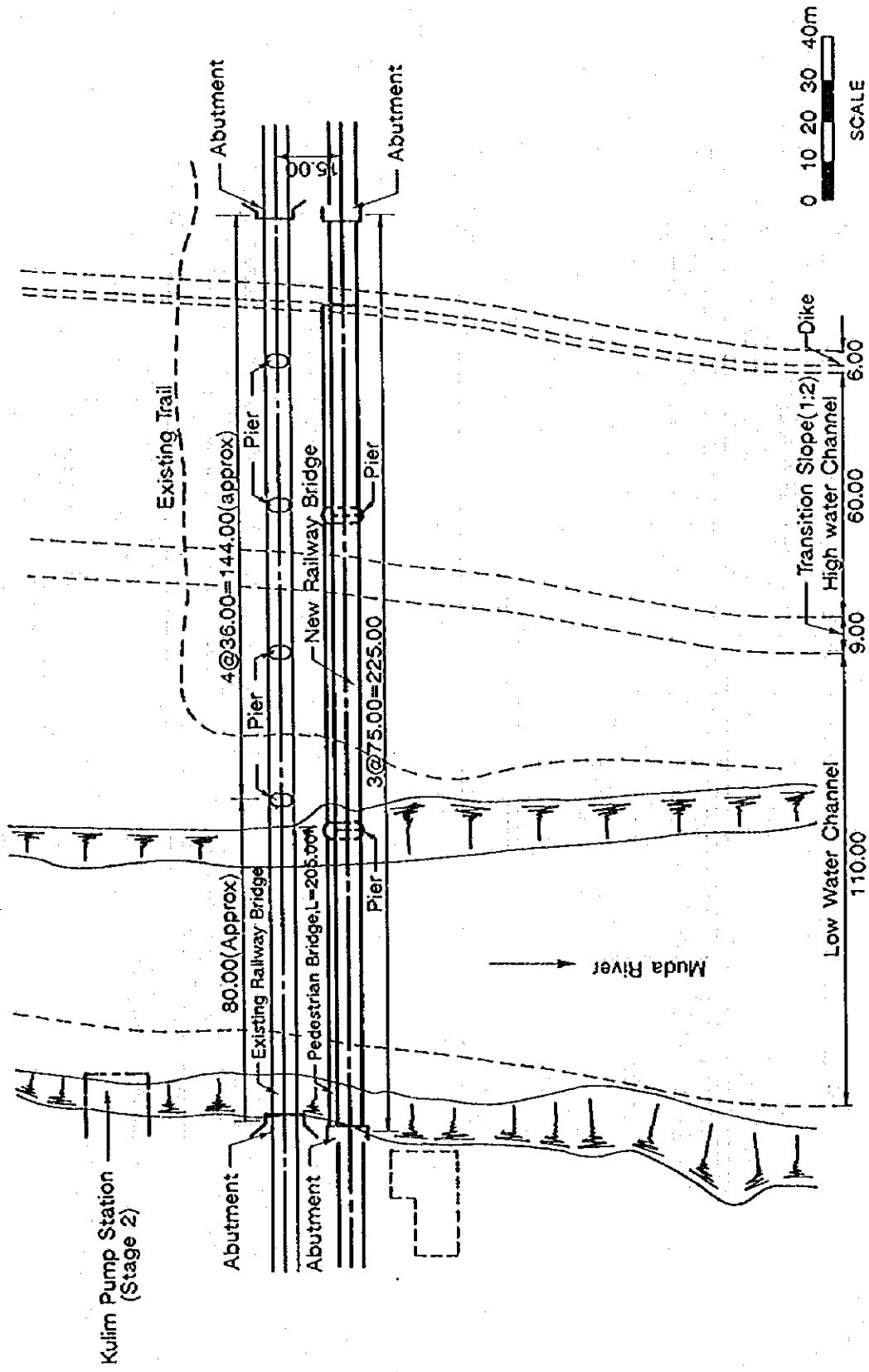


COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG.VI.1.5.1(1/2)
JAPAN INTERNATIONAL COOPERATION AGENCY	Plan of New Muda Barrage (Layout)

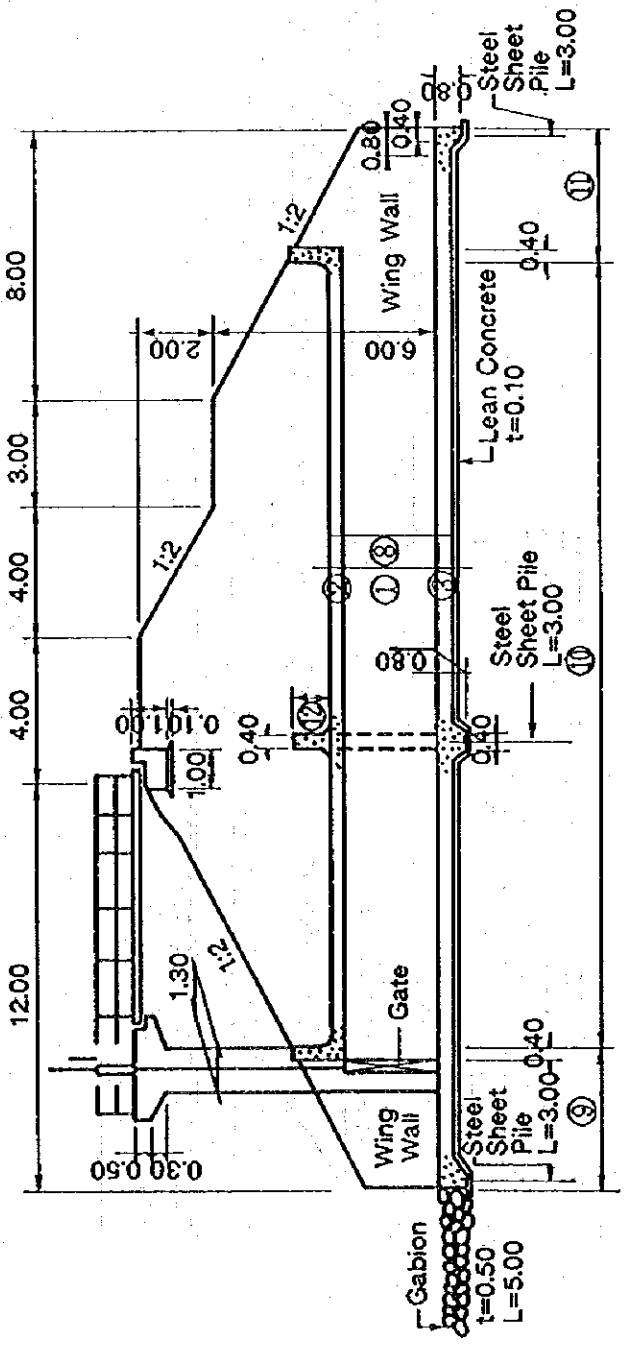


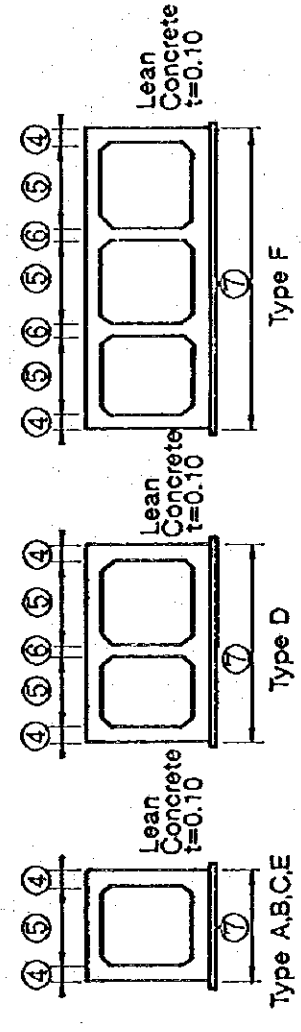


COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG.VI.1.5.1(2/2)
JAPAN INTERNATIONAL COOPERATION AGENCY	Plan of New Muda Barrage (Upstream View)



COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN JAPAN INTERNATIONAL COOPERATION AGENCY	FIG.VI.1.5.2 Relocation Plan of Railway Bridge

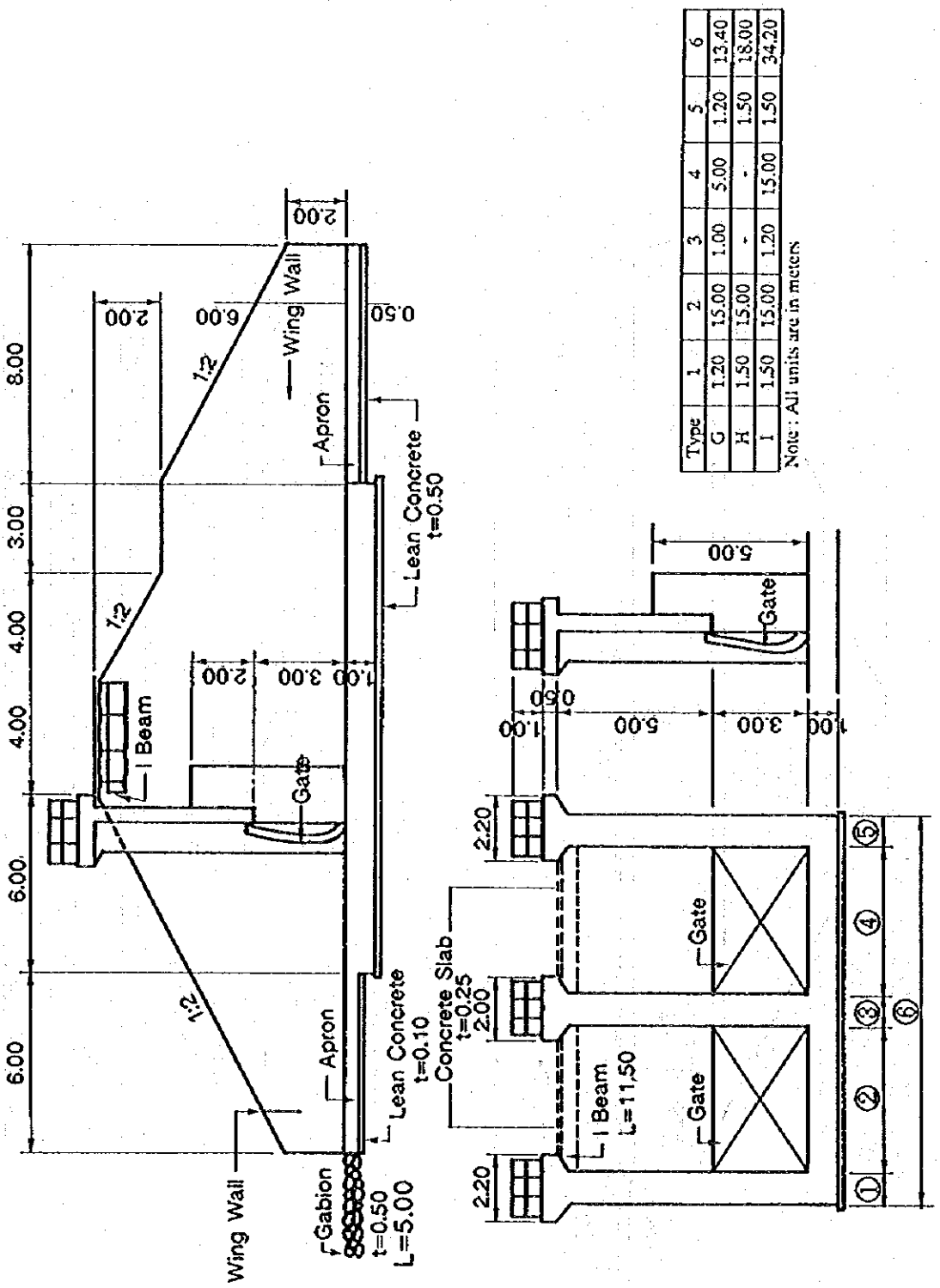




Type	1	2	3	4	5	6	7	8	9	10	11	12
A	1.80	0.30	0.40	0.45	1.50	-	1.95	2.55	4.00	23.00	4.00	1.10
B	2.00	0.35	0.40	0.45	1.80	-	2.70	2.75	4.00	22.00	4.00	1.10
C	2.00	0.35	0.40	0.45	2.00	-	2.90	2.75	4.20	22.50	4.20	1.05
D	2.50	0.40	0.50	0.45	2.40	0.30	6.99	3.40	4.20	22.60	4.20	1.05
E	2.60	0.45	0.55	0.50	2.70	-	3.70	3.55	5.00	21.00	5.00	1.00
F	2.60	0.50	0.50	0.50	2.70	0.30	9.70	3.60	5.00	21.00	5.00	1.00

Note : All units are in meters

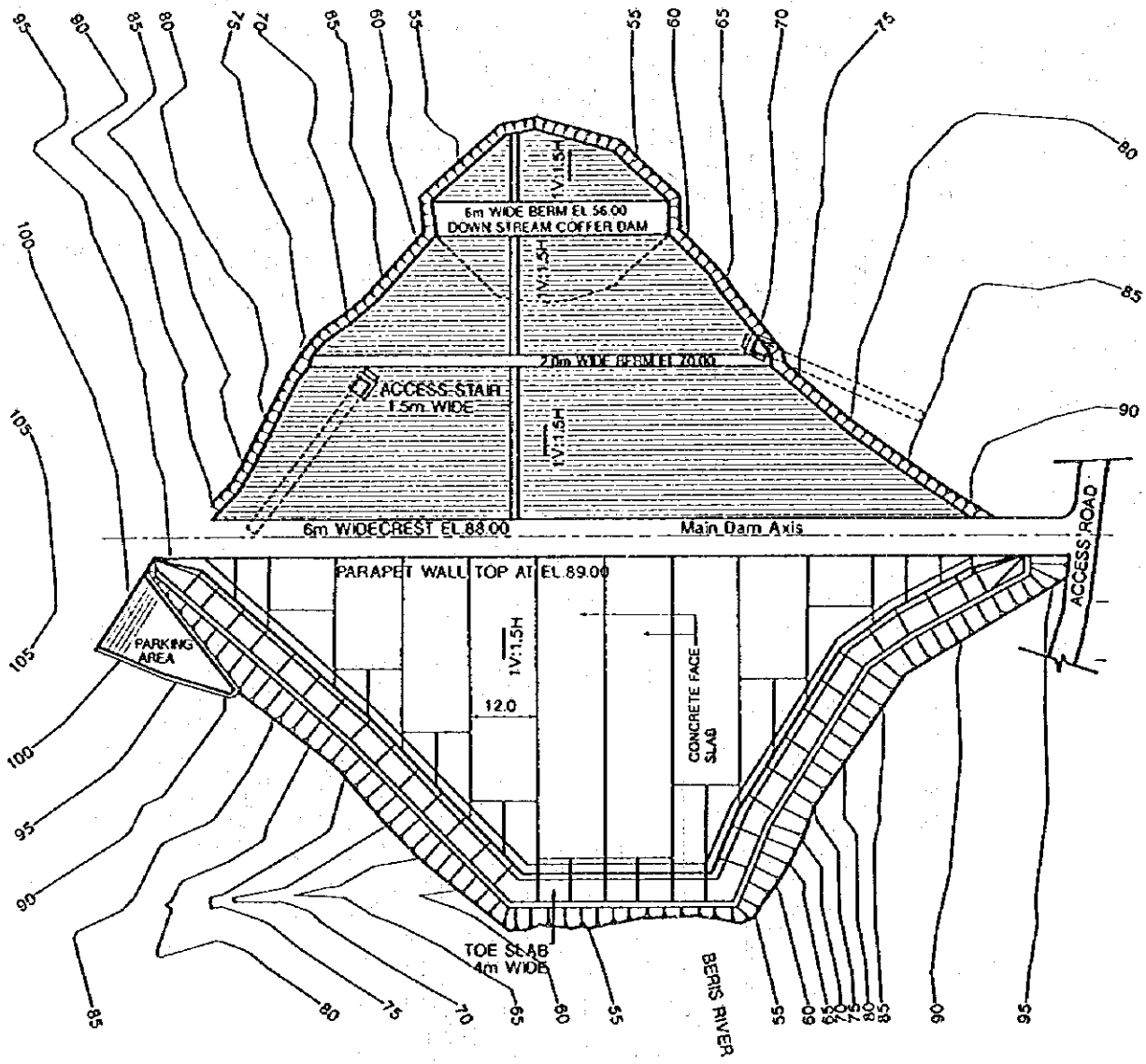
COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG. VI.1.5.3 (1/2)
JAPAN INTERNATIONAL COOPERATION AGENCY	Plan of Sluice Structures (Slide gate)



Type	1	2	3	4	5	6
G	1.20	15.00	1.00	5.00	1.20	13.40
H	1.50	15.00	-	-	1.50	18.00
I	1.50	15.00	1.20	15.00	1.50	34.20

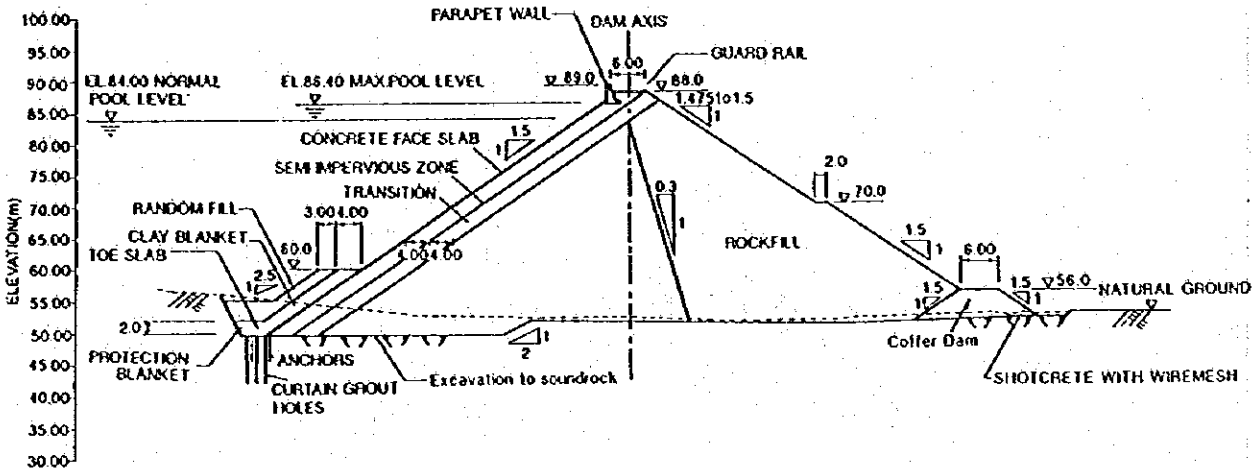
Note : All units are in meters

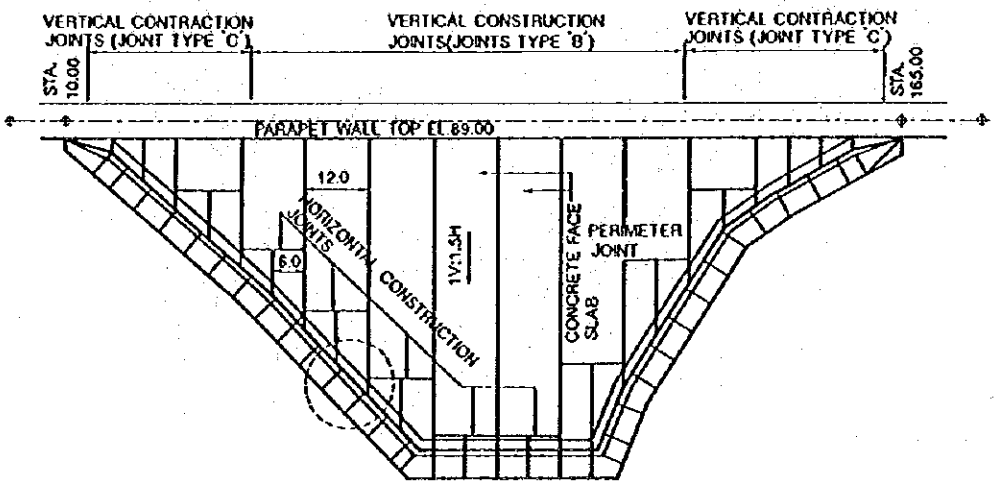
COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG. VI.1.5.3 (2/2) Plan of Sluice Structures (Roller gate)
JAPAN INTERNATIONAL COOPERATION AGENCY	



Souce : Beris Dam Detailed Design Report

COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG.VI.1.6.1
JAPAN INTERNATIONAL COOPERATION AGENCY	Layout Plan of Beris Dam

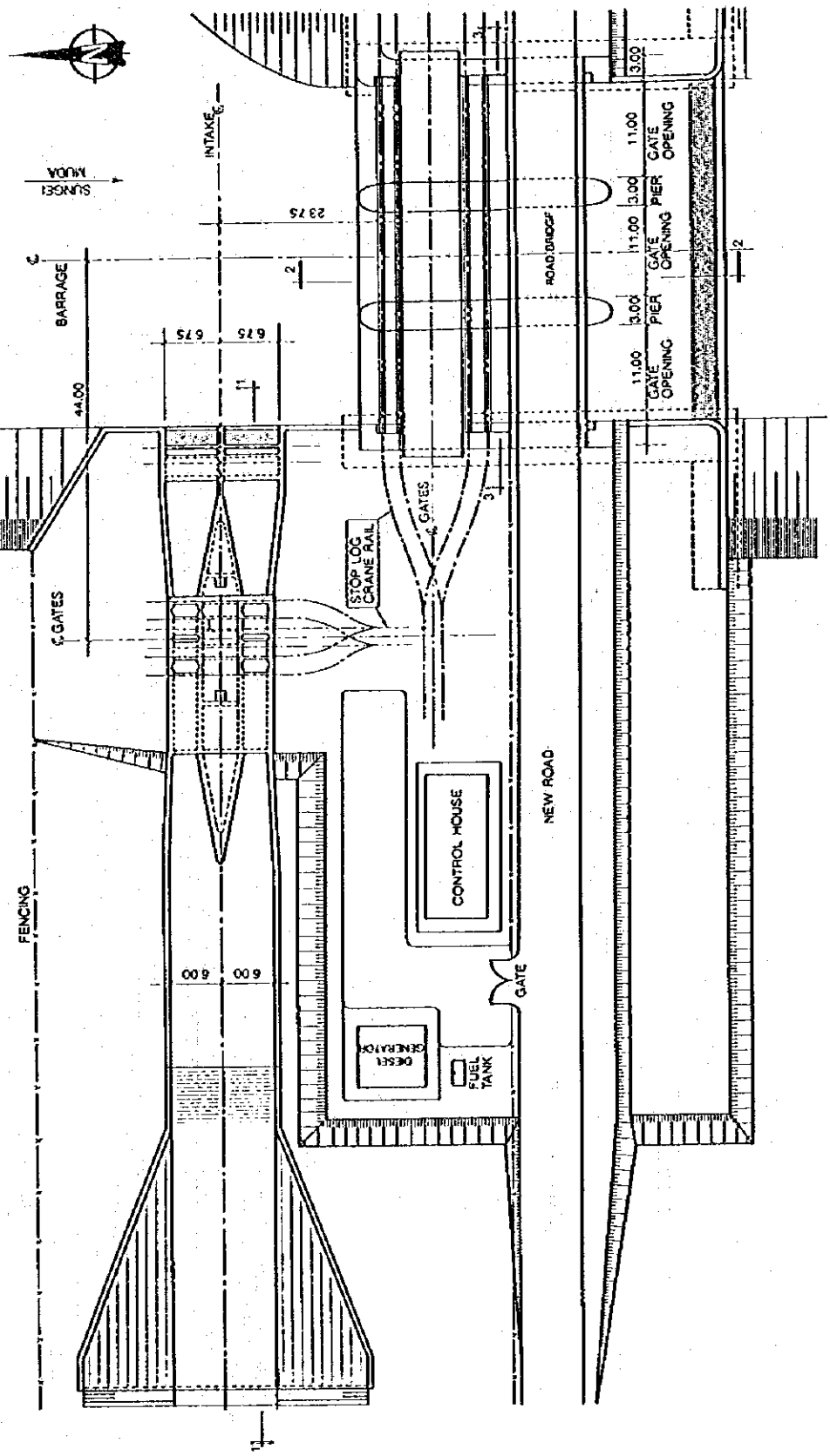




SCALE
0 10 20 30 40 50m

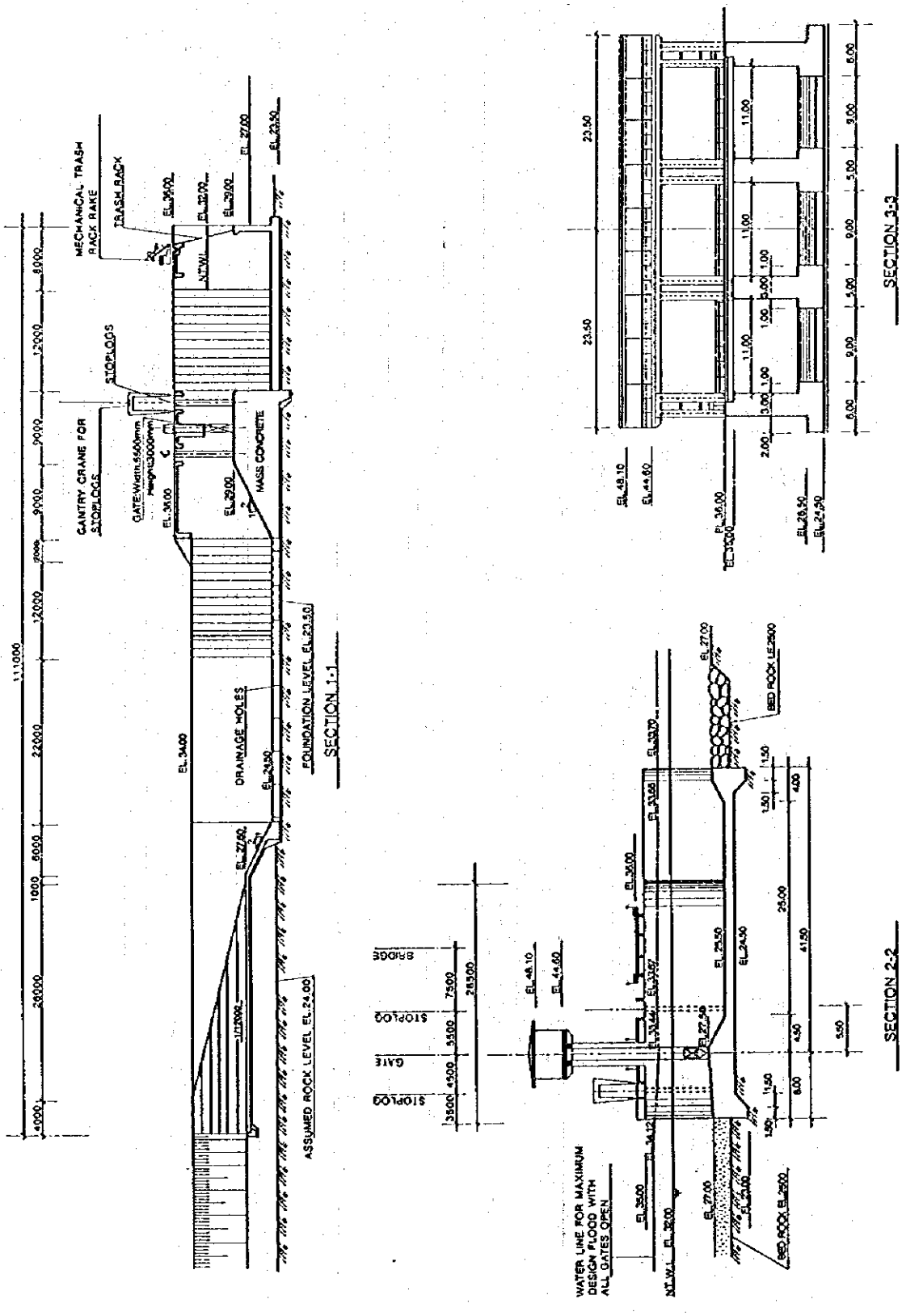
Source : Beris Dam Detailed Design Report

COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG.VI.1.6.2
JAPAN INTERNATIONAL COOPERATION AGENCY	Typical Cross Section and Face-slab Plan of Beris Dam



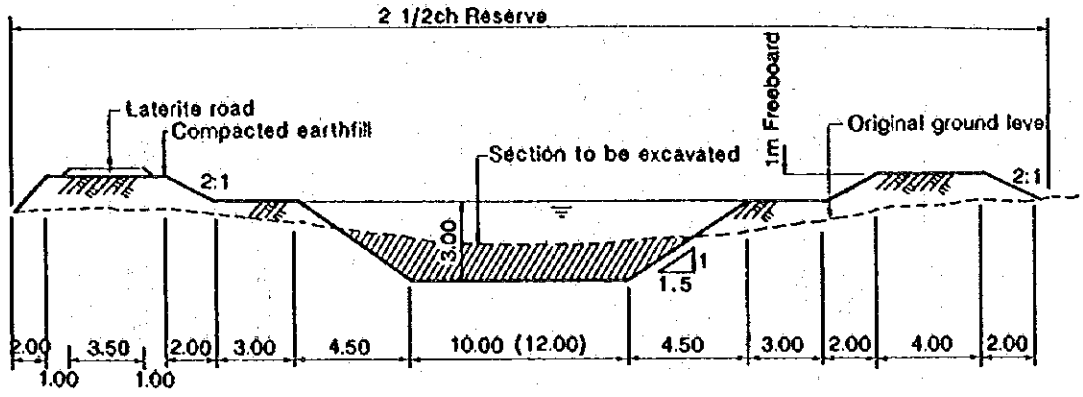
Source : F/S for Proposed Jeniang Diversion, Naok Reservoir and Transfer Canal

COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN JAPAN INTERNATIONAL COOPERATION AGENCY	FIG.VI.1.6.3 Plan View of Jeniang Diversion Barrage

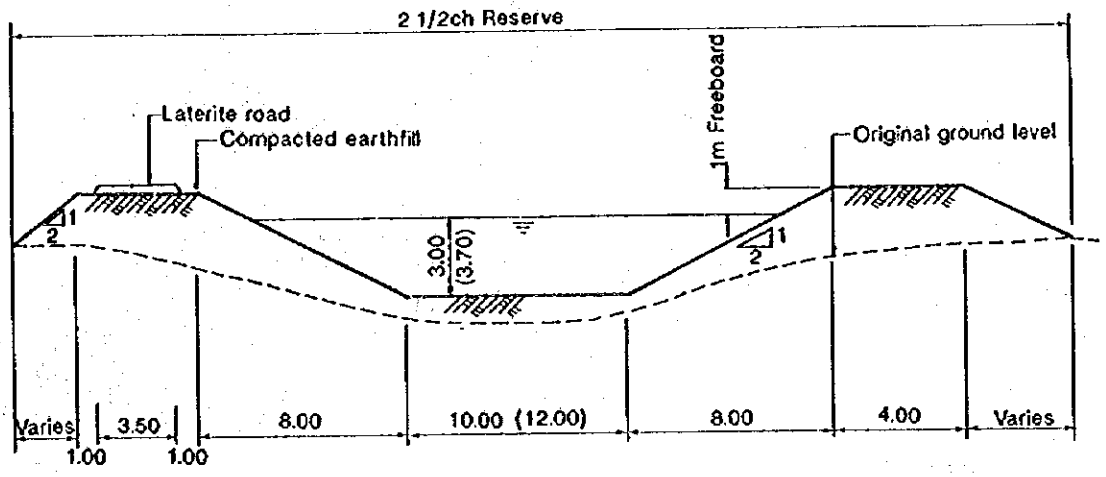


Source : F/S for Proposed Jenlang Diversion, Naok Reservoir and Transfer Canal

COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG.VI.1.6.4 Typical Cross Section of Jenlang Diversion Barrage
JAPAN INTERNATIONAL COOPERATION AGENCY	



CANAL SECTION IN CUT

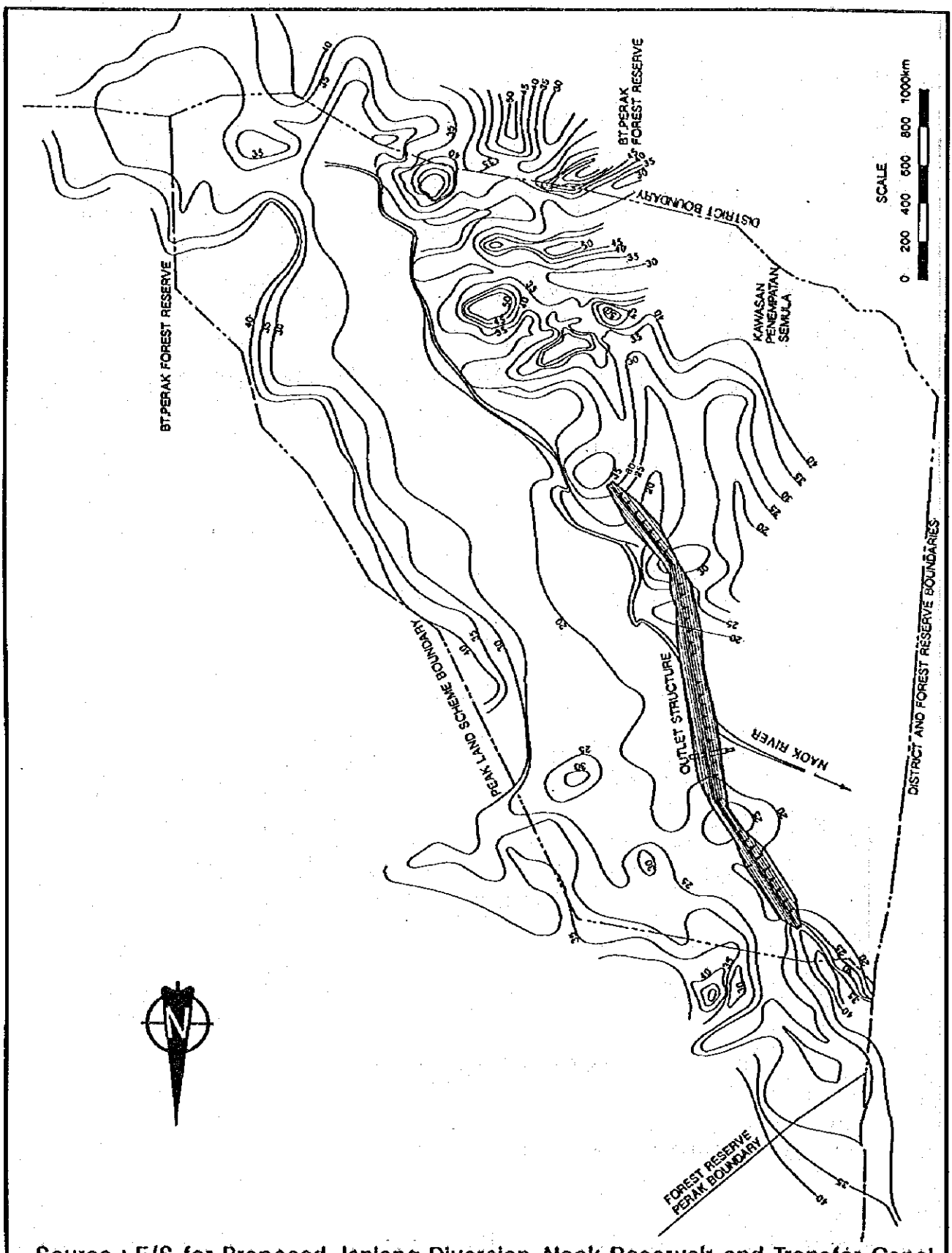


CANAL SECTION IN FILL

Note:
Figures in parentheses reter to transter canal

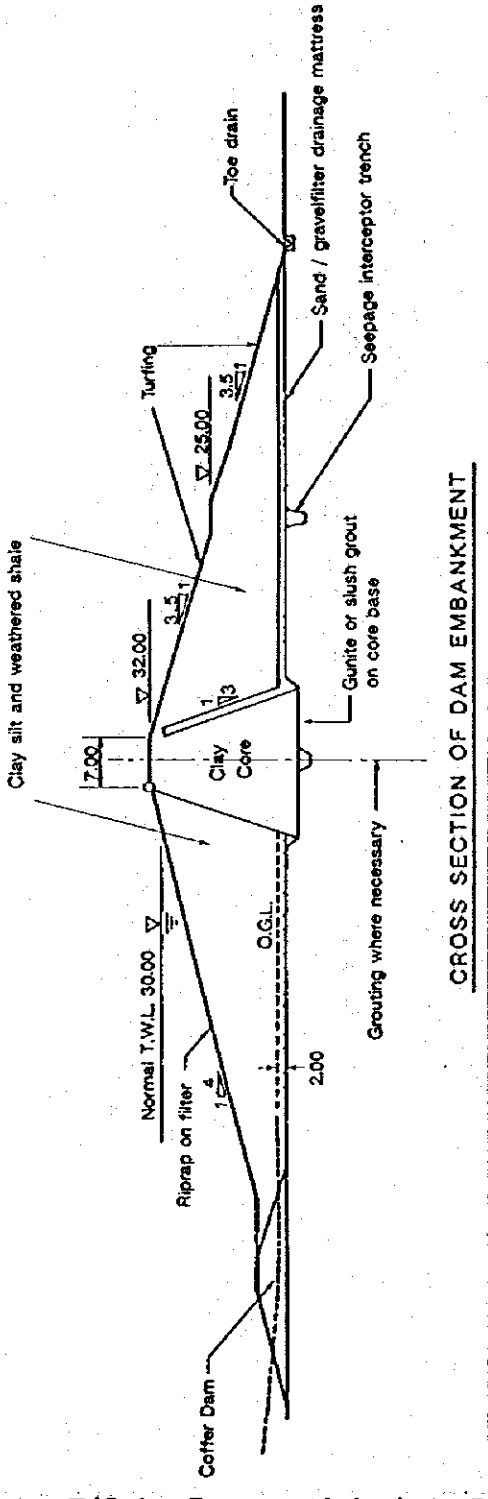
Source : F/S for Proposed Jenlang Diversion, Naok Reservoir and Transfer Canal

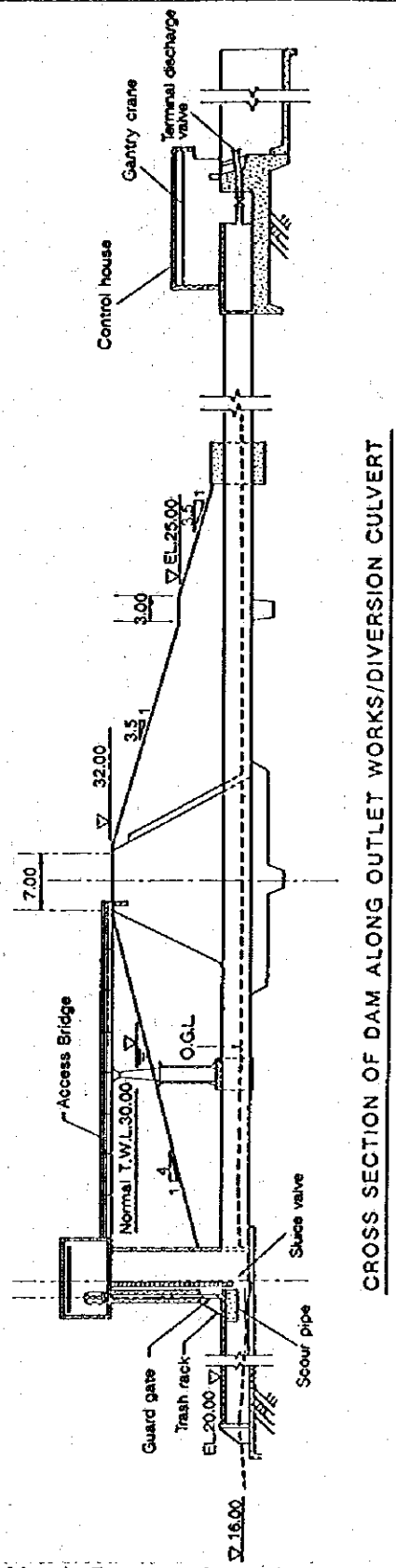
COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG.VI.1.6.5 Typical Canal Sections of Jenlang Transfer System
JAPAN INTERNATIONAL COOPERATION AGENCY	



Source : F/S for Proposed Jenlang Diversion, Naok Reservoir and Transfer Canal

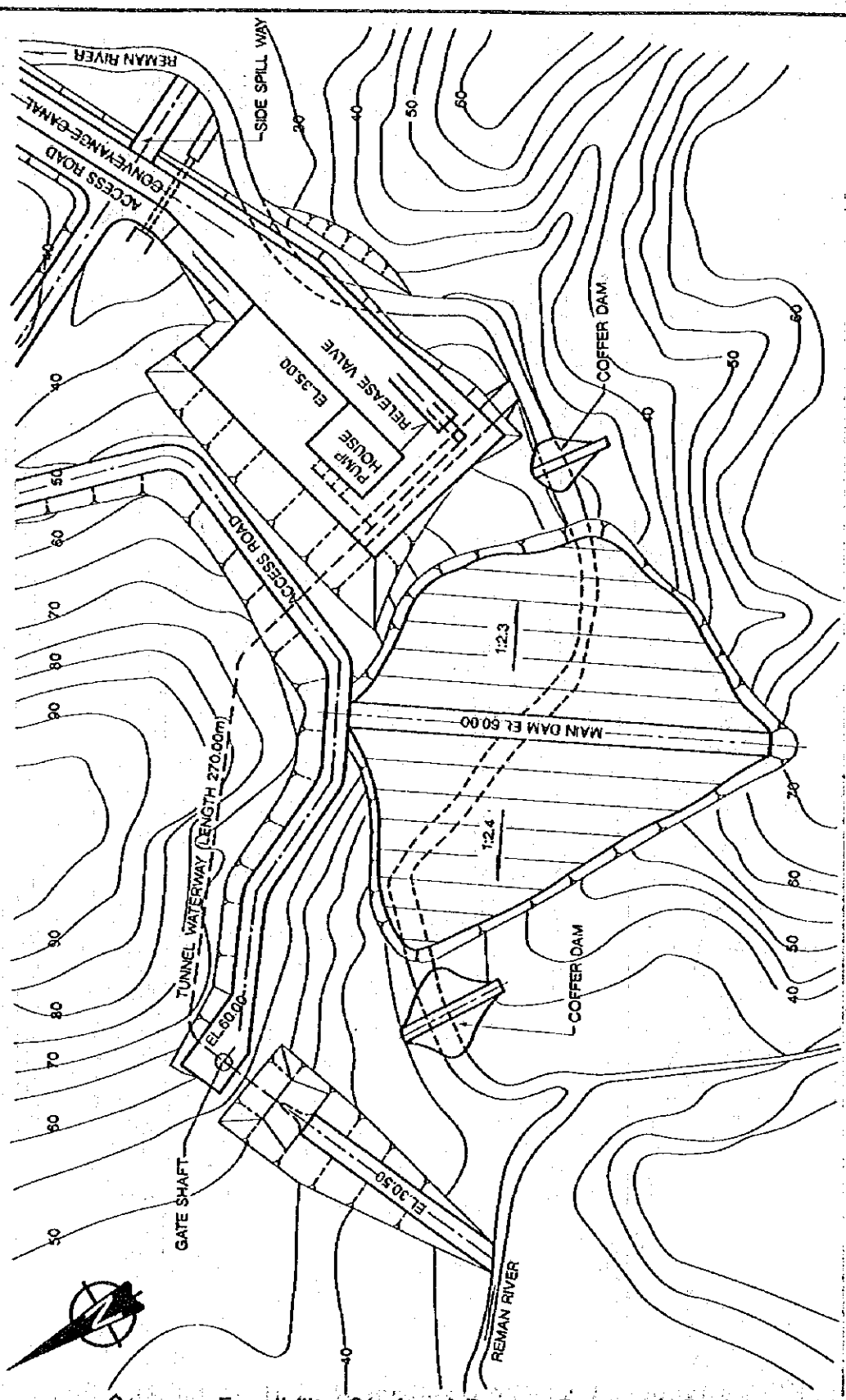
COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG. VI.1.6.6 Site Plan of Naok Dam (Reservoir)
JAPAN INTERNATIONAL COOPERATION AGENCY	





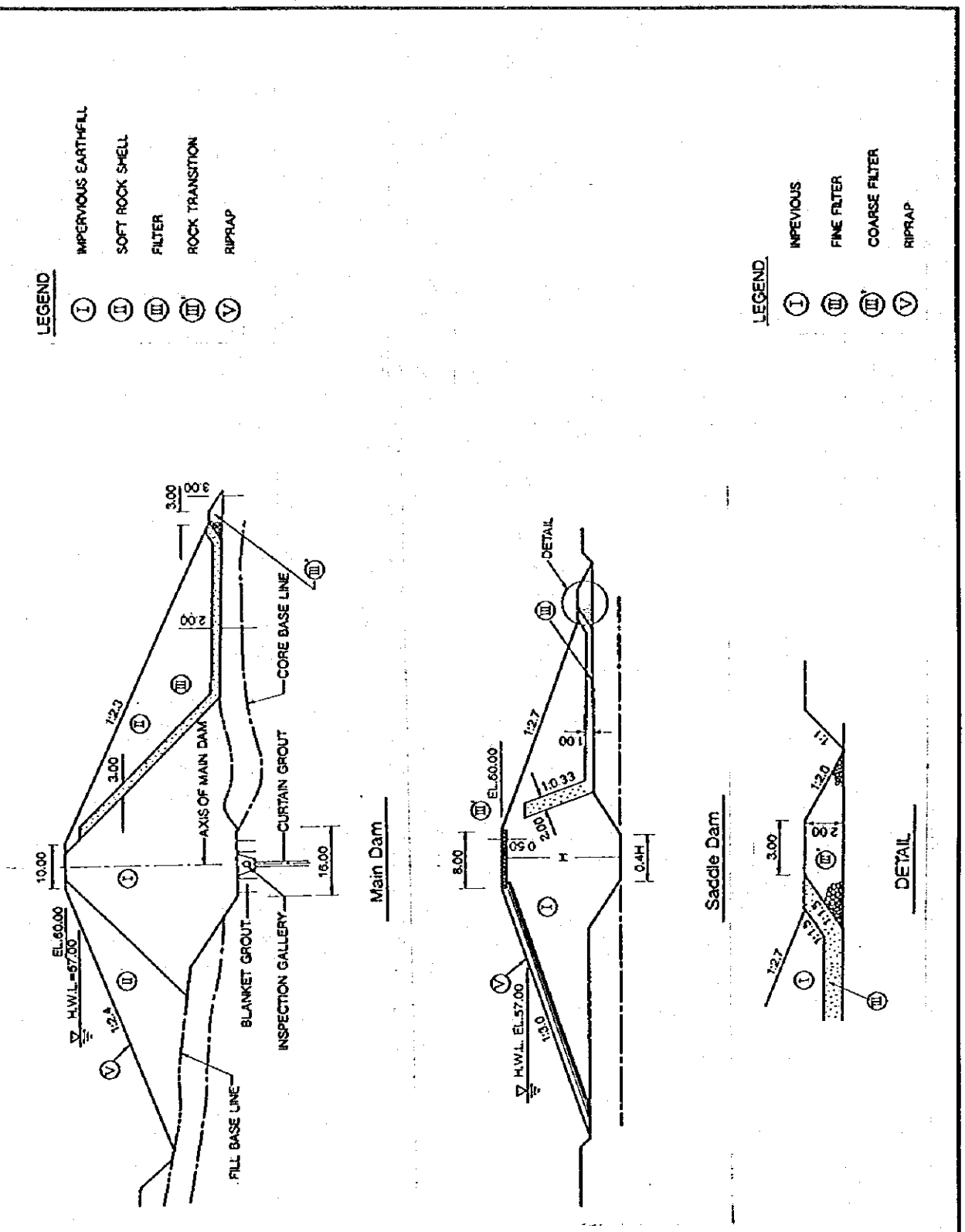
Source : F/S for Proposed Jeniang Diversion, Naok Reservoir and Transfer Canal

COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG.VI.1.6.7 Typical Cross Section of Naok Dam
JAPAN INTERNATIONAL COOPERATION AGENCY	



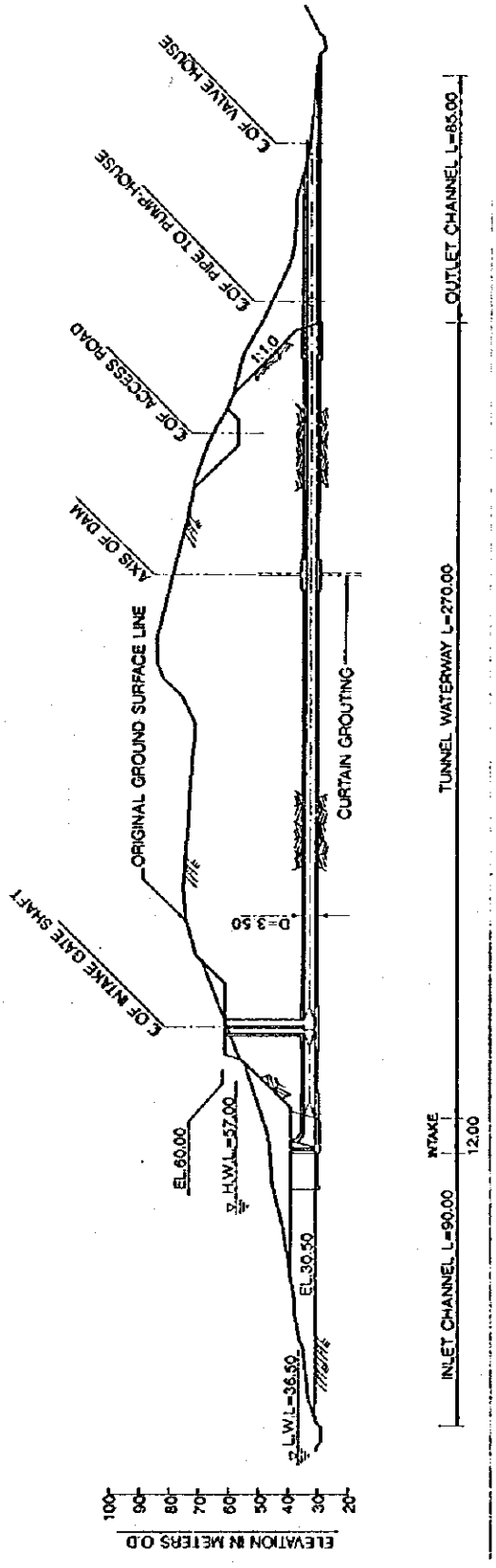
Source : Feasibility Study of Reman Reservoir Project

COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG. VI.1.6.8
JAPAN INTERNATIONAL COOPERATION AGENCY	Layout Plan of Reman Dam



Source : Feasibility Study of Reman Reservoir Project

COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG. VI.1.6.9 Typical Cross Section of Reman Dam and Saddle Dam
JAPAN INTERNATIONAL COOPERATION AGENCY	



Source : Feasibility Study of Reman Reservoir Project

COMPREHENSIVE MANAGEMENT PLAN OF MUDA RIVER BASIN	FIG.VI.1.6.10 Profile of Waterway (Reman Dam)
JAPAN INTERNATIONAL COOPERATION AGENCY	

SECTOR VII

SOCIO-ECONOMY

SECTOR VII
SOCIO-ECONOMY

TABLE OF CONTENTS

LIST OF TABLES

1. NATIONAL ECONOMY

1.1 Gross Domestic Product (GDP)

The Gross Domestic Product (GDP) of Malaysia amounted to RM 163,039 million at the current price in 1993, increasing at an average annual rate of 12.40% during the period from 1988 to 1993. The Gross National Product (GNP) showed RM 154,783 million at the current price in the same year, and its average annual growth rate was 12.53% for the same period. However, the real annual growth rates was 8.75% for the GDP and 8.82% for the GNP during the same period (refer to Table VII.1.1.1).

The per capita GDP also, growing at a high average annual rate of 9.92% during the period 1988-1993, amounted to RM 8,126 at current prices in 1993, and its real annual growth rate was 6.30% on average for the same period.

Table VII.1.1.2 provides the GDP according to economic activity. During the period 1988-1993, the highest and lowest of economic growth were construction and agricultural sectors which showed the average annual rate of 13.53% and 2.90%, respectively. Following the construction sector, the manufacturing sector indicated a rapid annual growth rate of 13.43% on average for the same period.

Among share of each sector in the GDP in 1993, the manufacturing sector showed the highest rate of 30. %, which was far higher than 15.9% share of the agricultural sector. It is expected that an upward trend in the share for the manufacturing sector and the gradual downward trend for the agricultural sector will be maintained for the time being in Malaysia.

1.2 External Trade

1.2.1 Export and Import

Exports and imports in the country are as described below.

(1) Exports

The Malaysian exports amounted to RM 121,237 million in 1993, an average annual growth rate of 17.0% during the period 1988-1993. On the other hand, the imports indicated RM 117,405 million in 1993, and the average annual growth rate was 22.1% for the same period. As shown in Table VII.1.2.1, the external trade was maintaining a favorable situation. In addition to the rapid growth in the trade amount, the exports exceeded the imports every year, except the year 1991, during the said period.

Among the export commodities, the sector of machinery and transport equipment achieved RM 58,797 million of the exports in 1993. This amount corresponds to 48% of the total exports, and its growth indicates a high annual

rate of 30.3% for the said period. Following this sector, mineral, fuels, lubricants, etc., amounted to RM 12,471 of the exports, or 10.3% of the total exports in the same year. Export statistics of other commodities are given in Table VII.1.2.2.

(2) Imports

In the Malaysian imports, the sector of machinery and transport equipment took first rank during the period 1988-1993. In 1993, imports of this sector amounted to RM 65,439 million, accounting for 56% of the total imports, and the average annual increase rate indicated 27.4% for the said period.

Following the sector of machinery and transport equipment, the manufactured goods amounted to RM 17,705 million of imports in 1993, or 15.0% of the total imports. During the period 1988-1993, the imports of this sector increased at an average annual rate of 19.8%. Import statistics of other goods are given in Table VII.1.2.3.

1.2.2 Balance of International Payments

Table VII.1.2.4 shows the balance of international payments of Malaysia. During the period from 1988 to 1993, merchandise account (f.o.b.) showed a favorable balance every year, except the year 1991. While, services account continued a remarkable deficit of RM 10,000 million and over. As a result, the current account has continued an unfavorable balance since 1989, as shown in the said table.

Such a deficit of the current account balance was compensated by the capital account in each year, and the international payment of Malaysia was being maintained at a favorable balance every year during the said period.

1.3 Federal Government Finance

During the period 1988-1993, budget of the Federal Government increased at an annual rate of 13.7% for revenue and 9.4% for expenditure, and in 1993, it amounted to RM 41,691 million for revenue and RM 42,341 million for expenditure.

Major sources of revenue consist of three categories: direct taxes, indirect taxes and non-tax revenue. During the same period, the annual increase rate showed 17.9% for direct taxes, 15.6% for indirect taxes and 6.2% for non-tax revenue. In 1993, those amounts (share) were RM 17,070 million (41%), RM 14,830 million (36%) and RM 9,791 million (23%), respectively. Of the tax revenue in 1993, the maximum amount (share) was RM 8,551 million (21% share) of company taxes (refer to Table VII.1.3.1).

The expenditure is composed of operating and development sectors, which amounted to RM 32,217 million and RM 10,124 million in 1993, respectively. Of the operating expenditure, the maximum was RM 11,803 million (37%) to the emoluments at the objective base, and RM 10,381 million (32%) to the social services at the sector base (refer to Table VII.1.3.2).

The development expenditure is divided into four groups as a basic objective: security, social services, economic services and general administration. The development expenditure for these four objectives was RM 2,258 million (22%), RM 2,220 million (22%), RM 5,265 million (52%) and RM 381 million (4%) in 1993, respectively. More breakdown is provided in Table VII.1.3.3.

1.4 Prices

Table VII.1.4.1 shows the consumer price index in Peninsular Malaysia for the period from 1988 to 1993. As seen in the table, annual inflation rate for the general prices recorded 3.6% on average during the said period. Of main groups, two groups of beverages and tobacco and transport and communication indicated the comparatively high inflation rate of 6.4% and 5.4% per annum, respectively. On the contrary, the lowest inflation rate was 1.5% for the group of gross rent, fuel and power.

In view of such stabilization of consumer prices and high growth in the foregoing GDP, it is expected that the Malaysian economy will maintain a stable high growth for the time being.

2. SOCIO-ECONOMY IN THE STUDY AREA

2.1 Location and Administrative Unit

The study area consists of three states: Perlis, Kedah and Pulau Pinang, which are located between longitude 99°39' E and 101°23' E and latitude 5°04' N and 6°44' N in the northwestern part of Peninsular Malaysia. The total territorial area is 11,252 km², consisting of 9,426 km² (84%) for Kedah State, 795 km² (7%) for Perlis State and 1,031 km² (9%) for Pulau Pinang State. The territorial area by district is given in Table VII.2.1.1.

Peninsular Malaysia is administratively composed of 11 states excluding the Federal Territory of Kuala Lumpur. Each state is subdivided into several districts, which are comprised of many mukims (parishes). Further, each mukim has several kampungs (villages) as the smallest administrative unit.

The three states in the study area cover 17 districts and 236 mukims in total, according to the breakdown of each state shown below.

State	District	Mukim
Kedah	11	133
Perlis	1	4
Pulau Pinang	5	99
Total	17	236

2.2 Population

2.2.1 Population and Number of Households

(1) Census Population

Population and housing censuses of Malaysia have been conducted three times in recent years; 1970, 1980 and 1991. The population of Malaysia reached 17,566,982 in 1991, increasing by 4,430,873 (34%) compared with the 1980 population. The average annual growth rate of population was 2.64% for the intercensal period from 1980 to 1991. This growth rate was somewhat higher than the rate of 2.30% for the intercensal period 1970-1980. The population and number of households by state in Malaysia in the census years are shown in Tables VII.2.2.1 and VII.2.2.2.

In 1991, the study area had a population of 2,553,945, consisting of 1,304,800 in the Kedah state, 184,070 in the Perlis state and 1,065,075 in the Pulau Pinang state. The average annual rate of population growth in the study area indicated 1.68% for the period 1980-1991 (refer to Table VII.2.2.3). This rate was very low compared to the average rate of the whole country, due mainly to migration of people from the study area to other states.

Population density in the study area reached 237 persons per km^2 in 1991, increasing by 38 persons per km^2, compared with the 1980 population density. The population density by state in 1991 indicated 232 persons per km^2 in the Kedah state, 138 persons per km^2 in the Perlis state and 1,033 persons per km^2 in the Pulau Pinang state. These figures show a concentration of population to the Pulau Pinang state. The population density at the district level in the study area is given in Table VII.2.2.3.

(2) Number of Households

Number of households in the study area amounted to 526,177 in 1991, consisting of 272,783 in the Kedah state, 40,116 in the Perlis state and 213,278 in the Pulau Pinang state. During the period 1980-1991, the number of households increased at the average annual rate of 2.23% in the study area, 2.14% in the Kedah state, 2.05% in the Perlis state and 2.38% in the Pulau Pinang state. The household number in each district is given in Table VII.2.2.4.

As shown in Table VII.2.2.2, an average family size in Malaysia indicated 4.91 persons per household in 1991, decreasing by 0.31 persons/hh compared to that in 1980. Such a downward trend appeared also in the study area, i.e., it decreased from 5.16 persons/hh in 1980 to 4.85 persons/hh in 1991.

Table VII.2.2.5 provides population, number of households and average family size in each mukim as basic data for estimating domestic water demand and flood damage in the study area.

2.2.2 Population Projections

The population projection study is as described below.

(1) General

Study of the population projection aims to obtain a basic material required in estimating the quantity of domestic water demand and the flood damage potential in the future. The projection is carried out on all mukims in three states; Kedah, Perlis and Pulau Pinang, for objective years 2000 and 2010. Where, institution of the objective areas is based on the assumption that the domestic water supply plan is formulated according to each mukim and flood damage potential is estimated at the mukim level.

The previous studies of the population projections for Kedah, Perlis and Pulau Pinang states are given in the following reports:

(a) Perlis Master Plan Study, Socio-Economic Framework, 1984, State Economic Planning Unit, the State Government of Perlis.

(b) Penang Island Structure Plan, Technical Report No. 3 Population, 1985, Pusat Penyelidikan Dasar Universiti Sains Malaysia.

(c) Feasibility Study and Preliminary Design Report on Kulim Water Supply, Phase 2, 1992, Kerajaan Negeri Kedah Darulaman.

Of these studies, reports (a) and (b) provide the population projections for the whole states of Perlis and Pulau Pinang, respectively, on the basis of the 1980 census population. The population projection shown in (c) was carried out for the Kulim District in the Kedah State, based on the 1991 census population. Results of these studies are as given below in Item (2), Review of Previous Study Results, to compare with result of the present projection.

The latest population census in Malaysia was carried out in 1991. The present population projection is studied using a preliminary count of the 1991 census population, together with the census data in 1980 and 1970.

The projection basically applies a mathematical model, not a demographic model, because the migration data by Mukim for the period from 1980 to 1991 are inadequate to forecast the future population. The result of the present projection therefore would provide a preliminary figure as against the ordinary projection which will be made based on a demographic model in the near future. Methodology of the present projection is as described below in Item (3), Methodology.

(2) Review of Previous Study Reports

(a) Perlis Master Plan Study, Socio-Economic Framework, 1984, State Economic Planning Unit, the State Government of Perlis

This study was carried out to prepare a comprehensive master plan for the integrated development of the Perlis state up to the year 2005, and the population projection was studied to get the population size and profile of the State in the future.

This projection is made an orthodox method which combined economic base and cohort-survival methods, using the census data in 1970 and 1980. The economic base method serves as guideline for the total population in the State on the basis of migration in the year 1970's. On the other hand, the cohort-survival method estimates the natural growth in population under the demographic analysis which uses statistical population structure covering age group, sex, ethnic group, birth and death, fertility and mortality and household size.

As a result, the total population of the Perlis State was projected to be 180,610 in 1990, an average growth rate of 1.96% per annum for the period 1980-1990, and 216,133 in 2000 with an average growth rate of 1.81% per annum for the period 1990-2000.

The 1990 population projected above indicates a close figure to the 1991 census population (184,070), although the average annual growth rate is a somewhat slower than the intercensal annual rate (2.17%) for the period 1980-1991. In this study, a detailed population projection was made for only the urban center in each mukim, not for the whole mukim. The projected population in 2000 is as discussed below in Item (4), Results.

(b) Penang Island Structure Plan, Technical Report No. 3, Population, 1985, Pusat Penyelidikan Dasar Universiti Sains Malaysia

This study was carried out for the purpose of preparing the structure plan for Penang Island in accordance with the Town and Country Planning Act, 1976, of Malaysia. The population projection, which forms a part of five reports on the structure plan, was made at the five-year interval for the period 1980 to 2000 on the basis of demographic and migration models using the census data in the years 1970 and 1980.

The future population was projected by ethnic group and district for the Penang Island and the whole of Pulau Pinang State. However, the projection by mukim was excluded from this study.

According to this study, the 1990 population of the whole Pulau Pinang was estimated at 1,111,400 in the low scenario and 1,113,700 in the high scenario at an average growth rate of 1.53% and 1.55% per annum for the year 1980's, respectively. These populations indicate the larger figure by approximately 50,000 compared to the 1991 census population, because

the 1980 population, which is a given condition of this projection, adopted a very different figure from the final result of the 1980 census population.

The population in the year 2000 for the whole Pulau Pinang State was estimated at 1,278,100 in the low scenario and 1,293,400 in the high scenario at an average growth rate of 1.41% and 1.5 % per annum for the period 1990-2000, respectively. These results are again discussed below in Item (4), Results.

(c) Feasibility Study and Preliminary Design Report on Kulim Water Supply, Phase 2, 1992, Kerajaan Negeri Kedah Darulaman

This study aims to examine the feasibility of the Kulim water supply project. In this study, a population projection was carried out according to mukim in Kulim District for the target years of 2000 and 2010, in order to prepare the basic data for estimating the future water demand.

The projection was made by extrapolation, using the census data in 1991, 1980 and 1970, taking into consideration the socioeconomic factors such as development of industrial estates, pace of development in the district, migration rate, employment, etc.

In estimating the future population, an average annual growth rate was first presumed by mukim for the periods 1991-2000 and 2000-2010, based on the rates derived from the extrapolation. In this process, the annual population growth was limited to be 8% as the highest rate and 0.5% as the lowest rate.

As a result, the average annual growth rate of Kulim District was assumed to be 4.0% and 2.9% in the 1990's and the 2000's respectively, and the total population of Kulim District was estimated at 192,964 in 2000 and 243,342 in 2010.

(3) Methodology

The present population projections are carried out for the objective years 2000 and 2010 for the Kedah, Perlis and Pulau Pinang States, on the basis of a mathematical model, in due consideration of development of industrial estate and land use.

(a) Process of Population Projection

The population projections are made by Mukim in accordance with the following procedure:

(i) First of all, an average annual growth rate of populations is estimated for the period 1991-2000, and it is given as an average value of both rates derived from an approximate exponential expression and extrapolation using the census data in 1970, 1980 and 1991.

(ii) The 2000 population is estimated using the census population in 1991 and an average annual growth rate for the period 1991-2000 given in (i) above. This estimate is made by using a compound interest formula.

(iii) Following the population projection in 2000, an average annual growth rate for the period 2000-2010 is estimated in the same method as that described in (i), using the census data in 1980 and 1991 and the 2000 population projected in (ii) above.

(iv) Finally, the 2010 population is estimated in the same compound interest expression as (ii) above, using the projected population in 2000 and an average annual growth rate for the period 2000-2010 given in (iii) above.

(b) Conditions and Assumptions for Population Projection

Several conditions and assumptions for the projection are set as follows:

(i) Basic data used for the present projection are the censuses' population in 1970, 1980 and 1991, and the intercensal average annual growth rates for the periods 1970-1980 and 1980-1991 (refer to Tables VII.2.2.6, VII.2.2.7 and VII.2.2.8).

(ii) Taking accuracy of the mathematical projection into account, three scenarios; high, low and medium variants, are prepared in terms of the rates estimated in (i) and (iii) of (a), Process of Population Projection.

(iii) The medium variant applies a mean value of both rates derived from the approximate exponential expression and extrapolation. The high and low variants are assumed to apply the highest and lowest values out of rates derived from the said mathematical model and an average annual growth rate for the period 1970-1991.

(iv) However, the mathematical projection produces occasionally an unexpected abnormal value. Such an abnormal value shall be adjusted under the following conditions:

According to the population census, an average annual growth rate for the period 1970-1991 ranged from 8 % to minus 2% for most of 234 mukims in the Study Area, except 13.66% for Mukim No. 1 in Seberang Perai Tengah District, minus 5.77% for Mukim No. 15 in Timur Laut District and minus 2.25% for Mukim No. 5 in Barat Daya District, Pulau Pinang State.

For example, Mukim No. 1 in the Seberang Perai Tengah District achieved the high population growth during the last two decades, an average annual growth rate of 18.86% for the period 1970-1980 and 8.47% for the period 1980-1991. However, it seems to be very difficult to maintain such rapid growth during the following two decades, from the viewpoint of land use.

On the other hand, Mukim No. 15 in Timur Laut District and Mukim No. 5 in Barat Daya District, Pulau Pinang State, which showed a negative growth in population during the last 20 years, are among the most depopulated area in the Study Area. In 1991, these Mukims had a population of 21 and 343 and are almost occupied by forests. If these Mukims will continue the negative growth in population after 1991, they will become an uninhabited area in near future. However, it will not be probably to incur such situation from the view-point of a public social policy of the Government.

Taking these matters into consideration, the projected average annual growth rate of population is assumed to be 8 % for the upper limit and minis 2 % as the lower bound, in order to adjust the abnormal value derived from the mathematical model.

(4) Results

The populations projected in the objective years of 2000 and 2010 by Mukim in the study area together with their growth rates are provided in Tables VII.2.2.9, VII.2.2.10 and VII.2.2.11. The results of the medium scenario by state are summarized below.

Projected Population and Annual Growth Rate (Medium Scenario)

State	Census Pop.	Population ('000 people)		Annual Growth Rate (%)	
	1991	2000	2010	1991-2000	2000-2010
Kedah	1,305	1,577	2,033	2.17	2.57
Perlis	184	228	301	2.46	2.79
P. Pinang	1,065	1,276	1,659	2.06	2.66
Study Area	2,554	3,081	3,993	2.15	2.63

(a) Total Population in the Study Area

The study area would be projected to have a population of approximately 3 million in 2000 and 4 million in 2010 for the medium scenario, an average annual growth rate of 2.15% and 2.63% for the periods 1991-2000 and 2000-2010, respectively.

According to the Sixth Malaysia Plan, the population of Malaysia is projected to grow at 2.4% per annum during the period 1991-1995. If it is assumed that this growth rate will continue by the year 2000, the national population will achieve 21.66 million in 2000 as against 17.57 million in 1991.

The table above indicates that the population in the Study Area will be a somewhat slower growth than that of the national population. If such growth rate is continued during the year 1990's, the ratio of population of the study area to the whole Malaysia will decline to 14.2% in 2000 from 14.5% in 1991. It is however expected that such a population ratio will gradually recovered in the year 2000's in accordance with the projected growth rate for the period 2000-2010.

(b) Population of Kedah State

The total population of Kedah State is projected to reach 1.577 million in 2000 and 2.033 million in 2010 in the medium scenario from 1.305 million in 1991, an average growth rate of 2.17% per annum for the period 1991-2000 and 2.57% for the period 2000-2010.

The average annual growth rate of population in Kedah State indicated a fairly high figure during the last decade compared to that for the year 1970's, i.e., 1.73% for the period 1980-1991 as against 1.22% for the period 1970-1980 (refer to Table VII.2.2.6). It is expected that more rapid growth will continue during the coming two decades, being supported by the increased migrants due to promotion of industrial development in Kulim and other districts, and tourism development in Langkawi and others (refer to Table VII.2.2.9).

For example, the population of Kulim District, with established industrial estates in the 1980's, reached 128,000 in 1991, through 93,000 in 1980 from 88,000 in 1970, i.e., the population achieved a rapid growth rate of 2.98% per annum during the period 1980-1991, compared to a slower rate of 0.45% per annum for the period 1970-1980 (refer to Table VII.2.2.6).

In the present study, it is estimated that the population of Kulim District will reach 175,000 in 2000 and 252,000 in 2010, an average annual rate of 3.56% for the period 1991-2000 and 3.71% for the period 2000-2010 (refer to Table VII.2.2.9). These figures of population are a relatively close to results of the previous studies described in Item (2)(c).

(c) Population of Perlis State

According to the population census, the population of Perlis State reached 184,000 in 1991 increasing from 145,000 in 1980 and 121,000 in 1970, and an average growth rate showed 1.81% per annum for the period 1970-1980 and 2.17% for the period 1980-1991 (refer to Table VII.2.2.7). The rapid growth rate for the last decade, compared to the growth rate for the decade of 1970's, was due mainly to an increase in immigrants from Kedah State.

Using these census data, the future population is projected to be 228,000 in 2000 and 301,000 in 2010 with the average annual growth rate of 2.46% for the period 1991-2000 and 2.79% for the period 2000-2010 (refer to Table VII.2.2.10).

The previous study described in Item (2)(a) projected the 2000 population to be 216,000, an average growth rate of 1.81% per annum based on the census population in 1980. Although it is difficult to simply compare both projections of present and previous studies because the base population is different, the population projected in the present study indicates a somewhat higher figure than the result of the previous study.

(d) Population of Pulau Pinang State

According to the national census, the population of Pulau Pinang State amounted to 1,065,000 in 1991 increasing from 901,000 in 1980 and 775,000 in 1970, an average growth rate of 1.51% per annum during the period from 1970 to 1991(refer to Table VII.2.2.8).

Based on the above census data, the future population is projected to be 1.276 million in 2000 and 1.659 million in 2010 in the medium scenario, an average annual growth rate of 2.06% for the period 1991-2000 and 2.66% for the period 2000-2010 (refer to Table VII.2.2.11).

On the other hand, the previous study described in Item (2)(b) projected the 2000 population to be 1.278 million for the low scenario and 1.293 million in the high scenario, an annual growth rate of 1.41% and 1.51% for the year 1990's, respectively.

In comparison between both results of present and previous studies, although the population growth rate projected in the present study indicates a fairly higher figure than rate given in the previous study, there is no great difference between both figures of the projected population in 2000. Such a contradiction seems to be due mainly to difference between both figures of the 1980 census population which was used as initial condition of the projection.

2.3 Gross Regional Domestic Product (GRDP)

2.3.1 Kedah State

Gross Regional Domestic Product (GRDP) of Kedah State amounted to RM 4,689 million in 1993 at the 1978 constant prices, achieving a rapid growth from RM 3,567 million in 1990 and RM 2,284 million in 1980. An annual real growth rate showed 9.5 % on average for the period 1990-1993 and 4.6 % in the 1980's. Ratio of GRDP of Kedah State to the National GDP indicated 4.7% in 1993 ranging from 4.5% to 5.1% since 1980 (refer to Table VII.2.3.1).

Per capita GRDP (at the 1978 prices) of Kedah State reached RM 3,327 in 1993, increasing from RM 2.653 in 1990 and RM 2,051 in 1980, an annual growth rate of 7.8% for the period 1990-1993 and 2.6% for the period 1980-1990. Ratio of the per capita GRDP of Kedah State to the average national GDP per capita would become 66.3% in 1993, changing from the 59.8% in 1990 and 63.9% in 1980.

Of the industrial sector of Kedah State, the primary industry was accounting for more than 50% of the State GRDP in the year 1970's, being supported by a favorable production of the addy fields in Muda irrigation area. However, since the year 1980's the primary industry has indicated a slow growth and its share in the State GDP fell to 35% in 1990 and 28% in 1993.

On the other hand, the secondary industry achieved a rapid growth owing to the development of several manufacturing industrial estates during the 1980's and the early period of 1990's. In fact, GRDP (at the 1978 prices) of this secondary industry amounted to RM 1,534 million in 1993, growing considerably from RM 869 million in 1990 and RM 251 million in 1980, an average annual rate of 20.9% and 13.2% for periods 1990-1993 and 1980-1990, respectively.

According to "Kedah Development Action Plan", an annual growth rate of the State GRDP for the period 1990-2000 is presumed to be 8.0% for the total GRDP, 2.5% for the primary industry, 12.0% for the secondary industry and 3.0% for the tertiary industry. As a result, the GRDP of Kedah State in the year 2000 is projected to be RM 7,700 million (at the 1978 prices) as a whole, composed of RM 1,628 million, RM 2,698 million and RM 3,484 million for respective industrial sectors (refer to Table VII.2.3.1).

2.3.2 Perlis State

The GRDP (at the 1978 prices) of Perlis State amounted to RM 704 million in 1993, growing from RM 570 million in 1990 and RM 329 million in 1980. An annual real growth rate showed 7.3% on average for the period 1990-1993 and 5.6% in the period 1980-1990. These growth rates are fairly high and there is no great difference, compared to the growth rate of the national GDP of 6. % and 8.3% for respective periods. Ratio of the GRDP of Perlis State to the National GDP indicated 0.7% in each year of 1980, 1990 and 1993 (refer to Table VII.2.3.2).

The per capita GRDP (at the 1978 prices) of Perlis State reached RM 4,252 in 1993, increasing from RM 3,528 in 1990 and RM 2,211 in 1980. These GRDP per capita indicated somewhat high values compared with those of Kedah State, and ratio of these to the national average values of GDP would become 84.8% in 1993 increasing from the 79.6% in 1990 and 68.9% in 1980. The average annual growth rate of the per capita GRDP of Perlis State was 6.4% for the period 1990-1993 and 4.8% for the period 1980-1990.

2.3.3 Pulau Pinang State

The GDP (at the 1978 prices) of Pulau Pinang State amounted to RM 7,677 million in 1993, achieving a high growth from RM 5,820 million in 1990 and RM 3,413 million in 1980, an average real growth rate of 9.7% per annum for the period 1990-1993 and 5.5% for the period 1980-1990. These rates indicate very rapid growth, compared with the GRDP of Kedah and Perlis States. Ratio of GRDP of Pulau Pinang State to the National GDP was 7.6% in 1993, 7.3% in 1990 and 7.7% in 1980 (refer to Table VII.2.3.3).

The per capita GRDP (at the 1978 prices) of Pulau Pinang State reached RM 6,728 in 1993, increasing from RM 5,274 in 1990 and RM 3,570 in 1980. The annual real growth rate indicated 8.5% on average for the period 1990-1993 and 4.0% for the period 1980-1990. Ratio of the GRDP per capita of Pulau Pinang State to the national average GDP per capita was 134.2% in 1993, 119.0% in 1990 and 128.0% in 1980, namely, the GRDP per capita of Pulau Pinang State indicated a fairly higher value than the average national GDP per capita.

Pulau Pinang State is one of the most developed states in Malaysia in terms of industrial and commercial sectors. Reflecting this matter, the secondary and tertiary industries in Pulau Pinang State achieved a rapid growth during the 1980's. During this period, the GRDP (at the 1978 prices) of the secondary industry indicated a high growth rate of 12.3% per annum and reached RM 2,838 million in 1990. The GRDP of the tertiary industry also grew at a high average rate of 5.9% per annum during the same period and amounted to 2,741 million in 1990.

To the contrary, the GRDP of the primary industry indicated a negative average annual rate of minus 0.8% and declined to RM 215 million in 1990 from RM 241 million in 1980. As a result, distribution of the GRDP for primary, secondary and tertiary industries changed from a ratio of 7 : 45 : 48 in 1980 to 4 : 49 : 47 in 1990.

According to "Penang into the 21st Century", the annual growth rate of the State GRDP for the period 1990-2000 is estimated to be 7.3% for the whole industries, 0.7% for the primary industry, 8.0% for the secondary industry and 7.0% for the tertiary industry. As a result, the GRDP of Pulau Pinang State in the year 2000 is estimated to be RM 11,754 million (at the 1978 prices), of which RM 231 million is for the primary industry, RM 6,148 million for the secondary industry, and RM 5,375 million for the tertiary industry.

2.3.4 Summary of GDP in the Study Area

GRDP and per capita GRDP for the three states, Kedah, Perlis and Pulau Pinang, are summarized below.

State	Amount				Annual Growth Rate (%)		
	1980	1990	1993	2000	1980-1990	1990-1993	1990-2000
GDP (RM 10^6)							
Kedah	2,284	3,567	4,689	7,700	4.6	9.5	8.0
Perlis	329	570	704	1,200*	5.6	7.3	7.7*
P. Pinang	3,413	5,820	7,677	11,754	5.5	9.7	7.3
Total	6,041	9,957	13,070	20,654	5.1	9.5	7.5
Per Capita GDP (RM)							
Kedah	2,051	2,653	3,327	4,768	2.6	7.8	6.0
Perlis	2,211	3,528	4,252	5,700*	4.8	6.4	4.9*
P. Pinang	3,570	5,274	6,728	8,354	4.0	8.5	4.7

* Estimated by the JICA Study Team, because of unavailable data.

It is estimated that the total GRDP for the three states will amount to RM 20,000 or more (at the 1978 prices) in the year 2000, an average annual growth rate of 7.5% for

the period 1990-2000, and the per capita GRDP is also expected to growth at the high annual rate of about 5%. These growth rates are close to the average growth rates of GDP and per capita GDP for the whole country as shown in Table VII.2.3.1(or Table VII.2.3.3).

3. ECONOMIC EVALUATION OF THE PROJECT

3.1 Conditions of Economic Evaluation

The economic evaluation is basically carried out in terms of three categories; (1) water resources management plan, (2) flood mitigation plan, and (3) river environmental improvement plan.

The water resources management plan is divided into three projects: (1a) Beris dam construction, (1b) construction of Jeniang Transfer Canal and Naok Reservoir, and (1c) Reman Dam construction. These facilities are scheduled to be constructed during the period 1997 to 2000 for the Beris Dam, 2002 to 2005 for the Jeniang Transfer Canal, 2003 to 2005 for the Naok Dam, and 2004 to 2007 for the Reman Dam (refer to Fig. VI.1.4.1). By completing these facilities, it is expected to increase the supply volume for irrigation and domestic water in the study area.

The flood mitigation plan is classified into four projects: (2a) the Muda River downstream, (2b) the Ketil River Stretch I, (2c) the Ketil River Stretch II, and (2d) the Chepir River Stretch. According to the implementation schedule shown in Fig. VII.1.4.1, the river improvement works are scheduled to be made over the period from 2004 to 2010 for the Muda river downstream, for two years of 2003 and 2004 for the Ketil River Stretch I, in 2003 for the Ketil River Stretch II, and in one year from the second half of 2003 to the first half of 2004 for the Chepir River Stretch. These improvement works are expected to reduce the flood damage to assets in the respective river basins.

The river environmental improvement plan in the Muda River and its tributaries would be over two periods: 1998 to 2000 and 2002 to 2010. Out of various effects in the environmental improvement of rivers, an economic effect is evaluated for river facilities, expecting that they be utilized as recreation facilities for inhabitants.

The economic evaluation mainly discusses the Economic Internal Rate of Return (EIRR) using present values of economic cost and benefit of the project under the following conditions and assumptions:

(a) The economic values of goods and services procured locally are covered from their market prices, taking regional factor into account on the basis of the "National Parameters for Project Appraisal in Malaysia," using the conversion factors as shown below:

Goods and Services	Conversion Factor
Construction (general)	0.84
Unskilled Labour Wage	0.83
Government Administration	0.82
Agricultural Input	0.91
Agricultural Output	1.00
Machinery and Equipment	0.90
Transport	0.79
Land Acquisition	0.88
Standard Conversion Rate	0.88

(b) Prices of goods and services procured from abroad are given by CIF at port.

(c) Transfer payments such as tax and government subsidy are not included in the economic prices.

(d) Inflation factor also is excluded from economic cost and benefit.

Economic life of the project (hereinafter referred to as the "project life") is taken as 50 years after completing construction of the respective facilities. The benefit and operating and maintenance costs (hereinafter referred to as the "OM cost") of the project are assumed to occur every year during the project life.

3.2 Water Resources Management Plan

3.2.1 Economic Benefit

Economic benefit of the project is defined as a deference between "with the project" and "without the project" situations, consisting of two benefits of domestic water supply and irrigation.

(1) Domestic Water Supply Benefit

The economic evaluation of the domestic water supply project is generally made by comparing the economic benefit produced by supplying the domestic water with the total economic construction and OM costs of facilities required to produce and distribute the domestic water. The present plan, however, does not include the construction of facilities such as treatment plants, transmission and distribution pipes, and house connection facilities. The economic evaluation is therefore carried out by comparing economic water value and economic facility cost (construction and OM costs) at the water production sites. The economic construction and OM costs of the facilities are described in the succeeding section.

According to similar water supply projects, producer price at the dam site is approximately estimated to be half of the domestic water supply tariff. The actual minimum water tariff is RM 0.40 per cubic metre for the domestic water supply, according to the Kedah state regulations. Based on this matter, the unit

water price at the dame site is assumed to be RM 0.20 per cubic metre in the present study.

In terms of domestic water supply, the economic benefit can be obtained by multiplying the unit water price with the water volume produced at the dam site. According to the foregoing Water Resources Management Plan, the water volumes produced for domestic use by completing the facilities are estimated at 51.83 million m^3 in 2001 from the Beris Dam, 110.96 million m^3 in 2006 from the Jeniang Transfer Canal and the Naok Dam, and 143.81 million m^3 in 2008 from the Reman Dam (refer to Table 3.2.1).

As a result, the annual benefit which accrues from each facility is estimated at RM 11,190,000 from 2001 by the Beris Dam, RM 35,402,000 from 2006 by the Jeniang Transfer Canal and the Naok Dam, and RM 52,043,000 from 2008 by the Reman Dam. These benefits are expected to accrue every year after completion of respective facilities during their project lives.

(2) Irrigation Benefit

According the Water Resources Management Plan, the production water firstly is supplied for domestic use, and the remaining is utilized as irrigation water for paddy in the Muda area.

The irrigation benefit is given by subtracting production cost from incremental value of paddy produced from an increased irrigation area, namely, it can be expressed by the following equation:

$$B = A \cdot (Y \cdot P - C)$$

where,

B : Net irrigation benefit (RM)
A : Increase in irrigation area (ha)
Y : Unit yield (tons/ha)
P : Farm gate price of paddy (RM/ton)
C : Unit production cost (RM/ha).

According to the paddy production statistics of Kedah State in 1994, it indicated an average yield of 4 tons/ha, and the farm gate price of RM 460/ton. Accordingly, the farm gate revenue from paddy would becomes RM 1,840 per ha. On the other hand, the production cost of paddy was estimated at RM 1,361.5 per ha in the same year. Excepting transfer payments such as land tax and water charge from this production cost and taking conversion factors into account, the economic production cost is estimated to be RM 1,121 per ha. As a result, the paddy production would accrue an economic benefit of RM 719 per ha per annum at the farm gate by subtracting the economic production cost from the said revenue (refer to Table VII.3.2.2).

As shown Table VII.3.2.1, the areas expected to reduce the deficit of irrigation water are estimated to be 1,146 ha by water production of the Beris dam,

3,956 ha by the Jeniang transfer canal and the Naok dam, and 1,515 ha by the Reman dam. As a result, these facilities is expected to produce the economic annual irrigation benefit of RM 824,000 during the project life from 2001 for the Beris dam, RM 2,844,000 from 2006 for the Jeniang transfer canal and the Naok dam, and RM 1,089,000 from 2011 for the Reman dam.

(3) Summary of Water Resources Benefit

Based on results of (a) and (b) mentioned above, the annual benefit of the project expected by the water resources management plan is summarized as follows:

Unit : RM 1,000

Year	Facilities	Annual Benefit		
		Domestic Water	Irrigation	Total
2001	Beris Dam	10,366	824	11,190
2006	Jeniang Transfer Canal & Naok Dam	32,558	2,844	35,402
2008	Reman Dam	50,954	1,089	52,043
	Total	93,878	4,757	98,635

These annual benefits are expected to accrue from the next year after completion of respective facilities during the periods of project lives. Annual flows of the benefits are shown in Table VII.3.2.6.

3.2.2 Economic Cost

Economic cost of the project is estimated from the project cost, taking into account the conversion conditions to economic prices described in Section 3.1, and the result is provided in Tables VII.3.2.3 to VII.3.2.5. Annual flows of the economic construction and OM costs together with the annual benefit flows are listed in Table VII.3.2.6. The total of economic cost is as follows:

Financial and Economic Costs of the Projects

Unit : RM 1,000

Plans	Financial Cost (Project Cost)		Economic Cost	
	Const. Cost	Annual OM Cost	Const. Cost	Annual OM Cost
Beris Dam	199,000	648	161,106	487
Jeniang T.C. & Naok Dam	225,605	941	148,446	571
Reman Dam	180,154	507	117,325	324
Total	604,759	2,096	426,877	1,382

Ratio of the economic cost to the project cost (except OM cost) would become 81% for the Beris Dam, 65% for the Jeniang Transfer Canal and the Naok Dam, and 54% for the Reman Dam. Difference among these ratios is mainly caused by price contingencies included in the project costs, due to the difference of the construction

periods among them. The annual OM cost is assumed to be 0.5% of the direct construction cost.

3.2.3 Cost-Benefit Analysis

The economic evaluation for the Water Resources Management Plan is mainly made by means of the economic rate of return (EIRR), using the annual flows of the economic cost and benefit given in Table VII.3.2.6. As a result, the EIRR is estimated at 14.61% for the comprehensive water resources management plan.

According to analyses of the international agencies, the opportunity cost of capital is estimated at 10 to 12%. Judging from this opportunity cost, the percentage of EIRR above shows that the project is economically justifiable.

A sensitivity test is made for the EIRR, under the conditions of the 10% up in the economic cost and the 10% down in the economic benefit, and the result is given below.

Sensitivity Test of EIRR for Comprehensive Plan

Unit : Percent

Plan	Original	10% up in Cost (1)	10 % down in Benefit (2)	Combination of (1) and (2)
Water Resources	14.61	13.65	13.55	12.63

Figures of EIRR above indicate that there is no question about the economic viability of the project, even in a conservative case which combines both conditions of the 10% up in cost and 10% down in benefit.

3.3 Flood Mitigation Plan

3.3.1 Economic Benefit

Study of economic benefit was made as below.

(1) General

The economic evaluation of flood mitigation project for the Muda River and its tributaries was firstly conducted for each at four locations: (1) the Muda River lower basin, (2) the Kuala Ketil Town along the Ketil River, (3) the Sik Town along the Sik River, and (4) Baling Town along the Ketil River. Next, a comprehensive evaluation was made for the whole of four locations.

The economic evaluation was carried out by comparison between economic cost and benefit, by means of EIRR, including net present value (NPV) and benefit-cost ratio (B/C) as need arises. The economic benefit is mainly expressed by a reduction effect in flood damage, under a difference between the "with the project" and "without the project" situations.

The economic benefit is classified into two categories: (a) direct effect of reduction in the flood damage to assets, and (b) reduction effect of flood damage to economic activities and public facilities. First, a flood damage analysis was conducted to assets, which are composed of general assets (buildings and household effects) and agricultural field crops. Next, the flood damages to public facilities and economic activities were estimated as a function of the flood damage to general assets.

(2) Flood Damage Analysis

Flood damage to general assets was estimated by using (a) number of assets to be inundated by flood, (b) appraisal value of the assets, and (c) damage rate of the assets inundated. On the other hand, the damage to agricultural field crops were estimated by using (a) areas inundated in the agricultural crop fields, (b) production per unit area, and (c) the damage rate of agricultural field crops inundated.

(a) Number and Area of Assets in Flood Prone Area

The flood-prone areas in the study area include farm houses, residential houses, shops, public/private buildings (offices, factories, etc.), and agricultural crops (paddy, farm crops and plantation crops). Number and area of assets to be damaged by flood were measured according to water depth estimated by each return period flood on the basis of results of hydrological and hydraulic analyses using aerial photographs and topographical maps which were made in 1994. The results are shown in Table VII.3.3.1.

Houses and buildings in the flood prone area, however, are expected to increase their number in proportion to the increase in number of households in its surrounding areas. According to the 1991 Census, number of households grew at the annual rate of 2.14% in the Kedah state and 2.38% in the Pulau Pinang state during the intercensal period 1980-1991.

The Muda river lower basin adjoins the Daerah Utara District of Penang, a greater urban area, and also the towns of Kuala Ketil, Sik and Baling are expected to promote their urbanization as small industrial zones. Number of houses and buildings, therefore, is expected to grow more rapidly than the average in the Kedah and Pulau Pinang states. However in the present study, these growths are assumed to be 2.3% per annum as a conservative estimate, considering that these locations are flood prone areas. This percentage is nearly the average growth rate of household number in the Kedah and Pulau Pinang states for the said intercensal period, and it was applied for the period from 1995 to the end of project lives for the respective plans.

On the other hand, the agricultural land in the flood prone area is not likely to bring a considerable variation in the area and kind of planted crops, judging from the agricultural statistics in the Kedah state, and also the flood damage to agricultural crops (including plantation crops) is

estimated at less than 10% of the total flood damage amount. Considering these matters, the present study does not take into account any variation in the agricultural land area and crops during the period of project life.

(b) Appraisal Values of Assets

An interview survey was carried out to obtain the appraisal values of buildings and household effects for general households, shops and small factories in the flood prone area in the Muda River lower basin, Kuala Ketil Town, Sik Town and Baling Town. Based on 100 samples which were obtained at random by the interview survey, the average appraisal values for buildings and household effects were estimated, as shown in Table VII.3.3.2.

Major agricultural crops in the flood prone area are paddy, farm crops (cassava, potatoes, vegetables, etc.), tree crops (cacao, fruits, etc.) and plantation crops such as oil palm and rubber. With regard to these crops, production (tons/ha) and farm gate prices (RM/ton) in 1994 were estimated on the basis of agricultural statistics in the Kedah state. These yields (RM/ha) together with the appraisal values of buildings and household effects are shown in Table VII.3.3.2.

(c) Flood Damage Rate of Assets

For estimating the flood damage to assets, damage rate for each asset was assumed based on the flood experience in the tropical zone and the economic survey manual on flood control in Japan, and it is listed, according to water depth and kind of assets submerged, as shown in Table 3.3.3.

In addition to flood damages to the said general assets, damage to public facilities and other economic losses are considered. Major public facilities are road, bridge, agricultural facilities, and water and electrical supply facilities, and the flood damage to these facilities is assumed to be 34% of damage to the general assets (building and household effects) based on the said economic survey manual. Likewise, the economic business losses caused by suspension of business activities and road traffic in and around the flooded area are assumed as approximately 6% of damage to the general assets.

(d) Estimates of Flood Damage Amount

Under the conditions above, the flood damage amounts are estimated according to kind of assets and each return period as listed in Table VII.3.3.4. The total damage amount according to each return period of flood in the flood prone areas is summarized below.

Unit: RM 1,000

Return Period (Year)	Lower Muda	Kuala Ketil	Sik	Baling	Total
2	14,017	136	148	52	14,353
5	24,581	886	540	522	26,529
10	30,608	2,564	1,000	816	34,988
20	39,194	3,735	1,224	1,644	45,797
50	50,994	5,561	2,044	2,374	60,973
100	56,567	6,505	2,703	2,714	68,489

(e) Average Annual Flood Damage

Average annual flood damage is estimated using the total flood damage above, taking the occurrence probability of flood into account. The results are summarized as follows:

Unit: RM 1,000

Return Period (Year)	Muda Lower	Kuala Ketil	Sik	Baling	Total
2	3,504.3	33.9	37.0	13.0	3,588.2
5	9,294.1	187.2	140.3	99.0	9,720.6
10	12,053.5	359.7	217.4	165.9	12,796.5
20	13,798.6	517.2	273.0	227.4	14,816.1
50	15,151.4	656.6	322.0	287.7	16,417.7
100	15,689.2	716.9	345.7	313.1	17,065.0

(3) Average Annual Benefit

After completion of the construction works, the average annual flood damage which corresponds to respective projects is expected to be eliminated, i.e., it is given as the expected average annual benefit of the projects.

The partial annual benefit, which will be expected to accrue before completion of the construction works, is assumed to be proportional to the progress of construction works, i.e., cost to the total construction cost.

As mentioned in the estimate of flood damage, the average annual flood damage is based on the number of assets in 1994, and the number of assets is expected to increase at the annual rate of 2.3%. Accordingly, the average annual benefit would increase year by year during the period of project life, in proportion to the increased number of assets. Annual flows of these benefit together with annual flows of the economic costs mentioned in the succeeding section are shown in Table VII.3.3.9.

3.3.2 Economic Cost

Economic cost of the project is estimated from the project cost, taking into account the conversion conditions to economic prices described in Section 3.1, and the result

is provided, compared with the financial cost, in Tables VII.3.3.5 to VII.3.3.8. Annual flows of the economic construction and OM costs together with the annual benefit flows are listed in Table VII.3.3.9. The total economic cost is summarized as follows:

Financial and Economic Costs of Projects

Unit: RM 1,000

Project	Financial Cost (Project Cost)		Economic Cost	
	Const. Cost	Annual OM Cost	Const. Cost	Annual OM Cost
Muda River Stretch	495,079	2,052	298,843	1,121
Kuala Ketil Stretch	24,816	99	16,452	63
Sik Stretch	9,635	34	6,558	22
Baling Stretch	13,037	40	8,804	26
Total	542,567	2,225	330,657	1,232

Ratio of the economic cost to the project cost (except OM cost) would become 60% for the Muda River down stretch, 66% for the Kuala Ketil stretch, 68% for the Sik stretch, and 68% for the Baling stretch. Difference among these ratios is mainly caused by price contingencies included in the project costs, due to the difference of their construction periods. The annual OM cost is assumed to be 0.5% of the direct construction cost.

3.3.3 Cost-Benefit Analysis

Cost-benefit analysis was made as below.

(1) Estimate of EIRR

The economic internal rate of return (EIRR) for the Flood Mitigation Plan is estimated using the annual flows of the economic cost and benefit given in Table VII.3.3.9. The result is summarized as follows:

Project	EIRR (%)
Muda River Lower Stretch	8.57
Kuala Ketil Stretch	6.38
Sik Stretch	7.56
Baling Stretch	5.17
Comprehensive	8.29

These percentage of EIRR is somewhat low in relation to the opportunity cost of capital (10 to 12%) in Malaysia; namely, the flood mitigation project does not satisfy the economic viability. However, the flood mitigation project is one of the social environmental improvement projects, which have no high economic return. The flood mitigation project which indicates the EIRR of 8%, if anything, would come into the high return projects. Implementation of the project is expected to mitigate the menace to flooding and ensure stability of community life for inhabitants, i.e., it aims essentially to ensure a stable social environment promoting an economic development of the region. Accordingly,

the project would have a great significance for the economic development of the region.

(2) Sensitivity Test

A sensitivity test was made for the EIRR regarding the comprehensive flood mitigation plan, under the conditions of the 10% up in the economic cost and the 10% down in the economic benefit, and the result is summarized below.

Sensitivity of EIRR for Comprehensive Flood Mitigation Plan

Unit: Percent

Plan	10% up in Cost (1)	10% down in Benefit (2)	Combination of (1) and (2)
Comprehensive	7.35	7.28	6.63

In a conservative case which combines both conditions of the 10% up in cost and 10% down in benefit, EIRR indicates 6.6% decreasing by 1.4% compared with the original EIRR. However, significance of the project would be essentially unchanged from the discussion mentioned above.

3.4 River Environmental Management Plan

3.4.1 Economic Benefit

(1) Concept of Benefit for Recreation Park

The present study aims to give a general outline of economic evaluation for the 38 recreation parks proposed in the river environmental management plan (SECTOR IV). In the present study, these parks are regarded as facilities without an entrance charge, though some parks may be in need of the entrance charge in the future.

Economic effects of resort park without the entrance charge can generally be estimated from the visitor side by using two factors; (a) number of visitors, and (b) time and cost which they spend to get amenity and enjoyment at the recreation park, where the time and cost spent are considered as based on their "willingness to pay." The spent time can be expressed in monetary term using the average household income and family size of visitors.

The number of visitors to the park is generally related to distance from visitors' place of residence to the park, population around the park, characteristics (quantity and quality) of facilities in the park, and others (per capita GRDP, day of the week, weather, etc.). Taking these matters into consideration, the number of visitors to similar parks was surveyed because it is difficult to forecast the number of visitors to the proposed parks under the plan.

(2) Surveys of Similar Parks

The proposed recreation parks of 38 places contain three large-scale parks of Beris Reservoir, Muda Barrage and Bumbong Lima, and other small-scale parks. With the aim to estimate the approximate number of visitors to the proposed parks, a questionnaire survey was carried out at four similar parks; the large-scale parks of Pedu and Bukit Hijau, the small-scale parks of Lata Bayu and Iboi, which are located in the Kedah state.

(a) Pedu Park is a large-scale resort with first class hotel and excellent recreation facilities, and has an area of 116 ha in total. According to information from the hotel manager, the number of visitors is approximately estimated at 280,000 per annum, including about 20% of the hotel guests. Origination distribution of visitors is approximately estimated at 60% from the Pulau Pinang state, 20% from the Kedah state, 15% from Kuala Lumpur, and 5% from foreign countries.

(b) Bukit Hijau Park in the Baling District is also one of the large-scale resorts, with recreation facilities such as restaurants, lodges, souvenir shops, hall, chalets, fall, swimming facilities, etc., and it has an area of 108 ha. According to information from the park manager, the number of visitors is estimated at approximately 370,000 per annum, of which the visitors from the Pulau Pinang state and the Kulim and Baling districts in the Kedah state account for a greater part.

(c) Lata Baya Park in the Baling district is a small-scale park with some recreation facilities and forest, and it has an area of 15 ha. The number of visitors, based on information from the park manager, is estimated at 48,000 per annum, and inhabitants around the park account for a greater part of the visitors.

(d) Iboi Park which is administered by the DID, is also a small scale park with some recreation facilities and swimming poor, having an area of 9 ha. The annual number of visitors is estimated at 31,000 based on information from the park administrator. Almost all of the visitors are the neighboring people.

Breakdown of number of visitors is given in Table VII.3.4.1, and it is summarized as follows:

Park	Area (ha)	Annual Number of Visitors (person day)
(A) Pedu	116	139,500
(B) Bukit Hijau	108	253,000
(C1) Lata Bayu	15	18,300
(C2) Iboi	9	10,400

Note: Time spent at C1 and C2 is half-day per visitor.

(3) Conditions and Assumption for Estimating the Economic Benefit

The economic benefit was estimated under the following conditions and assumptions:

(a) Number of Visitors: For convenience of estimating the benefit, the proposed 36 parks (except 2 parks without construction cost) are classified into three groups: (A) Beris Reservoir Park (227 ha); (B) Muda Barrage and Bumbong Lima parks (142 ha); and (C) Other Parks (163 ha in total).

Assuming that Groups (A), (B) and (C) in the proposed parks correspond to (A), (B) and (C) [C_1 or C_2] of the similar parks, respectively, and the number of visitors is in proportion to the park area of each corresponding group, the annual number of visitors to the proposed parks is estimated as follows:

Park	Area (ha)	Annual Number of Visitors (person-day)
(A) Beris Reservoir	227	273,000
(B) Muda Barrage & Bumbong Lima	142	332,600
(C) Others	163	194,900
Total	532	800,500

In the table above, the time spent by visitors is assumed to be full day at (A) and (B) parks, and half day at the parks of group (C), including transport hours to and from the parks.

Although the number of visitors is expected to be somewhat increased year by year in proportion to the increased population around the park, the increase in the number of visitors will not be too much, because of the limited capacities and functions of the parks. Accordingly, in the present study the number of visitors is assumed to be constant during the period of project life.

(b) Transport cost is assumed as RM 10 on average per round trip for (A) parks, RM 5 for (B) parks and free of charge for (C) parks, based on factors such as the result of interview survey to visitors at Bukit Hijau and Iboi parks, geographical positions of the proposed parks, fuel expenses and depreciation cost of passenger car, bus and taxi charges.

(c) Average income per household is estimated at RM 1,200 per month in 1990, according to statistics of Peninsular Malaysia. By assuming an average annual growth rate of 4% for household income and the family size of 5 persons per household, the average income per capita is estimated at RM 9.50 per day in 1995.

(4) Estimate of Annual Economic Benefit

The economic annual benefit can be obtained by multiplying the total number of the visitors (person.day) per annum, by a sum of the per capita income (RM/day) and the transport costs a trip (RM/person). Under the conditions and assumptions above, the expected annual benefit, which accrues from the proposed parks, is estimated at RM 9,598,000 in total, consisting of RM 4,259,000 from the Beris Reservoir Park, RM 3,858,000 from the Muda Barrage and Bumbong Lima parks, and RM 1,481,000 from the other small-scale parks. The total annual benefit accrues every year after completion of facilities of all parks during the period of project lives.

A partial annual benefit, which is expected to accrue before completion of all facilities, is assumed to be proportional to the progress of construction works, i.e., the partial benefit is approximately estimated by a ratio of the invested construction cost to the total construction cost, as shown in Table VII.3.4.3.

3.4.2 Economic Cost

Economic cost of the project is estimated from the project (financial) cost, taking into account the conversion conditions to economic prices described in Section 3.1. The total economic cost of the project is estimated at RM 37.214 million, composed of RM 10.976 million for the foreign currency portion and RM 26.238 million for the local currency portion. The annual economic cost for the construction period is provided, compared with the financial cost, in Table VII.3.4.2.

Annual OM cost is estimated to be RM 140,000 (as 0.5% of the direct construction cost), after completion of all park facilities, during the period of project life. The annual flows of construction and OM costs together with the annual benefit flow are listed in Table VII.3.4.3.

3.4.3 Cost-Benefit Analysis

The economic internal rate of return (EIRR) for the Environmental Improvement Plan is estimated at 23.79%, using present values of the annual flows of the economic cost and benefit given in Table VII.3.4.3. This percentage of EIRR shows a high economic return, judging from the opportunity cost of 10 to 12% in Malaysia, i.e., the economic feasibility of the project is very high.

Such a favorable evaluation is still maintained even in a conservative case, which combines both conditions of the 10% up in cost and 10% down in benefit, as shown in the following result of sensitivity test.

Unit: %

Plan	Original	10% up in Cost (1)	10% down in Benefit (2)	Combination of (1) and (2)
Environmental Plan	23.79	21.69	21.68	19.58

Although the river environmental improvement project has been economically evaluated highly as described above, work scale for this plan is very small compared with those for water resources and flood mitigation plans, i.e., the construction cost is only 10% or less of each cost for the said two plans. According to the proposed construction plan, the environmental improvement work would be considered as an incidental one of the said two works.

From such viewpoint, the economic effect for the proposed environmental improvement project may be regarded as an additional effect of the water resources development and river mitigation projects.

3.5 Summary of Economic Evaluation

According to the proposed plan, the construction work (including preparation work) as a whole is scheduled to be executed over a period of 15 years from 1996 to 2010, containing three sorts of works for dam construction, river improvement and river environmental improvement plans. Table VII.3.5.1 provides an annual flow of the economic cost and benefit for a comprehensive plan composed of the said three works.

As a result of cost-benefit analysis, EIRR for the comprehensive plan is estimated to be 13.55%, and the result of sensitivity test for this EIRR is summarized as follows.

Unit: %

Plan	Original	10% up in Cost (1)	10% down in Benefit (2)	Combination of (1) and (2)
Comprehensive	13.55	12.55	12.45	11.50

Percentage of EIRR above, including the results of sensitivity test, shows that the whole project is economically feasible. Accordingly, all plans contained in the present study are desired to be realized as soon as possible from the standpoints of improvement of social environment and promotion of economic development in the study area.