GOVERNMENT OF MALAYSIA

NATIONAL WATER RESOURCES STUDY, MALAYSIA
PERLIS-KEDAH-PULAU PINANG REGIONAL WATER RESOURCES STUDY
PART 1

VOL. 2
ANNEX

A. SOCIO-ECONOMY
B. DOMESTIC AND INDUSTRIAL WATER SUPPLY

GOVERNMENT OF MALAYSIA

NATIONAL WATER RESOURCES STUDY, MALAYSIA
PERLIS-KEDAH-PULAU PINANG
REGIONAL WATER RESOURCES STUDY
PART 1

VOL. 2
ANNEX

A. SOCIO-ECONOMY
B. DOMESTIC AND INDUSTRIAL WATER SUPPLY

FEBRUARY 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

NATIONAL WATER RESOURCES STUDY, MALAYSIA
PERLIS-KEDAH-PULAU PINANG
REGIONAL WATER RESOURCES STUDY
PART 1

LIST OF VOLUMES

ABBREVIATIONS

(1) Organization/Plan

4MP	:	Fourth Malaysia Plan
DID (JPT)	:	Drainage and Irrigation Department
EPU	:	Economic Planning Unit
FELCRA	:	Federal Land Consolidation and Rehabilitation Authority
FELDA	:	Federal Land Development Authority
GSD	:	Geological Survey Department
JICA	:	Japan International Cooperation Agency
MADA	:	Muda Agricultural Development Authority
NEB (LIN)	:	National Electricity Board
NWRS	:	National Water Resources Study
PWD (JKR)	:	Public Works Department
RISDA	:	Rubber Industry Small-Holders 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
NHWL	:	Normal High Water Level
O&M	:	Operation and Maintenance
Q	:	Discharge
Ref.	:	Reference
SS	:	Suspended Solid

ABBREVIATIONS OF MEASUREMENT

Length

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

Area

cm^2 = square centimeter
m^2 = square meter
ha = hectare
km^2 = square kilometer

Volume

cm^3 = cubic centimeter
l = lit = liter
kl = kiloliter
m^3 = 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
PS = horsepower
° = degree
' = minute
" = second
°C = degree in centigrade
10^3 = thousand
10^6 = million
10^9 = billion (milliard)

Derived Measures

m^3/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

	From Metric System	To Metric System
Length	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
Area	1 cm^2 = 0.155 sq.in 1 m^2 = 10.76 sq.ft 1 ha = 2.471 acres k 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
Volume	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
Weight	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
Energy	1 kWh = 3,413 BTU	1 BTU = 0.293 Wh
Temperature	°C = (°F - 32)·5/9	°F = 1.8°C + 32
Derived Measures	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
Local Measures	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

ANNEX A

SOCIO-ECONOMY

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 Objectives of the Study

The socio-economic study was carried out mainly to give future perspective of the socio-economic conditions of the Study Area i.e., Perlis State, major portion of Kedah State excluding Pulau Langkawi and large part of Bandan Baru district and Pulau Pinang State in 1982, 1985, 1990 and 2000, as the basic framework for the other sectoral studies including Domestic and Industrial Water Supply, Flood Mitigation Plan and evaluation of the proposed projects. To serve for this purpose, projection will be made for the following socio-economic indices:

(1) Population,

(2) Gross domestic product (GDP) of Malaysia and per capita GDP,

(3) Gross regional product (GRP) of the States in the Study Area and per capita GRPs,

(4) Gross value added of manufacturing sector of the States in the Study Area, and

(5) Gross value of manufacturing output by commodity group of the States in the Study Area.

This Study should be understood in this context and should not be considered as a proposal for future socio-economic planning.

1.2 Basic Principles for the Projection

The socio-economic projection was made in compliance with the policies and principles stated in the New Economic Policy (NEP), i.e., eradication of the poverty and restructuring of the society.

Population projection was made in principle based on the 1970 and 1980 Population Census figures given in the original Fourth Malaysia Plan (4MP) and the state population figures up to 1990 and population of Malaysia up to 2000. In the Pulau Pinang State, two new towns, i.e., Bandar Seberang Jaya and Bandar Bayan Baru were taken into account, population of which was estimated on the basis of the projection made by the Pulau Pinang Development Corporation (PDC).

The socio-economic framework was projected for the following two cases, one being based on the planned values of the original 4MP and the Outline Perspective Plan to achieve NEP with the target year of 1990 and the other being a lower growth framework considering the recent worldwide recession by which Malaysia is seriously affected.

Case 1: 4MP/OPP target by 1990 will be achieved. Thereafter, GDP growth rate of 7.5% p.a. up to 2000 was assumed.

Case 2: GDP growth rates were assumed to be 6% p.a. for 4MP period, 5% p.a. for 5MP period and 4% p.a. thereafter up to 2000.

The results of the Midterm Review which is in progress by EPU were partly made available to the Study Team and the possible socio-economic framework in line with the Midterm Review perspective was assessed.

2. PRESENT CONDITION OF SOCIO-ECONOMY IN MALAYSIA AND STUDY AREA

2.1 Malaysia

2.1.1 Geographical features and administrative division

Malaysia covers an area of 330,080 km^2, comprising Peninsular Malaysia, Sabah and Sarawak. The States of Sabah and Sarawak occupy the north-western part of Borneo Island. Peninsular Malaysia, bordered on the north by Thailand, covers 131,930 km^2, while Sabah covers 73,700 km^2 and Sarawak 124,450 km^2.

Malaysia consists of 13 states including the Perlis, Kedah and Pulau Pinang States which are located in the Study Area and Sabah and Sarawak States in Borneo. Peninsular Malaysia which comprises 11 states is subdivided into 77 districts. Sabah comprises 5 divisions and Sarawak consists of 7 divisions.

2.1.2 Population and GDP

Population of the whole Malaysia in 1980 was 14,261 x 10^3. The population size had grown at 2.84% per annum from the figure in 1970 which was recorded to be 10,777 x 10^3. In 1980, population of Peninsular Malaysia was 11,849 x 10^3, while Sabah had the population of 1,098 x 10^3 and Sarawak had 1,314 x 10^3. Of these three regions, Sabah indicated a significant population growth from 1970 to 1980 (Table 2).

Population density in the whole Malaysia in 1980 was 43 persons/km^2 while these in Peninsular Malaysia, Sabah and Sarawak were 90 persons/km^2, 14.8 persons/km^2 and 10.6 persons/km^2, respectively. During 1970 - 1980 period, urban population grew at the average rate of 4.6% p.a. and got a share of 65% in the total population in 1980 (Table 3).

GDP of Malaysia was M$25,376 x 10^6 in 1980 in terms of 1970 constant price. The annual growth rate during the period from 1971 to 1980 was 8.1% on an average. Per capita GDP grew to M$1,779 in 1980 with the growth rate of 5.1% per annum during the same period. Manufacturing sector occupied the share of 21.2% in GDP, while 22.9% of GDP was contributed by agriculture sector (Tables 4 and 5).

In 1980, GRP of Peninsular Malaysia was M$21,706 x 10^6. From 1971 to 1980, average annual growth rate was 8.0%. Per capita GRP of Peninsular Malaysia became M$1,832 with the growth rate of 5.2% per annum. Manufacturing sector contributed to GRP by 23.8% and agricultural sector 20.7%.

2.1.3 External trade, employment and consumer price

In 1982, the exports of Malaysia totalled M$26,440 x 10^6 (Table 6). Major export commodities comprised crude petroleum, manufactured goods, rubber, sawlogs, tin and palm oil (Table 7). Although traditionally rubber and tin were the major export commodities, their share declined in the past decade. On the contrary, crude petroleum, palm oil, round and sawn timber and manufactured and processed products registered remarkable growth.

Imports of Malaysia amounted to M$28,893 x 10^6 in 1982 (Table 6). Major commodities were machinery and transport equipments, manufactured goods, food, beverages and tobacco (Table 7).

Trade balance of Malaysia had recorded surplus until 1980. However, it turned into red since 1981 because of the decrease of the exports due to the weak primary commodity prices affected by the recession of the economy of the advanced countries. Since the economy of Malaysia is essentially export oriented, it has been affected badly by the export decline and consequent trade balance and balance of payment deterioration in recent years.

Labor force in Malaysia was 5,694 x 10^3 in 1982, of which 5,341 x 10^3 was employed. Unemployment rate was estimated at 6.2% (Table 8). Services and others sector absorbed the biggest portion or 39.6% of the total. Agriculture, forestry and fishery followed with 37.3%. Manufacturing sector accounted for 15.7% (Table 9).

Consumer price in Malaysia has been stable in these years. In recent years, however, upward trend of prices were observed (Table 10).

2.2 The Study Area

2.2.1 Geographical features and administrative division

The State of Perlis of 810 km^2 is located in the northernmost part of the west coast of Peninsular Malaysia, between 100°7' and 100°22' east in longitude and between 6°15' and 6°44' north in latitude. It faces the Strait of Melaka in the west and adjoins the State of Kedah in the south and Thailand in the north and east. The State comprises one district.

The State of Kedah of 9,480 km^2, including Pulau Langkawi, is located in the northern part of the west coast of Peninsular Malaysia, between 99°40' and 101°8' east in longitude and between 5°5' and 6°33' in latitude. It faces the Strait of Melaka in the west and adjoins the State of Perlis in the north and the States of Pulau Pinang and Perak in the south. The State comprises 11 districts. It is noted that the whole of Pulau Langkawi district and major portion of Bandar Baru district lie outside of the Study Area.

The State of Pulau Pinang of 1,040 km^2, composed of Seberang Perai and Pulau Pinang, is located in the northern portion of the west coast of Peninsular Malaysia, between 100°1' and 100°33' east in longitude and 5°8' and 5°35' north in latitude. It faces the Strait of Melaka in the west and adjoins the State of Kedah in the north and the east and the State of Perak in the south. The State comprises 5 districts.

The administrative division in the Study Area is shown in Table 1 and Fig. 1.

2.2.2 Population and GRP

Population of Perlis/Kedah was 1.3 x 10^6 in 1980 with the average annual growth rate of 1.8% during the period from 1970 to 1980. Population density increased from 109 persons/km^2 in 1970 to 129 persons/km^2 in 1980.

The GRP increased from M$806 x 10^6 in 1971 to M$1,422 x 10^6 in 1980 in factor cost at 1970 constant price with the average annual growth rate of 6.5%. GRP of manufacturing sector shared M$39 x 10^6 or 4.8% of the total in 1971 and M$110 x 10^6 or 7.7% in 1980. Per capita GRP was M$1,069 in 1980 in factor cost at 1970 constant price and its average annual growth rate between 1971 and 1980 was 4.7%.

Population of Pulau Pinang was 1.0 x 10^6 in 1980 with the average annual growth rate of 1.9% during the period from 1970 to 1980. Population density increased from 774 persons/km^2 in 1970 to 933 persons/km^2 in 1980.

The GRP increased from M$827 x 10^6 in 1971 to M$2,221 x 10^6 in 1980 in factor cost at 1970 constant price with the average annual growth rate of 11.6%. GRP of manufacturing sector shared M$174 x 10^6 or 21.0% of the total in 1971 and M$825 x 10^6 or 37.2% in 1980. Per capita GRP was M$2,289 in 1980 in factor cost at 1970 constant price and its average annual growth rate between 1971 and 1980 was 9.6%.

3. NATIONAL ECONOMIC DEVELOPMENT PLAN

3.1 New Economic Policy

New Economic Policy (NEP) was enunciated in the Mid-Term Review of the Second Malaysia Plan, 1971 to 1975, in order to promote national unity through eradicating poverty irrespective to race and restructuring society to eliminate the identification of race with economic functions (Refs. 1 to 5).

3.2 Outline Perspective Plan

Outline Perspective Plan (OPP) was initiated in 1971 to achieve the goals of NEP in 1990. The targets set for the 1981 - 1990 period or the second decade of OPP period may be summarized hereunder (Refs. 2 to 5).

3.2.1 Development strategies for major sectors

Development strategies and prospects of major leading sectors for 1981 - 1990 period are summarized below.

(1) Development in agricultural sector

Rubber will benefit considerably from the expected increase in energy costs which make synthetic rubber less competitive. And the new land for rubber is planned to be opened and the productivity improvement efforts will be strengthened.

Export prices of palm oil are expected to fall when the prospective increases in the world supply of oils and fats are considered. While it is expected that the market share of palm oil in total oils and fats would decline, Malaysia is expected to be capable of securing increases in the share of world palm oil market.

National Forestry Policy, adopted in 1978, will be implemented for the conservation, management and development of the forest resources on a systematic basis in order to avoid depletion of the forest resources.

The policy of self-sufficiency in the rice production will be maintained through increase in the yield of existing paddy crop as well as expansion of paddy cultivation area.

(2) Development in manufacturing sector

Output of this sector is projected to grow at a rapid rate of growth through the export expansion and import substitution strategies. The Government will emphasize the processing of primary commodities as a part of its strategy to encourage the growth of resource-based industries to meet the demand for the domestic market and for export.

Necessary steps will be taken to develop new manufactured export activities based on Malaysia's comparative advantage with less manpower required.

Improvement of living standards and rapid economic growth will bring about the demand increase for consumptive goods, capital and international goods and construction materials.

With the establishment of Heavy Industries Corporation Malaysia Berhad, heavy industrial production will be accelerated.

(3) Development in mining sector

The slow growth in 1980s will be derived from the depletion in alluvial tin bearing deposits as well as slowdown in the rate of production of crude petroleum.

The prospects for the development of the natural gas industry to meet domestic and export needs will be bright. Natural gas from offshore fields in Trengganu, Sabah and Sarawak will be used for the generation of electricity and to produce liquified petroleum gas (LPG). In addition, the domestic refining capacity will be significantly enhanced with the establishment of oil refineries in Melaka and Trengganu.

3.2.2 Regional development strategies

In accordance with the goals of NEP, regional development during 1980s will continue to be directed towards reducing the socio-economic disparities among regions by encouraging the promotion policy for the less developed regions.

(1) Perlis/Kedah area

(a) improvement of productivity in agricultural sector,

(b) completion of Chankat Jering-Alor Setar-Jitra highway linked to the regional commercial center at Pulau Pinang, and

(c) increase in agricultural productivity by Muda II and Titi Tinggi projects.

(2) Pulau Pinang State

(a) increase of high-technology industries,

(b) strengthening the role of this state as the regional growth center for northern Peninsular Malaysia, and

(c) completion of Penang bridge to improve economic linkages with the mainland.

3.3 Fourth Malaysia Plan (4MP)

The economy is expected to undergo further expansion and diversification during 4MP period.

The worldwide economic recession is likely to continue during the former half of 4MP period and will have significant adverse impact on the Malaysian economy. The world economic environment, however, is expected to be improved during the latter half of 4MP period and exports are expected to perform better. Characteristics and strategies for sectoral development contemplated in 4MP are summarized as follows (Ref. 5):

(1) Agriculture, forestry and fishing sector

(a) slower growth of the major commodities such as rubber and palm oil,

(b) declining of the sawlog output by the National Forest Policy in Peninsular Malaysia and the conservation policy of Sabah and Sarawak,

(c) continuation of the encouragement of the dominant tree crops at present,

(d) production promotion of cocoa, pepper, tobacco, vegetables and fruits,

(e) expansion of rubber output by the Government's Dynamic Production Policy through replanting and opening the new planted area,

(f) development of new land and replanting program for oil palm, and

(g) continuation of self-sufficiency policy in paddy production.

(2) Mining sector

(a) increase of crude petroleum output from 280 x 10^3 barrels/d in 1980 to 363 x 10^3 barrels/d in 1985,

(b) bright prospects of LNG including 6 x 10^6 tonnes by Bintulu LNG project, and

(c) decrease of tin production and copper output because of the limited availability of existing resources.

(3) Manufacturing sector

(a) stimulating the expansion of the manufacturing sector from both external and domestic demand,

(b) strengthening of the export-oriented industries such as timber products, electronics, textiles and rubber products,

(c) promotion of the agro-based industries including processing of cocoa and palm oil, production of specific rubber products and high value timber-based products,

(d) import-substitution policy including the production of processed food, intermediate goods such as oils and fats, industrial chemicals, chemical products and cement, and

(e) encouragement of capital-intensive industries such as aluminium, cement and steel by the Heavy Industries Corporation Malaysia Berhad.

3.4 Midterm Review

Midterm Review of 4MP is currently being made by EPU. Reflecting the recent unfavorable economic environment, the original 4MP budget may be revised downward. Preliminary figures by Midterm Review of population and GRP of the States of Perlis, Kedah and P. Pinang and these of Malaysia in 1980 and 1990 were made available to the Study Team as shown in Tables 11 and 12. Per capita GDP and per capita GRP were estimated accordingly and given in Table 13 (Ref. 69).

The population of the States of Perlis, Kedah and P. Pinang in 1980 by Midterm Review estimate is lower than that adopted in the Study by about 3.5%. Population growth rate for the States during 1980 - 1990 period by Midterm Review projection is 0.08% p.a. lower. Accordingly, population of the States preliminarily projected by Midterm Review is about 5% lower than that by the Study (Table 11).

The GRP of the States in 1980 by Midterm Review estimate is 1.2% lower than that by the Study. Midterm Review projection for 1990 for the States is almost identical with that by Case 2 (Table 12).

Per capita GRP of the States in 1980 by Midterm Review estimate is 2.5% higher than that by the Study. Midterm Review projection for 1990 lies between the two figures projected by Case 1 and Case 2 (Table 13).

The data, however, are not adequate for making projection for population and gross value of manufacturing output by city/town and rural area in each State in 1982, 1985, 1990 and 2000, lacking the following informations:

(1) population, GDP and GRP of the States and Malaysia in 1985, and

(2) population and GDP of Malaysia in 2000.

No projection for socio-economic framework, therefore, was made based on the Midterm Review figures. Outline estimate for D&I water demand under the condition of Midterm figures is given in Annex Domestic and Industrial Water Supply.

4. POPULATION PROJECTION

4.1 Basic Data and Assumption

Basic data for the population projection are as follows:

(1) 4MP (Ref. 5) and data provided by EPU (Ref. 21),

(2) Population Census for the years of 1970 and 1980 (Refs. 6 & 20), and

(3) regional study reports (Refs. 22 to 25).

Population of the whole Malaysia and that of each state were projected based on the data available in 4MP and the information obtained from EPU. For the Census years of 1970 and 1980, 4MP figures were also adopted rather than DOS ones (Table 14). In projecting the district population, district boundaries given in the 1980 Population Census were adopted. The district boundaries in 1970 were adjusted, as required, to those adopted in 1980 Population Census.

4.2 Projection Procedure and Methodology Adopted by NWRS

4.2.1 Projection of population in Malaysia

The nation population estimated and projected in 4MP for the years of 1980, 1985 and 1990 was adopted and the population for the year of 2000 provided by EPU was also adopted.

4.2.2 Projection of population by State

The state population estimated and projected in 4MP for the years of 1980, 1985 and 1990 was adopted. In projecting the state population for 2000, a binominal function was assumed. Namely, the population of each state was assumed to be related to the nation population by the equation of:

$$Y = aX^2 + bX + c$$

where, Y: Population in a State
X: Population in whole Malaysia

As an exception, for Pulau Pinang State, the function of $Y = a + b \cdot X^c$ was applied to project its population because it was found to be more fitted than the equation of $Y = aX^2 + bX + c$. The values of coefficients a, b and c were determined for each state based on the population figures in 1980, 1985 and 1990.

4.2.3 Projection of urban population

Urban population was projected based upon the following assumption which was made based on the historical trend of urbanization phenomena.

(1) Projection method of urbanization ratio in Malaysia

The urbanization ratio is herein defined as the ratio of urban population, i.e., sum of the populations of cities/towns population of which is larger than 10,000, to the total population. For Malaysia, a linear relationship between per capita GDP and the urbanization ratio as assumed based on the data for 1970, 1975 and 1980 as well as the projected figures in 4MP for 1985 as shown in the following function:

$$Y = aX + b$$

where, Y: Urbanization ratio for Malaysia
X: Per capita GDP

The values of coefficients a and b were calculated from the values of Y and X shown in 4MP for 1970 and 1980.

(2) Projection method for the first approximation of population in each city/town

The ratio of the population in a city/town to the population in the state to which the city/town belongs is herein called the population share of the city/town.

The cities/towns were classified into the following three groups:

Group 1: Town, in which population share has increased between 1970 and 1980.

$$Y = 1 - 1/(aX + b)$$

where, Y: Share of population in a town to total of State
X: Population in State

The values of coefficients a and b were estimated from Y and X in 1970 and 1980 (Refs. 5 to 7 and 20).

Group 2: Town, in which population share to total of State has decreased between 1970 and 1980.

$$Y = 1/(aX + b)$$

The values of coefficients a and b were estimated from the same data as referred for Group 1.

Group 3: Town, in which population share to total of State was constant between 1970 and 1980.

Future share of population of a town to total of the State was estimated to be equal to that in 1980.

(3) Population of cities/towns

All the gazetted towns with population of more than 3,000 in 1980 Population Census were picked up. The population projection (First Approximation) was carried out through 2000 based on the formula shown in Section 4.2.3 (2). Those towns whose population was projected to exceed 10,000 by 2000 were identified and defined as city/towns in this Study.

Urbanization ratios for Malaysia for Case 1 and Case 2 were projected for the years of 1985, 1990 and 2000 based on the per capita GDP in each year for each case according to the formula shown in Section 4.2.3 (1). The total urban population in Malaysia for Case 1 and Case 2 were estimated by multiplying the population in Malaysia by the urbanization ratios.

The population of the cities/towns derived as the first approximation was adjusted so that the sum of the population of the cities/towns equals to the total urban population estimated by the urbanization ratio.

4.2.4 Projection of rural population

Rural population was defined in this Study as the population living in other area than city/town area. The rural population of each district was projected based on the same function as adopted for the projection of urban population stated in sub-section 4.2.3 (2), but Y and X stand for as follows:

Y: Share of population of a district rural area to the State rural population, and

X: Total population of the State rural area.

The values of coefficients a and b were derived based on the historical Y and X in 1970 and 1980 Population Censuses. This function assumed that the rural population trend experienced during the period from 1970 to 1980 would continue through the year 2000.

The future rural population of each district was derived by the share derived above multiplied by the projected State rural population which was obtained by deducting the total urban population of the State from the State total population.

4.2.5 Projection of district population

District population was derived by aggregating the district urban population projected in Section 4.2.3 and the district rural population projected in Section 4.2.4.

4.3 Projection Procedure and Methodology Adopted in the Study

4.3.1 General

The data and assumptions and methodologies adopted by NWRS were basically used for this Study. In the Study, however, 2 new cities/towns, Bandar Seberang Jaya and Bandar Bayan Baru in the Pulau Pinang State, were taken into account in addition to these in NWRS. Projected population for these two cities/towns made by the Pulau Pinang Development Corporation (PDC) up to 1995 was adopted for Case 1 and extrapolated to 2000 in this Study (Ref. 70).

The population of the States of Perlis, Kedah and Pulau Pinang was held the same as that in NWRS, or the 4MP projection up to 1990. The population of Malaysia projected up to 2000 was kept the same as that in NWRS or 4MP projection.

It is noted that the population in the States by city/town and rural area in 1982 was projected based on the population in 1980 and 1985, assuming constant growth rate during 1980 - 1985 period.

As presumed in NWRS, it was assumed that the socio-economic framework would affect only urban-rural distribution of the population. The population in each state as well as that in Malaysia was assumed to be the same for Case 1 and Case 2.

4.3.2 Population of the Pulau Pinang State

According to PDC projection, population of Bandar Seberang Jaya and Bandar Bayan Baru will grow sharply, reaching 250,000 each in 2000, while their population in 1980 together accounted to only 19 x 10^3. Considering this sharp increase in these two new towns, it was assumed in this Study for Case 1 that population growth in the Pulau Pinang State would take place only in these towns and Georgetown, the capital of the State up to 1990, holding the population of the rest of the State the same as that in 1980. It was also assumed that the total State population in 1990 is the same as that projected by NWRS or the one projected by 4MP. Consequently, in 1990 State population will reach 1,133 x 10^3, increasing by 163 x 10^3, which is accounted for by the increase of 134 x 10^3 in the two new towns and increase of 29 x 10^3 in Georgetown. Thereafter until 2000 it was assumed that population increase will occur only in the two new towns. The state population in 2000 will consequently reach 1,480 x 10^3, which higher than that projected by NWRS by about 310 x 10^3. The average growth rate of the state population was estimated at 2.1% p.a. which is slightly lower than that

for Malaysia, 2.2% p.a. projected by 4MP. The State population by city/town and rural area was projected for Case 2 based on the for Case 1, taking into account the difference of the urbanization ratio.

4.3.3 Population of the States of Perlis and Kedah

First, total urban population in the States other than the Pulau Pinang State including Perlis and Kedah States in 1980, 1985 and 1990 was estimated by deducting the urban population in the Pulau Pinang State from that in Malaysia in each year. Then the city/town population of the other States in each year estimated as the first approximation was adjusted so that the sum of the population of the cities/towns tallies with the total urban population in the States other than the Pulau Pinang State in each year. The population of a district rural area was obtained by the share of the district rural population in the total population of the State rural area multiplied by the State rural population which was derived as State population less State urban population.

The population by city/town and rural area in 2000 in the States other than the Pulau Pinang State was estimated similarly except that the population of each State in 2000 was adjusted downward in proportion to the population size projected by NWRS, keeping the population in Malaysia the same as that projected by 4MP.

4.4 Projected Population

4.4.1 Projected population in Malaysia

The projected population in Malaysia is the same as that in NWRS or the 4MP projection up to 2000, i.e., 14,261 x 10^3 in 1980, 16,180 x 10^3 in 1985, 18,143 x 10^3 in 1990 and 22,057 x 10^3 in 2000. The average growth rate for 1980 - 2000 period was estimated at 2.2% p.a.

The projected population in Malaysia is shown in Fig. 2.

4.4.2 Projected population in the States of Perlis, Kedah and Pulau Pinang

In the State of Perlis, the population will grow at the average growth rate of 1.6% p.a. for 1980 - 2000 period, reaching 217 x 10^3 in 2000. In the State of Kedah, it will grow at the rate of 0.9% p.a., reaching 1,398 x 10^3 in 2000. In the State of Pulau Pinang, the growth rate will be 2.1% p.a. with the population of 1,480 x 10^3 in 2000. The total population of these three states will grow at the average rate of 1.5% p.a., raaching 3,095 x 10^3 in 2000.

In 2000, about 13% of the population will live in urban area in the State of Perlis. It will be 22% in the case of the State of Kedah and 68% in the case of the State of Pulau Pinang. Urban population of these three States will account for about 43% of the total population in 2000.

In Case 2, about 10% of the population will live in urban area in the State of Perlis. It will be 19% in the case of the State of Kedah and 52% in the case of the State of Pulau Pinang. Urban population of these three States will account for about 33%, which is about 10% lower than for Case 1.

The projected population by city/town and rural area in the States of Perlis, Kedah and Pulau Pinang for Case 1 is shown in Tables 15 to 17 and that for Case 2 is shown in Tables 18 to 20. The projected population of the States are shown in Fig. 2.

5. GDP AND GRP PROJECTION

5.1 Basic Data and Assumptions

GDP and GRP of the States of Perlis, Kedah and Pulau Pinang were projected for the following two cases, taking into consideration the planned value of 4MP/OPP (Refs. 5 & 26).

Case 1: 4MP target in 1985 and OPP target in 1990 were assumed to be achieved as initially planned. For the period from 1990 to 2000, a GDP growth rate of 7.5% which is 0.5% less than that set for the period from 1980 to 1990 was assumed.

Case 2: The GDP growth rates were assumed at 6% for 1980 to 1985, 5% for 1985 to 1990 and 4% for 1990 to 2000, taking into consideration the recent worldwide depression. As the result, the attainment of GDP in Case 1 in 2000 would delay in Case 2 by about 15 years.

The assumed average annual growth rates of GDP for Case 1 and Case 2 are as follows:

	1980 - 85 (4MP)	1986 - 90 (5MP)	1991 - 95 (6MP)	1996 - 2000 (7MP)
Case 1	7.6%	8.4%	7.5%	7.5%
Case 2	6.0%	5.0%	4.0%	4.0%

Average annual growth rate assumed during 1990 - 2000 period for Case 1 is similar to these recorded by the rapidly growing countries including Singapore and Korea in recent years.

The growth rates for Case 2 were set, considering the recent world-wide recession, the depression in the advanced countries in particular which would give an adverse impact on the heavily export dependent economy of Malaysia. It is noted that compared with Case 2 in NWRS the growth rates were lowered, taking into consideration the actual performance of the economy of Malaysia which marked 6.7% growth of GDP in 1981 and 4.6% growth in 1982, which are much lower than that set by 4MP (Refs. 67 to 69 and 71 to 75).

5.2 Projection Methodology of GDP and GRP

5.2.1 Projection of GDP of Malaysia

GDP of Malaysia was estimated by means of the assumed growth rates for each Malaysia Plan period. In Case 1, GDP was estimated to increase by 345%. It would increase by 153% in Case 2.

5.2.2 Projection of GRP of the States of Perlis, Kedah and Pulau Pinang

Per capita GRP of each State was assumed to be related to per capita GDP of the whole nation by the following function:

$$Y = X + a/X + b/X^2 + c/X^3$$

where, Y: Per capita GRP of State
X: Per capita GDP of whole nation

The values of coefficients a, b and c were determined for each State based on the values of X and Y projected in 4MP and OPP for the years of 1980, 1985 and 1990. The above function implies that the per capita GRP of each State will converge to the per capita GDP of whole nation in the long run. The GRP of each State was obtained by the projected per capita GRP of each State multiplied by the projected population of each State.

5.3 Projected GDP and GRP

5.3.1 GDP of Malaysia

GDP of Malaysia in Case 1 will grow at the average annual growth rate of 7.75% during 1980 - 2000 period, reaching M$113,068 x 10^6 in 2000 in terms of factor cost in 1970 constant price. In Case 2, it will grow at the rate of 4.75%, reaching M$64,155 x 10^6.

GDP of Malaysia in Case 1 is shown in Table 21 and that in Case 2 is shown in Table 22. They are also shown in Fig. 3.

5.3.2 Per capita GDP and per capita GRP of the States of Perlis, Kedah and Pulau Pinang

Per capita GDP of Malaysia is obtained by dividing the GDP by total population in Malaysia. In Case 1, per capita GDP will increase at the average annual rate of 5.4%, reaching M$5,126 in 2000 in terms of factor cost in 1970 constant price. In Case 2, it will increase at the rate of 2.5%, reaching M$2,909 in 2000.

Per capita GRP of the States will increase at GDP increases. In Case 1, per capita GRP of the States of Perlis and Kedah will increase at the average annual growth rate of 7.1%, reaching M$4,213 in 2000. Per capita GRP of the State of Pulau Pinang will increase at the rate of 5.1%. In Case 2, it will grow at the rate of 3.1% for the States of Perlis and Kedah and 2.4% for the State of Pulau Pinang. It is noted that due to the characteristics of the function adopted for per capita GRP projection, the increase rate is higher for the States with lower GRP in 1980.

In Case 1, per capita GRP of the States of Perlis, Kedah and Pulau Pinang will be improved rapidly, catching up the per capita GDP of Malaysia in 2000. Though gap will be narrowed, per capita GRP of the

States will still be behind the per capita GDP of Malaysia in 2000 in Case 2.

The per capita GDP and per capita GRP in Case 1 are shown in Table 23 and these in Case 2 are shown in Table 24.

5.3.3 GRP of the States of Perlis, Kedah and Pulau Pinang

GRP of the States of Perlis and Kedah will grow at the average annual growth rate of 8.1% during 1980 - 2000 period, reaching M$6,804 x 10^6 in 2000 in terms of factor cost in 1970 constant price in Case 1. That of the State of Pulau Pinang will grow at the rate of 7.3%, reaching M$9,111 x 10^6 in 2000. For the States of Perlis, Kedah and Pulau Pinang, it will grow at the rate of 7.7%, which is about the same as the average growth rate of GDP.

In Case 2, GRP of the States of Perlis and Kedah will grow at the average annual growth rate of 4.2%. That of the State of Pulau Pinang will grow at the rate of 4.6%. For the States of Perlis, Kedah and Pulau Pinang, it will grow 4.4%, which is slightly lower than the average growth rate of GDP.

The projected GRP in Case 1 is shown in Table 21 and that in Case 2 is shown in Table 22. They are also shown in Fig. 3.

6. PROJECTION OF GROSS VALUE OF OUTPUT IN MANUFACTURING SECTOR

6.1 Basic Data and Assumption

Basic data for the projection of gross value of output in manufacturing sector were obtained from the followings:

(1) 4MP;

(2) Survey of Manufacturing Industries, Peninsular Malaysia, 1974, Vol. I DOS, Survey of Manufacturing Industries, sabah, 1974, DOS, and Survey of Manufacturing Industries, Sarawak, 1974, DOS (Refs. 32 to 34);

(3) Survey of Manufacturing Industries by DOS, 1978, Sarawak (Ref. 35);

(4) Directory of Approved Companies in Production, 1979, MIDA (whole Malaysia) (Ref. 58);

(5) planned production provided by MIDA for Peninsular Malaysia, 1981;

(6) planned production provided by the Heavy Industries Corporation of Malaysia Bhd. and Project Investment Unit of Sabah and the Bintulu Development Authority of Sarawak, 1981 (Refs. 61 to 63); and

(7) Economic Report 1980/81, MOF (Ref. 54).

Projection was basically proceeded based upon the 4MP/OPP figures in the Peninsular Malaysia. In Sabah and Sarawak, projection depends upon the actual economic structure in 1974, 1978 and 1979 shown in the above-mentioned references, because of a lack of the planned figure by 4MP/OPP.

Classification of commodity groups in manufacturing sector shown in the next page was adopted for the projection of industrial water demand. The correspondence with the classification adopted by DOS is also shown in Table 25.

The information and data referred to for the purpose of this chapter are given in Refs. 27 to 66.

6.2 Projection Methodology

6.2.1 Projection of value added (VA) of manufacturing sector by State

In projection VA of manufacturing sector, the share of VA of manufacturing sector to GRP of each State was first projected according to the following function:

$$Y = 50 + a/X^2 + b/X^3 + c/X^4$$

where, Y: Share of VA of manufacturing sector to GRP of each State
X: Per capita GRP of each State

As an exception, for the States of Perlis and Kedah, the function of $Y = 50 + a/X + b/X^2 + c/X^3$ was applied because it was found to be more fitted. The values of coefficients a, b and c were determined for each State based on the X and Y values in 1980, 1985 and 1990.

The above function assumes that the share of VA of manufacturing sector has a functional relationship with per capita GRP. The constant of 50% was derived through trial and error computation aiming that the share of VA of manufacturing sector in GDP in 2000 will fall in the range of 32% to 33% in Case 1, which was estimated to be the ceiling share according to the historical and planned share by 4MP and OPP.

Based on thus projected share, VA of manufacturing sector of each State was projected by GRP of each State multiplied by the above-mentioned share of VA of manufacturing sector of each State.

6.2.2 Projection of VA of manufacturing sector by State by commodity group

VA of manufacturing sector of a State was further broken down into 11 commodity groups by multiplying VA of manufacturing sector of a State by the share of 11 commodity groups which were estimated by the following procedures. It is noted that VA of manufacturing sector of each State as projected in Section 6.2.1 was assumed to include the large scale industrial development projects.

(a) clarification of the future development plan of large scale industries including petro-chemical products and basic metals (Step 1);

(b) estimation of VA of manufacturing sector by State based upon the historical trend without the large scale industrial development (Step 2);

(c) projection of share of VA of 11 commodity groups in VA of manufacturing sector by State based upon the historical trend without the large scale industrial development (Step 3);

(d) projection of VA of manufacturing sector by commodity group of each State without the large scale industrial development (Step 4);

(e) estimation of the aggregated total of the projected value by historical trend and the value added by the large scale industrial development (Step 5); and

(f) adjustment of the projected value added by taking into consideration the availability of water source (Step 6).

(1) Step 1

Development plan is as shown in Table 26. These projects were planned by the Heavy Industries Corporation of Malaysia Bhd., the Project Investment Unit of Sabah, and the Bintulu Development Authority of Sarawak. Stagewise achievement ratio of the planned production target was assumed to be as follows in both cases:

	1985	1990	1995	2000
Case 1	15%	50%	100%	100%
Case 2	15%	35%	60%	100%

(2) Step 2

VA of manufacturing sector of each State without large scale industries was estimated by deducting VA produced by the large scale industrial development estimated in Step 1 from VA of manufacturing sector of each State.

(3) Step 3

The share of VA of 11 commodity groups in the VA of manufacturing sector of each State was projected according to the following procedures:

(A) Peninsular Malaysia

First, the share of VA of 11 commodity groups of manufacturing sector in 1980 and 1985 was estimated by following procedures:

(a) Considering the big share (12.4% to the total) in 1980 of "Other manufactures" which was presented in 4MP (p. 294), it was intended to breakdown this share into some commodity groups by utilizing the 1974 Industrial Survey in which the share of "Other manufactures" was 0.3% to the total. First, based on the commodity shares in 1975 and their growth rates for the period of 1971 - 1980 shown in 4MP (p. 294), the estimated share in 1974 was obtained. By comparing this estimated shares with those obtained from the 1974 Industrial Survey, the estimated share of "Other manufactures" for 1974 was distributed to the commodity groups by the ratio of 1974 estimated share to that obtained by 1974 Industrial Survey. Through this procedures, the share of "Other manufactures" in 1974 was lessened to that indicated in 1974 Industrial Survey. Thereafter, by applying the growth rate of each commodity share for 1971 - 1980 available in 4MP (p. 294), the commodity share in 1980 was obtained; and

(b) Based on thus estimated commodity share in 1980, the share in 1985 was obtained by applying the growth rate of each commodity group for 1981 - 1985 available in 4MP (p. 252).

The estimated share of 11 commodity groups in 1980 and 1985 is presented in Table 27.

Secondly, the share of 11 commodity groups of manufacturing sector after 1985 was projected by applying the following function.

If the share of a commodity group in 1985 is greater than that in 1980:

$$Y = 1 - 1/(aX + b)$$

If the share of a commodity group in 1985 is less than that in 1980:

$$Y = 1/(aX + b)$$

where, Y: Share of VA of a commodity group to total VA of manufacturing sector in Peninsular Malaysia in the years of 1990 and 2000

X: Total VA of manufacturing sector in Peninsular Malaysia projected for the years of 1990 and 2000

If the share of VA of a commodity group in 1985 is equal to that in 1980, the share of the commodity group after 1985 was assumed to be equal to those in 1980 and 1985.

Finally, the share of 11 commodity groups of manufacturing sector of Peninsular Malaysia in each year was broken down into those of each State in the Peninsular Malaysia through converging computation by "Frater Method". As a result of this computation, the share of 11 commodity groups by 10 States of the Peninsular Malaysia was derived for each year from 1980 through 2000.

It is noted that the new large scale industrial development was not considered in deriving the above share of 11 commodity groups of manufacturing sector in the Peninsular Malaysia; it was considered in the following Step 5.

(B) Sabah

For the estimation of share by 11 commodity groups of manufacturing sector in Sabah, only the Survey of Industries carried out in 1974 (Ref. 33) was availed. Therefore, in estimating the share by 11 commodity groups, the data on number of establishment available for 1974 in the above survey and for 1979 in the Directory of approved Companies in Production as of 1979 prepared by MIDA (Ref. 58) were utilized. The share of VA by 11 commodity groups in 1979 was estimated by the said share in 1974 multiplied by the increase in the number of establishment between 1974 and 1979. The above share estimated

for 1979 was assumed to be unchanged for future and applied for the years from 1980 to 2000.

It is noted that the new large scale industrial development was not considered in deriving the above share of 11 commodity groups of manufacturing sector in Sabah; it was considered in the following Step 5.

(C) Sarawak

The share of 11 commodity groups to total VA of manufacturing sector in Sarawak was available for 1978 in Survey of Manufacturing Industries, Sarawak prepared by DOS (Ref. 35). The above share in 1978 was applied for the years from 1980 to 2000 assuming that there will be no structural change in the share of commodity group of manufacturing sector in Sarawak.

It is noted that the new large scale industrial development was not considered in deriving the above share of 11 commodity groups of manufacturing sector in Sarawak; it was considered in the following Step 5.

(4) Step 4

VA by 11 commodity groups of manufacturing sector in each State was projected by the total VA of manufacturing sector multiplied by the share of 11 commodity groups projected in Step 3 for each State and for each year from 1980 to 2000.

It is noted that the projected VA of manufacturing sector by 11 commodity groups by each State does not include the new large scale industrial development projects.

(5) Step 5

VA of manufacturing sector by 11 commodity groups by each State was finally derived by aggregating VA of new large scale industries projected in Step 1 and VA of manufacturing sector excluding the new large scale industries projected in Step 4 for each commodity group and for each State.

(6) Step 6

Based on the projected VA of manufacturing sector of each State, the future requirement of industrial water was tentatively estimated by each State. After aggregating the industrial water demand and domestic water demand, the future total water requirement was checked with the availability of water through water balance study by each State.

6.2.3 Projection of gross value of output in manufacturing sector

The gross value of output in manufacturing sector was projected by VA in manufacturing sector projected in Section 6.2.2 divided by VA ratio which is defined as the ratio of VA to gross value of output in manufacturing sector.

VA ratio was assumed to be 30% in manufacturing sector in whole Malaysia taking into consideration the experience of Japan and Korea as well as Peninsular Malaysia.

VA ratio by commodity group in 1974 was adopted for all the years and adjusted by the control total of 30% in total manufacturing sector as mentioned above.

Basic data for determining VA ratio are as shown in Tables 28 to 30.

6.3 Projected Gross Value of Output in Manufacturing Sector of the States of Perlis, Kedah and Pulau Pinang

Share of manufacturing sector in GRP and gross value added of manufacturing sector for the States of Perlis, Kedah and Pulau Pinang for Case 1 and Case 2 projected according to the methodology given in the preceding section are shown in Tables 31 to 34.

Projected gross value of manufacturing output of the States in 1982, 1985, 1990 and 2000 in Case 1 is shown in Table 35 and that in Case 2 is shown in Table 36.

REFERENCES

1. FIRST MALAYSIA PLAN 1966-1970, GOM

2. SECOND MALAYSIA PLAN 1971-1975, GOM

3. THIRD MALAYSIA PLAN 1976-1980, GOM

4. MID-TERM REVIEW OF THE THIRD MALAYSIA PLAN 1976-1980, GOM

5. FOURTH MALAYSIA PLAN 1981-1985, GOM

6. 1970 GENERAL REPORT, POPULATION CENSUS OF MALAYSIA, VOLUME I, DOS

7. 1970 GENERAL REPORT, POPULATION CENSUS OF MALAYSIA, VOLUME II, DOS

8. 1970 POPULATION AND HOUSING CENSUS OF MALAYSIA, VOLUME I - BASIC POPULATION TABLES PART XII, SABAH, DOS

9. 1970 POPULATION AND HOUSING CENSUS OF MALAYSIA, VOLUME I - BASIC POPULATION TABLES PART I, PERLIS, DOS

10. 1970 POPULATION AND HOUSING CENSUS OF MALAYSIA, VOLUME I - BASIC POPULATION TABLES PART II, PENANG AND PROVINCE WELLESLEY, DOS

11. 1970 POPULATION AND HOUSING CENSUS OF MALAYSIA, VOLUME I - BASIC POPULATION TABLES PART III, MALACCA, DOS

12. 1970 POPULATION AND HOUSING CENSUS OF MALAYSIA, VOLUME I - BASIC POPULATION TABLES PART IV, NEGERI SEMBILAN, DOS

13. 1970 POPULATION AND HOUSING CENSUS OF MALAYSIA, VOLUME I - BASIC POPULATION TABLES PART V, SELANGOR, DOS

14. 1970 POPULATION AND HOUSING CENSUS OF MALAYSIA, VOLUME I - BASIC POPULATION TABLES PART VI, PAHANG, DOS

15. 1970 POPULATION AND HOUSING CENSUS OF MALAYSIA, VOLUME I - BASIC POPULATION TABLES PART VII, TRENGGANU, DOS

16. 1970 POPULATION AND HOUSING CENSUS OF MALAYSIA, VOLUME I - BASIC POPULATION TABLES PART VIII, KELANTAN, DOS

17. 1970 POPULATION AND HOUSING CENSUS OF MALAYSIA, VOLUME I - BASIC POPULATION TABLES PART IX, KEDAH, DOS

18. 1970 POPULATION AND HOUSING CENSUS OF MALAYSIA, VOLUME I - BASIC POPULATION TABLES PART X, PERAK, DOS

19. 1970 POPULATION AND HOUSING CENSUS OF MALAYSIA, VOLUME I - BASIC POPULATION TABLES PART XI, JOHOR, DOS

20. PRELIMINARY FIELD COUNT SUMMARY OF 1980 POPULATION AND HOUSING CENSUS OF MALAYSIA, DOS

21. POPULATION, 1980, HUMAN RESOURCES SECTION, EPU

22. KOTA KINABALU WATER SUPPLY MASTER PLAN STUDIES, VOLUME I - REPORT, 1977, Watson (S.E. Asia) & Majkonsult Sdn. Bhd.

23. WATER RESOURCES AND WATER SUPPLY FOR LABUAN ISLAND, VOLUME I - MAIN REPORT, 1978, Watson (S.E. Asia) & Majkonsult Sdn. Bhd.

24. KUCHING URBAN AND REGIONAL STUDY, VOLUME I, STRATEGY AND STRUCTURE, PLAN, 1974, Shauklanol Cox Partnership

25. BINTULU REGIONAL CENTRE STUDY, FINAL REPORT SUMMARY, VOLUME I, 1979, P.G. Pak-Poy & Associates Pty Ltd.

26. GDP, 1980, REGIONAL SECTION, EPU

27. CENSUS OF STONE QUARRYING, 1974, DOS

28. SURVEY OF MANUFACTURING INDUSTRIES, WEST MALAYSIA, 1970 VOL. I, DOS

29. SURVEY OF MANUFACTURING INDUSTRIES, PENINSULAR MALAYSIA, 1971, VOL. I, DOS

30. SURVEY OF MANUFACTURING INDUSTRIES, PENINSULAR MALAYSIA, 1972, VOL. I, DOS

31. CENSUS OF MANUFACTURING INDUSTRIES, PENINSULAR MALAYSIA, 1973, VOL. I, DOS

32. SURVEY OF MANUFACTURING INDUSTRIES, PENINSULAR MALAYSIA, 1974, VOL. I, DOS

33. SURVEY OF MANUFACTURING INDUSTRIES, SABAH, 1974, DOS

34. SURVEY OF MANUFACTURING INDUSTRIES, SARAWAK, 1974, DOS

35. SURVEY OF MANUFACTURING INDUSTRIES, SARAWAK, 1978, DOS

36. PALM OIL, COCONUT AND TEA STATISTICS, 1970, DOS

37. PALM OIL, COCONUT AND TEA STATISTICS, 1971, DOS

38. PALM OIL, COCONUT AND TEA STATISTICS, 1972, DOS

39. PALM OIL, COCONUT AND TEA STATISTICS, 1973, DOS

40. PALM OIL, COCONUT AND TEA STATISTICS, 1974, DOS

41. PALM OIL, COCONUT AND TEA STATISTICS, 1975, DOS

42. PALM OIL, COCONUT AND TEA STATISTICS, 1976, DOS

43. PALM OIL, COCONUT AND TEA STATISTICS, 1977, DOS

44. RUBBER STATISTICS HANDBOOK, MALAYSIA, 1974, DOS

45. RUBBER STATISTICS HANDBOOK, MALAYSIA, 1976, DOS

46. PADI STATISTICS, PENINSULAR MALAYSIA, 1974, MOA

47. PADI STATISTICS, PENINSULAR MALAYSIA, 1977, MOA

48. ANNUAL FISHERIES STATISTICS, 1975, MOA

49. STATISTICAL DIGEST, WEST MALAYSIA, 1970, MOA

50. STATISTICAL DIGEST, WEST MALAYSIA, 1971, MOA

51. STATISTICAL DIGEST, PENINSULAR MALAYSIA, 1975, MOA

52. ECONOMIC REPORT 1979/80, MOF

53. ECONOMIC REPORT 1980/81, MOF

54. ECONOMIC REPORT 1981/82, MOF

55. QUARTERLY ECONOMIC BULLETIN, VOL. II NO. 4, DECEMBER 1978 BANK NEGARA MALAYSIA

56. TIN PRODUCTION, 1980, DEPARTMENT OF MINES, MALAYSIA

57. THE PRESENT LAND USE OF PENINSULAR MALAYSIA, 1974, MOA

58. DIRECTORY OF APPROVED COMPANIES IN PRODUCTION (AS AT 30TH JUNE, 1979), MIDA (WHOLE MALAYSIA)

59. POSITION OF INDUSTRIAL ESTATES IN INDUSTRIAL ESTATES, MALAYSIA (AS AT 30TH JUNE, 1979), MIDA

60. MALAYSIA INDUSTRIAL CLASSIFICATION, 1972, DOS

61. REQUIREMENT BRIEF 1/81: ENERGY, 1981, Heavy Industries Corporation of Malaysia Bhd.

62. HEAVY INDUSTRY DEVELOPMENT PLAN, 1981, Project Investment Unit of Sabah

63. ANNUAL REPORT OF 1979, Bintulu Development Authority

64. STATISTICAL ABSTRACT OF THE US DEPARTMENT OF COMMERCE, 1979

65. CENSUS OF MANUFACTURES, 1981, Miti of Japan

66. PRICE PROSPECTS FOR MAJOR PRIMARY COMMODITIES, Jan. 1980, IBRD

67. ECONOMIC REPORT 1982/83, MOF

68. BANK NEGARA ANNUAL REPORT, 1983, Bank Negara

69. PRELIMINARY INFORMATION ABOUT MIDTERM REVIEW OF 4MP, 1983, EPU

70. INFORMATION ABOUT DEVELOPMENT PLAN FOR BANDAR BAYAN BARU AND BANDAR SEBERANG JAYA, 1983, P. Pinang Development Corporation

71. DEVELOPMENT REPORT 1982, IBRD

72. INTERFUTURES, 1979, OECD

73. THE GLOBAL 2000 REPORT TO THE PRESIDENT, 1980, Government of USA

74. WORLD ECONOMIC OUTLOOK, 1982, 1983, IMF

TABLES

Table 1 CITIES/TOWNS AND DISTRICTS DEFINED IN THE STUDY

District		City/Town	
1.	Perlis	1.	Kangar
2.	Pulau Langkawi		
3.	Kubang Pasu	101.	Jitra
4.	Padang Terap		
5.	Kota Setar	2.	Alor Setar
6.	Pendang		
7.	Yan	102.	Guan Chempedak
		103.	Yan
8.	Sik		
9.	Kuala Muda	3.	Sg. Petani
		104.	Tikan Batu
10.	Baling	203.	Kuala Ketil
11.	Kulim	4.	Kulim
12.	Bandar Bharu		
13.	Seberang Perai Utala	5.	Butterworth
		109.	Kg. PMTG Kuching
14.	Seberang Perai Tengah	6.	Bk. Mertajam
		110.	Perai
		201.	Bandar Seberang Jaya
15.	Selatan		
16.	Timur Laut	8.	Georgetown
		105.	Air Itam
		106.	Tg. Tokong
		107.	Gelugor
		108.	Tg. Bunga
17.	Barat Daya	202.	Bandar Bayan Baru

Remarks; Whole of the Pulan Langkawi district and major portion of the Bandar Bharn district lies outside of the Study Area.

Table 2 POPULATION AND ITS GROWTH FROM 1970 TO 1980

Unit: 10^3

Region	1970	1980	Average Annual Growth Rate (%)
Peninsular Malaysia	9,147.0	11,849.0	2.6
Sabah	653.6	1,097.8	5.3
Sarawak	976.3	1,314.4	3.0
Whole Malaysia	10,776.9	14,261.2	2.8

Source; Ref. 5

Table 3 POPULATION DISTRIBUTION BETWEEN URBAN AND RURAL BY ETHNIC GROUP IN PENINSULAR MALAYSIA

Unit: 10^3

Ethnic Group	1970		1980		Average Annual Growth Rate of Urban Population (%)
	Urban	Rural	Urban	Rural	
Malay	713	4,109	1,359	5,025	6.7
Chinese	1,557	1,717	2,234	1,902	3.7
Indian	338	640	508	731	4.2
Others	30	43	47	43	4.6
Total	2,638	6,509	4,148	7,701	4.6

Source; Ref. 5

Table 4 GDP, GRP, PER CAPITA GDP AND PER CAPITA GRP IN 1980

Region	GDP or GRP		Per Capita GDP or Per Capita GRP	
	Amount /1 ($M\$ 10^6$)	Growth /2 Rate (%)	Amount /1 (M$)	Growth /2 Rate (%)
Malaysia	25,376	8.1	1,779	5.1
Perlis/Kedah	1,422	6.5	1,069	4.7
P. Pinang	2,221	11.6	2,290	9.6

Remarks; /1: At factor cost in 1970 constant price.
/2: During 1971 - 1980 period.

Source; Ref. 5

Table 5 GDP AND GRP BY SECTOR IN 1980

Unit: $M\$10^6$

Sector	Kedah/Perlis	Pulau Pinang	Malaysia
Agriculture, forestry and fishing	666 (46.9)	130 (5.9)	5,809 (22.9)
Mining and quarrying	4.5 (0.3)	0.5 (0.0)	1,214 (4.8)
Manufacturing	110 (7.7)	825 (37.1)	5,374 (21.2)
Construction	25 (1.8)	84 (3.8)	1,186 (4.7)
Services	616 (43.3)	1,181 (53.2)	11,793 (46.5)
Total	1,421.5 (100.0)	2,220.5 (100.0)	25,376 (100.0)

Remarks; (1): In 1970 constant price at factor cost
(2): Figures in parentheses signify the percentage share of each sector in the GDP or GRP

Source; Ref. 5

Table 6 TRADE BALANCE OF THE WHOLE MALAYSIA IN THE LAST DECADE

Unit: $M\$10^6$

Year	Export	Import	Balance of Trade
1973	7,372	5,934	+1,338
1974	10,022	9,350	+672
1975	9,057	8,333	+724
1976	13,330	9,568	+3,762
1977	14,861	10,990	+3,871
1978	16,932	13,242	+3,690
1979	24,060	17,457	+6,603
1980	28,013	23,104	+4,909
1981	26,910	27,020	-110
1982[1]	26,440	28,893	-2,453

Remarks; (1): Merchandise trade f.o.b.

Source; Refs. 52, 54 and 67

Table 7 MAJOR EXPORT AND IMPORT COMMODITIES IN 1982

Unit: $M\$10^6$

Commodity	Amount
Export (F.O.B.)	
Rubber	2,740
Petroleum Crude	7,332
Tin	1,528
Palm Oil (Crude or Processed)	2,673
Sawlogs	2,880
Manufactures	6,602
Import (C.I.F.)	
Food, Beverages and Tobacco	3,269
Manufactures	5,896
Petroleum Crude	1,544
Machinery and Transport Equipment	11,170

Source; Ref. 67

Table 8 EMPLOYMENT IN MALAYSIA

Unit: 10^3 persons

Item	1970	1980	1982
Labour Force (L)	3,682	5,377	5,694
Employment (E)	3,396	5,075	5,341
Growth Rate of E/1 (%)	-	3.7	3.6
Unemployment Rate (%)	7.8	5.6	6.2

Remarks; /1: Average annual growth for 5 years

Source; Refs. 5 and 67

Table 9 EMPLOYMENT BY SECTOR IN MALAYSIA

Unit: 10^3 persons

Sector	1970	1980	1982
Agriculture, forestry and fishery	1,714	1,961	1,992
Mining and quarrying	89	90	82
Manufacturing	386	802	836
Construction	137	279	315
Services and others	1,070	1,943	2,116
Total	3,396	5,075	5,341

Source; Refs. 5 and 67

Table 10 CONSUMER PRICE INDEX IN PENINSULAR MALAYSIA

Year	Index	Rate
1970	101.3	1.9
1975	144.0	4.5
1976	147.7	2.6
1977	154.8	4.7
1978	162.4	4.9
1979	168.3	3.6
1980	179.5	6.7
1981	196.8	9.6
1982	209.6	6.5

Remarks; Index: 1967 = 100
Rate : Average annual growth rate (%)

Source; Refs. 54 and 67

Table 11 PRELIMINARY POPULATION ESTIMATE BY MIDTERM REVIEW

Unit: 10^3

Area	1980		1990		Growth Rate for 1980 - 90 (%/y)	
	Midterm	Study	Midterm	Study	Midterm	Study
Perlis	148	157	173	191	1.57	1.98
Kedah	1,116	1,173	1,249	1,328	1.13	1.25
P/K	1,264	1,330	1,422	1,519	1.18	1.34
P. Pinang	955	970	1,105	1,133	1.47	1.57
P/K/P	2,219	2,300	2,527	2,652	1.31	1.43
Others	11,526	11,961	14,882	15,491	2.59	2.62
Malaysia	13,745	14,261	17,409	18,143	2.39	2.44

Table 12 PRELIMINARY GDP AND GRP ESTIMATE BY MIDTERM REVIEW

Unit: M$10^6

Area	1980		1990			Growth Rate for 1980 - 90 (%/y)		
	Mid-term	Study	Mid-term	Study Case 1	Study Case 2	Mid-term	Study Case 1	Study Case 2
Perlis/ Kedah	1,500	1,422	2,300	3,177	2,646	4.37	8.37	6.41
P. Pinang	2,100	2,220	4,100	4,364	3,751	6.92	6.99	5.39
P/K/P	3,600	3,642	6,400	7,541	6,397	5.92	7.55	5.79
Others	22,600	21,758	40,500	47,359	36,903	6.01	8.09	5.43
Malaysia	26,200	25,400	46,900	54,900	43,300	6.00	8.01	5.48

Table 13 PRELIMINARY GDP/CAPITA AND GRP/CAPITA ESTIMATE BY MIDTERM REVIEW

Unit: M$

Area	1980		1990		
	Midterm	Study	Midterm	Study Case 1	Study Case 2
Perlis/Kedah	1,187	1,069	1,617	2,091	1,557
P. Pinang	2,199	2,289	3,710	3,852	2,994
P/K/P	1,622	1,583	2,533	2,844	2,412
Others	1,961	1,819	2,721	3,057	2,382
Malaysia	1,906	1,781	2,694	3,024	2,387

Table 14 COMPARISON OF POPULATION OF THE STATES IN THE STUDY AREA ACCORDING TO POPULATION CENSUS AND EPU FIGURES

Unit: 10^3 persons

Region	1970		1980	
	Census (DOS)	EPU (4MP)	Census (DOS)	EPU (4MP)
Perlis/Kedah	1,076	1,117	1,250	1,330
P. Pinang	776	805	912	970
Malaysia	10,439	10,777	13,535	14,261

Table 15 HISTORICAL AND PROJECTED POPULATION OF DISTRICTS BY CITY/TOWN AND RURAL AREA IN PERLIS STATE FOR CASE 1

Unit: 10^3

District	City/Rural	Historical	Estimated	Projected			Average Annual Growth Rate (%)
		1980	1982	1985	1990	2000	1980 - 2000
1. Perlis	1. Kangar	14	15	17	21	29	3.7
	Rural	143	149	158	170	188	1.4
Urban Total		14	15	17	21	29	3.7
Rural Total		143	149	158	170	188	1.4
State Total		157	164	175	191	217	1.6

Remarks; 1982 population was estimated assuming constant growth rate during 1980 - 85 period.

Table 16 HISTORICAL AND PROJECTED POPULATION OF DISTRICTS BY CITY/TOWN AND RURAL AREA IN KEDAH STATE FOR CASE 1

Unit: 10^3

District	City/Rural	Historical 1980	Estimated 1982	Projected 1985	Projected 1990	Projected 2000	Average Annual Growth Rate (%) 1980 - 2000
2. Pulau Langkawi	Rural	31	32	34	36	37	0.9
3. Kubang Pasu	101. Jitra	15	17	20	26	38	4.8
	Rural	125	126	128	130	130	0.2
District Total		140	143	148	156	168	0.9
4. Padang Terap	Rural	45	48	52	56	59	1.4
5. Kota Setar	2. Alor Setar	76	77	78	82	96	1.2
	Rural	228	238	254	273	279	1.0
District Total		304	315	332	355	375	1.1
6. Pendang	Rural	82	84	87	90	92	0.6
7. Yan	102. Guan Chempedak	9	9	10	11	14	2.2
	103. Yan	6	6	7	9	12	3.5
	Rural	49	49	50	50	50	0.1
District Total		64	64	67	70	76	0.9
8. Sik	Rural	47	48	50	52	53	0.6
9. Kuala Muda	3. Sg. Petani	49	51	54	61	75	2.2
	104. Tikan Batu	4	5	6	9	13	6.1
	Rural	156	161	170	177	181	0.7
District Total		209	217	230	247	269	1.3
10. Baling	203. Kuala Ketil	4	5	6	7	10	4.7
	Rural	111	111	112	113	113	0.1
District Total		115	116	118	120	123	0.3
11. Kulim	4. Kulim	29	31	33	39	50	2.8
	Rural	73	73	74	74	73	0.0
District Total		102	104	107	113	123	0.9
12. Bandar Bharu	Rural	34	34	34	33	33	-0.1
Urban Total		169	176	195	219	308	3.0
Rural Total		1,004	1,029	1,064	1,109	1,100	0.5
State Total		1,173	1,205	1,259	1,328	1,408	0.9

Remarks; (1): 1982 population was estimated assuming constant growth rate during 1980 - 85 period.

(2): Whole of Pulau Langkawi district and major portion of Bandar Bharu district lies outside of the Study Area.

Table 17 HISTORICAL AND PROJECTED POPULATION OF DISTRICTS BY CITY/TOWN AND RURAL AREA IN PULAU PINANG STATE FOR CASE 1

Unit: 10^3

District	City/Rural	Historical 1980	Estimated 1982	Projected 1985	Projected 1990	Projected 2000	Average Annual Growth Rate (%) 1980 - 2000
13. Seberang Perai Utala	5. Butterworth	82	82	82	82	82	0.0
	109. Kg. PMTG Kuching	11	11	11	11	11	0.0
	Rural	120	120	120	120	120	0.0
District Total		213	213	213	213	213	0.0
14. Seberang Perai Tengah	6. Bk. Mertajam	30	30	30	30	30	0.0
	110. Perai	10	10	10	10	10	0.0
	201. Bandar Seberang Jaya	7	13	34	64	250	19.6
	Rural	126	126	126	126	126	0.0
District Total		173	179	200	230	416	4.5
15. Selatan	Rural	78	78	78	78	78	0.0
16. Timur Laut	8. Georgetown	267	278	295	296	296	0.5
	105. Air Itam	39	39	39	39	39	0.0
	106. Tg. Tokong	15	15	15	15	15	0.0
	107. Gelugor	14	14	14	14	14	0.0
	108. Tg. Bunga	12	12	12	12	12	0.0
	Rural	76	76	76	76	76	0.0
District Total		423	434	451	452	452	0.3
17. Barat Daya	202. Bandar Bayan Baru	12	22	53	89	250	16.4
	Rural	71	71	71	71	71	0.0
District Total		83	93	124	160	321	7.0
Urban Total		492	526	595	662	1,009	3.7
Rural Total		478	471	471	471	471	-0.1
State Total		970	997	1,066	1,133	1,480	2.1

Remarks; 1982 population was estimated assuming constant growth rate during 1980 - 85 period.

Table 18 HISTORICAL AND PROJECTED POPULATION OF DISTRICTS BY CITY/TOWN AND RURAL AREA IN PERLIS STATE FOR CASE 2

Unit: 10^3

District	City/Rural	Historical 1980	Estimated 1982	Projected 1985	Projected 1990	Projected 2000	Average Annual Growth Rate (%) 1980 - 2000
1. Perlis	1. Kangar	14	15	17	19	22	2.3
	Rural	143	149	158	172	195	1.6
Urban Total		14	15	17	19	22	2.3
Rural Total		143	149	158	172	195	1.6
State Total		157	164	175	191	217	1.6

Remarks; 1982 population was estimated assuming constant growth rate during 1980 - 85 period.

Table 19 HISTORICAL AND PROJECTED POPULATION OF DISTRICTS BY CITY/TOWN AND RURAL AREA IN KEDAH STATE FOR CASE 2

Unit: 10^3

District	City/Rural	Historical 1980	Estimated 1982	Projected 1985	1990	2000	Average Annual Growth Rate (%) 1980 - 2000
2. Pulau Langkawi	Rural	31	32	34	37	40	+1.3
3. Kubang Pasu	101. Jitra	15	17	19	24	29	+3.4
	Rural	125	126	128	130	132	+0.3
District Total		140	143	147	154	161	+0.7
4. Padang Terap	Rural	45	48	52	58	66	+1.9
5. Kota Setar	2. Alor Setar	76	76	76	75	74	-0.1
	Rural	228	240	262	287	319	+1.7
District Total		304	316	338	362	393	+1.3
6. Pendang	Rural	82	84	87	92	97	+0.8
7. Yan	102. Guan Chempedak	9	9	10	10	11	+1.0
	103. Yan	6	6	7	8	9	+2.0
	Rural	49	49	50	50	51	+0.2
District Total		64	64	67	68	71	+0.5
8. Sik	Rural	47	48	50	52	55	+0.8
9. Kuala Muda	3. Sg. Petani	49	51	53	56	57	+0.8
	104. Tikan Batu	4	5	6	8	10	+4.7
	Rural	156	161	169	180	193	+1.1
District Total		209	217	228	244	260	+1.1
10. Baling	203. Kuala Ketil	4	5	6	7	9	+4.1
	Rural	111	111	111	112	112	0.0
District Total		115	116	117	119	121	+0.3
11. Kulim	4. Kulim	29	30	32	36	38	+1.4
	Rural	73	73	73	73	73	0.0
District Total		102	103	105	109	111	+0.4
12. Bandar Bharu	Rural	34	34	34	33	33	-0.1
Urban Total		169	174	190	201	219	+1.3
Rural Total		1,004	1,031	1,069	1,127	1,189	+0.8
State Total		1,173	1,205	1,259	1,328	1,408	+0.9

Remarks; (1): 1982 population was estimated assuming constant growth rate during 1980 - 85 period.

(2): Whole of Pulau Langkawi district and major portion of Bandar Bharu district lies outside of the Study Area.

Table 20 HISTORICAL AND PROJECTED POPULATION OF DISTRICTS BY CITY/TOWN AND RURAL AREA IN PULAU PINANG STATE FOR CASE 2

Unit: 10^3

District	City/Rural	Historical 1980	Estimated 1982	Projected 1985	1990	2000	Average Annual Growth Rate (%) 1980 - 2000
13. Seberang Perai Utara	5. Butterworth	82	81	80	75	63	-1.3
	109. Kg. PMTG Kuching	11	11	11	10	8	-1.6
	Rural	120	116	111	114	149	+1.1
District Total		213	208	202	199	220	+0.2
14. Seberang Perai Tengah	6. Bk. Mertajam	30	30	29	27	23	-1.3
	110. Perai	10	10	10	9	8	-1.1
	201. Bandar Seberang Jaya	7	13	33	58	192	+18.0
	Rural	126	131	140	159	215	+2.7
District Total		173	184	212	253	438	+4.8
15. Selatan	Rural	78	75	71	73	95	+1.0
16. Timur Laut	8. Georgetown	267	275	287	271	227	-0.8
	105. Air Itam	39	39	38	36	30	-1.3
	106. Tg. Tokong	15	15	15	14	11	-1.5
	107. Gelugor	14	14	14	13	11	-1.2
	108. Tg. Bunga	12	12	12	11	9	-1.4
	Rural	76	79	83	96	133	+2.8
District Total		423	434	449	441	421	0.0
17. Barat Daya	202. Bandar Bayan Baru	12	22	52	81	192	+14.9
	Rural	71	74	80	86	114	+2.4
District Total		83	96	132	167	306	+6.7
Urban Total		492	522	581	596	749	+2.1
Rural Total		478	475	485	537	731	+2.1
State Total		970	997	1,066	1,133	1,480	+2.1

Remarks; 1982 population was estimated assuming constant growth rate during 1980 - 85 period.

Table 21 PROJECTED GDP AND GRP OF THE STATES OF RERLIS, KEDAH AND P. PINANG FOR CASE 1

Unit: M$10^6

Region	Actual 1980	Estimated 1982	Projected 1985	1990	2000
Malaysia	25,376	28,515	36,732	54,860	113,068
Perlis/Kedah/1	1,422	1,618	2,104	3,176	6,804
P. Pinang	2,220	2,369	3,010	4,364	9,111
P/K/P	3,642	3,987	5,114	7,540	15,915

Remarks; (1): At factor cost in 1970 constant price.

(2): P/K/P denotes the States of Perlis, Kedah and Pulau Pinang.

/1 : Due to the availability of relevant data, the States of Perlis and Kedah are treated as one region.

Table 22 PROJECTED GDP AND GRP OF THE STATES OF PERLIS, KEDAH AND P. PINANG FOR CASE 2

Unit: M$10^6

Region	Actual 1980	Estimated 1982	Projected 1985	1990	2000
Malaysia	25,376	28,512	33,959	43,341	64,155
Perlis/Kedah/1	1,422	1,618	1,916	2,365	3,209
P. Pinang	2,220	2,369	2,772	3,392	5,485
P/K/P/2	3,642	3,987	4,688	5,757	8,694

Remarks; (1): At factor cost in 1970 constant price.

/1 : Due to the availability of relevant data, the States of Perlis and Kedah are treated as one region.

/2 : P/K/P denotes the States of Perlis, Kedah and Pulau Pinang.

Table 23 PROJECTED PER CAPITA GDP AND PER CAPITA GRP OF THE STATES OF PERLIS, KEDAH AND P. PINANG FOR CASE 1

Unit: M$

Region	Actual 1980	Estimated 1982	Projected 1985	1990	2000
Malaysia	1,779	1,901	2,270	3,024	5,126
Perlis/Kedah/1	1,069	1,180	1,467	2,091	4,213
P. Pinang	2,289	2,376	2,824	3,852	6,156
P/K/P/2	1,583	1,685	2,046	2,843	5,142

Remarks; (1): At factor cost in 1970 constant price

/; : Due to the availabiity of relevant data, the States of Perlis and Kedah are treated as one region.

/2 : P/K/P denotes the States of Perlis, Kedah and Pulau Pinang.

Table 24 PROJECTED PER CAPITA GDP AND PER CAPITA GRP OF THE STATES OF PERLIS, KEDAH AND P. PINANG FOR CASE 2

Unit: M$

Region	Actual 1980	Estimated 1982	Projected 1985	1990	2000
Malaysia	1,779	1,901	2,099	2,389	2,909
Perlis/Kedah/1	1,069	1,180	1,336	1,557	1,987
P. Pinang	2,289	2,376	2,600	2,994	3,706
P/K/P/2	1,538	1,685	1,875	2,171	2,809

Remarks; (1): At factor cost in 1970 constant price.

/1 : Due to the availability of relevant data, the States of Perlis and Kedah are treated as one region.

/2 : P/K/P denotes the States of Perlis, Kedah and Pulau Pinang.

Table 25 CLASSIFICATION OF COMMODITY GROUPS IN MANUFACTURING SECTOR

	Commodity Group in This Study	Commodity Group Adopted by DOS
1.	Food Group	Food, beverage and tobacco
2.	Textiles Group	Textiles, wearing apparel, leather and footwear
3.	Wood Group	Wood, furniture, fixture and wood and cork products
4.	Paper Group	Paper and paper products
5.	Publishing Group	Printing publishing and allied industries
6.	Chemical Group	Chemicals, petroleum refineries, plastic products
7.	Rubber Group	Rubber products
8.	Non Metal Group	Pottery, china, earthenware, glass products, non-metallic mineral products
9.	Basic Metal Group	Iron, steel and non-ferrous metal basic products
10.	Machinery Group	Fabricated metal, machinery, electrical and transport equipment
11.	Others	Other manufacturing industries

Table 26 OUTPUT AND VALUE ADDED OF LARGE SCALE INDUSTRIES

Unit: $M\$10^6$

Commodity	State	Production Capacity per Year: Quantities	Gross Output	Value Added	Stagewise Target of Value Added	1985	1990	1995	2000
Basic Metal Products	Trengganu (Kemaman District)	·Steel billets[/1] 559×10^3 tons	483	156	Case 1	23	78	156	156
		·Steel coils[/2] 600×10^3 tons	483	156	Case 2	23	55	94	156
		·Sponge iron[/3] 80×10^3 tons							
	Sabah (Labuan District)	·Sponge iron[/4] 700×10^3 tons	297	96	Case 1	14	48	96	96
					Case 2	14	34	58	96
Petro-chemical Products	Sabah (Labuan District)	·Methanol & LPG[/5] 700×10^3 tons	237	52	Case 1	8	26	52	52
					Case 2	8	18	31	52
	Sarawak (Bintulu District)	·LNG[/6] $6,000 \times 10^3$ tons	1,380	427	Case 1	64	214	427	427
		·Urea/Ammonia[/6] Urea: 1,500 t/day Ammo: 1,000 t/day	570		Case 2	64	149	256	427

Remarks; (1): In 1970 constant price

(2): Unit price:

a. Sponge iron - based upon the export price by Malayawata in 1978, M$625/t.

b. Petroleum gas - based upon the export price from Kuwait in 1981, US$258/t.

c. Urea - based upon the international market price, average of 1970 to 1974, US$285/t, by Price Prospects for Major Primary Commodities, Jan. 1980, World Bank.

d. LNG - based upon the export price of Brunei in 1980, which was US$253/t being adjusted at 1970 constant price by the growth rate of international price of petroleum:

Average price in 1970 - 1974: US$9.7/barrel
Average price in 1980 : US$28.0/barrel

Source; /1, /2 and /3: Ref. 61
/4 and /5 : Ref. 62
/6 : Ref. 63

Table 27 ESTIMATED SHARE OF 11 COMMODITY GROUPS IN MANUFACTURING SECTOR IN PENINSULAR MALAYSIA IN 1980 AND 1985

Commodity Group	Share			Average Annual Growth Rate/2 (% p.a.)
	1974/1	1980/3	1985/4	1981 - 1985
Food	0.235	0.222	0.192	7.5
Textile	0.053	0.076	0.067	8.0
Wood	0.109	0.108	0.096	8.0
Paper	0.010	0.012	0.014	13.9
Publishing	0.052	0.064	0.074	14.0
Chemical	0.104	0.099	0.105	11.7
Rubber	0.128	0.085	0.090	12.0
Non Metal	0.052	0.058	0.059	11.3
Basic Metal	0.035	0.033	0.035	11.8
Machinery	0.218	0.239	0.263	12.7
Others	0.003	0.004	0.006	20.0
Total	1.000	1.000	1.000	10.6

Remarks; /1: Source: Ref. 32

/2: Source: Ref. 5, p. 252 adjusted by the classification adopted in this Study

/3: Estimated based on the shares in Industrial Survey in 1974, those for 1975 available in 4MP (p. 294) and the growth rate of the shares for 1971 - 1980 available in 4MP (p. 294)

/4: Estimated based on 1980 share and the growth rate of the shares for 1981 - 1985 given in Ref. 5 excluding large-scale industries

Table 28 VALUE ADDED RATIO TO GROSS VALUE OF OUTPUT IN MANUFACTURING SECTOR BY COMMODITY GROUP IN 1974

Commodity Group	Value Added (A)	Value of Output (B)	V.A. Ratio (A/B)
Food	669.5	3,338.7	0.2005
Textile	151.0	510.0	0.2961
Wood	380.1	1,071.4	0.3548
Paper	26.9	88.2	0.3050
Publishing	151.9	319.4	0.4756
Chemical	256.3	1,174.8	0.2182
Rubber	354.1	1,352.2	0.2619
Non Metal	142.8	316.2	0.4516
Basic Metal	97.1	299.9	0.3238
Machinery	612.1	1,806.8	0.3388
Others	79.9	727.3	0.1099
Total	2,921.7	11,004.8	0.2655

Source; Refs. 32, 33 and 34

Table 29 VALUE ADDED RATIO TO GROSS VALUE OF OUTPUT IN MANUFACTURING SECTOR IN PENINSULAR MALAYSIA

Unit: $M\$10^6$

Year	Value Added (A)	Gross Value of Output (B)	V.A. Ratio (A/B) (%)
1963	420	1,689	0.249
1964	402	1,700	0.237
1965	501	1,955	0.256
1966	576	2,176	0.265
1967	644	2,302	0.280
1968	874	3,079	0.284
1969	992	3,280	0.302
1970	1,182	5,937	0.300
1971	1,206	4,164	0.304
1972	1,525	5,120	0.298
1973	2,327	7,678	0.303
1974	2,759	10,113	0.273

Source; Ref. 32

Table 30 VALUE ADDED RATIO OF MANUFACTURING INDUSTRIES FOR USA IN 1976, FOR JAPAN IN 1979 AND FOR KOREA IN 1978

Unit: US$10^6

Commodity Group	Value Added Ratio		
	USA 1976/1	Japan 1979/2	Korea 1978/2
Food and Kindered Products	0.292	0.297	
Tobacco Products	0.470	-	Light I
Textile Mill Products	0.398	0.382	0.312
Apparel and Other Textile Products	0.485	0.460	
Lumber and Wood Products	0.431	0.324	Heavy I
Furniture and Fixtures	0.518	0.427	0.282
Paper and Allied Products	0.427	0.313	
Printing and Publishing	0.645	0.539	
Chemicals and Allied Products	0.494	0.386	
Petroleum and Coal Products	0.160	0.119	
Rubber and Miscellaneous Plastics Products	0.502	0.409	
- Tyres and inner tubes	0.458	-	
- Fabricated rubber products	0.535	-	
Leather and Leather Products	0.496	0.355	
Stone, Clay and Glass Products	0.548	0.454	
Primary Metal Industries	0.368	0.318	
Fabricated Metal Products	0.505	-	
Machinery	0.544	0.417	
Electric and Electronic Equipment	0.564	0.406	
Transportation Equipment	0.395	0.274	
Instruments and Related Products	0.655	0.403	
Miscellaneous	0.542	0.383	
Total	0.431	0.352	0.297

Remarks; /1: Value added ratio for US: Value added divided by value of shipment

/2: Value added ratio for Japan and Korea : Value added divided by gross value of manufacturing industries

Table 31 PROJECTED SHARE OF MANUFACTURING SECTOR IN GRP FOR THE STATES OF PERLIS, KEDAH AND P. PINANG FOR CASE 1

State	1980	1982	1985	1990	2000
Perlis/Kedah/1	0.077	0.094	0.109	0.133	0.236
P. Pinang	0.372	0.382	0.421	0.460	0.485

Remarks; /1: Due to the availability of relevant data, the States of Perlis and Kedah are treated as one region.

Table 32 PROJECTED SHARE OF MANUFACTURING SECTOR IN GRP FOR THE STATES OF PERLIS, KEDAH AND P. PINANG FOR CASE 2

State	1980	1982	1985	1990	2000
Perlis/Kedah/1	0.077	0.094	0.104	0.112	0.128
P. Pinang	0.372	0.382	0.415	0.445	0.471

Remakrs; /1: Due to the availability of relevant data, the States of Perlis and Kedah are treated as one region.

Table 33 PROJECTED GROSS VALUE ADDED OF MANUFACTURING SECTOR FOR THE STATES OF PERLIS, KEDAH AND P. PINANG FOR CASE 1

Unit: $M\$10^6$

State	1980	1982	1985	1990	2000
Perlis/Kedah/1	109	152	229	422	1,606
P. Pinang	826	905	1,267	2,007	4,419

Remarks; /1: Due to the availability of relevant data, the States of Perlis and Kedah are treated as one region.

Table 34 PROJECTED GROSS VALUE ADDED OF MANUFACTURING SECTOR FOR THE STATES OF RERLIS, KEDAH AND P. PINANG FOR CASE 2

Unit: $M\$10^6$

State	1980	1982	1985	1990	2000
Perlis/Kedah/1	109	152	199	265	411
P. Pinang	826	905	1,150	1,509	2,583

Remarks; /1: Due to the availability of relevant data, the States of Perlis and Kedah are treated as one region.

Table 35 PROJECTED GROSS VALUE OF MANUFACTURING OUTPUT FOR THE STATES OF PERLIS, KEDAH AND P. PINANG BY COMMODITY GROUP FOR CASE 1

Unit: $M\$10^6$

Commodity Group	Perlis/Kedah[/1]				P. Pinang			
	1982	1985	1990	2000	1982	1985	1990	2000
Food	314	497	836	2,040	559	608	644	498
Textile	0	0	0	1	472	544	640	693
Wood	73	90	122	232	41	34	29	18
Paper	0	0	0	0	38	56	58	73
Publishing	1	2	7	62	122	179	336	952
Chemical	5	11	57	408	158	211	751	1,671
Rubber	129	222	483	2,264	135	158	217	322
Non Metal	8	14	31	168	22	28	39	68
Basic Metal	1	1	4	31	328	453	755	1,964
Machinery	16	33	90	690	1,170	1,643	2,854	7,077
Others	0	0	0	1	0	0	1	1
Total	547	870	1,630	5,897	3,045	3,914	6,324	13,337

Remarks; (1): In 1970 constant price

/1 : Due to the availability of relevant data, the States of Perlis and Kedah are treated as one region.

Table 36 PROJECTED GROSS VALUE OF MANUFACTURING OUTPUT FOR THE STATES OF PERLIS, KEDAH AND P. PINANG BY COMMODITY GROUP FOR CASE 2

Unit: M$10^6

Commodity Group	Perlis/Kedah/1				P. Pinang			
	1982	1985	1990	2000	1982	1985	1990	2000
Food	314	413	544	662	559	540	602	485
Textile	0	0	0	0	472	484	516	581
Wood	73	80	84	81	41	31	25	18
Paper	0	0	0	0	38	48	47	55
Publishing	1	2	3	10	122	157	230	460
Chemical	5	9	31	90	158	185	502	1,125
Rubber	129	193	297	547	135	142	170	234
Non Metal	8	12	19	37	22	24	30	44
Basic Metal	1	1	2	6	328	401	545	1,032
Machinery	16	28	50	123	1,170	1,446	2,024	3,743
Others	0	0	0	0	0	0	1	1
Total	547	756	1,030	1,556	3,045	3,458	4,692	7,778

Remarks; (1): In 1970 constant price

/1 : Due to the availability of relevant data, the States of Perlis and Kedah are treated as one region.

FIGURES

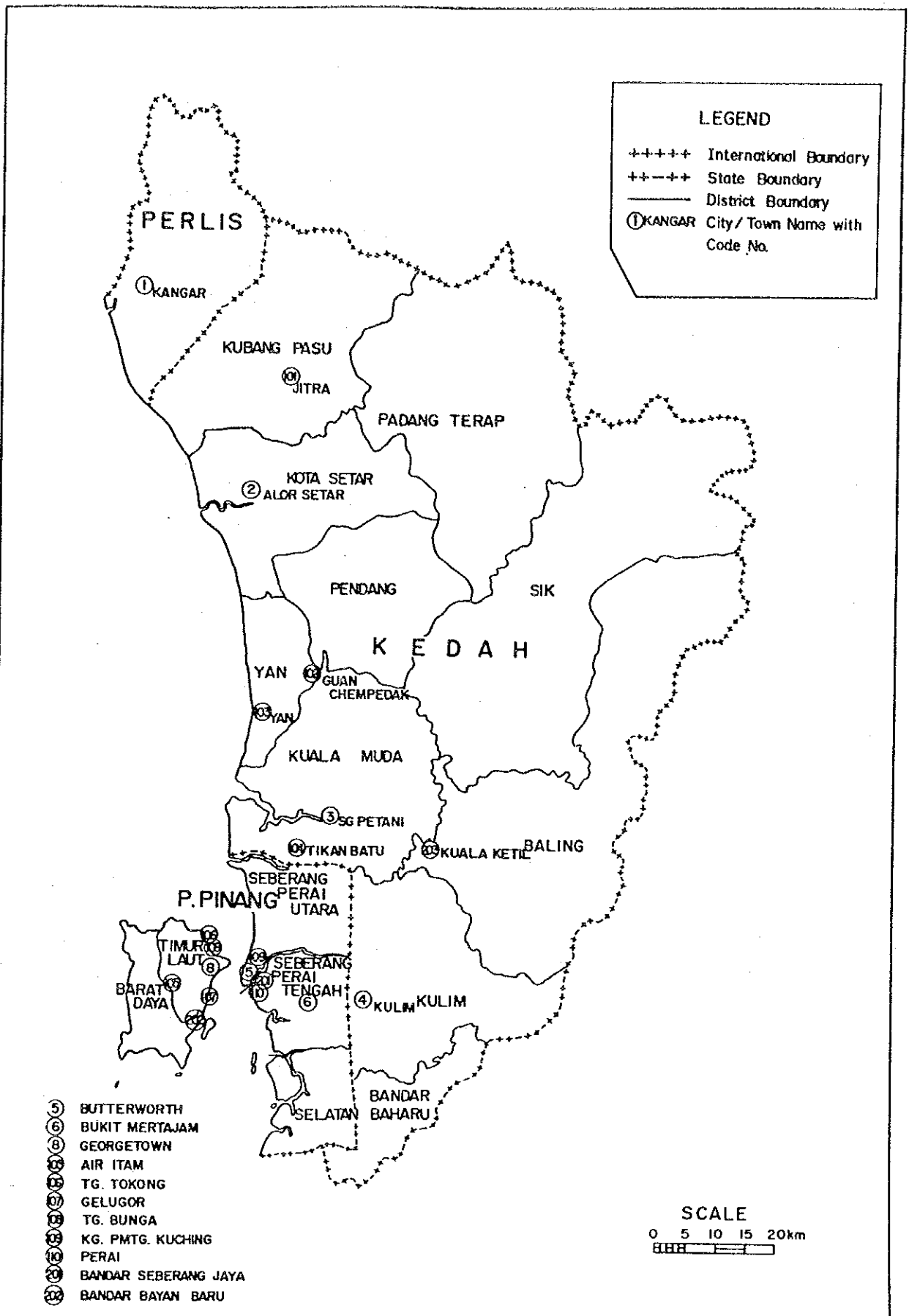

Fig. 1 Administrative Division in the Study Area

GOVERNMENT OF MALAYSIA
NATIONAL WATER RESOURCES STUDY, MALAYSIA
PERLIS-KEDAH-PULAU PINANG
REGIONAL WATER RESOURCES STUDY
JAPAN INTERNATIONAL COOPERATION AGENCY

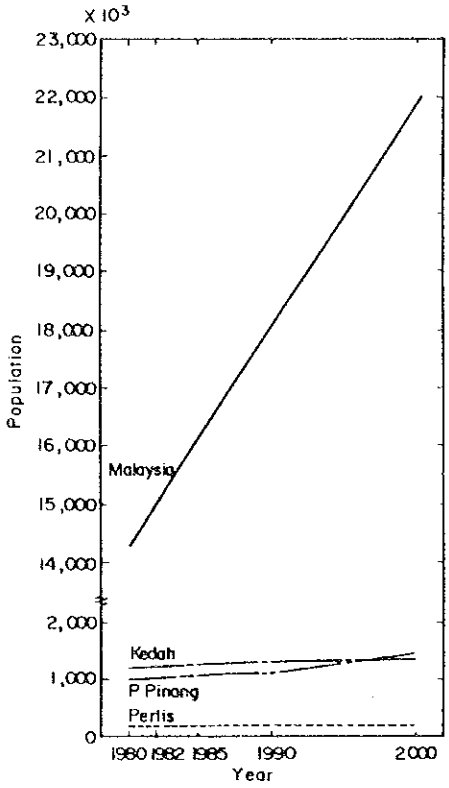

Fig. 2 Projected Population of Malaysia and the States in the Study Area

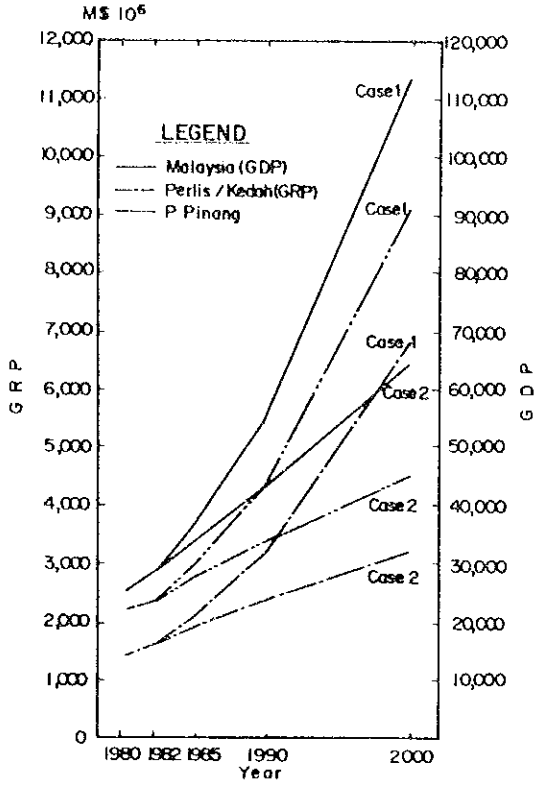

Fig. 3 Projected GDP and GRP of the States in the Study Area for Case 1 and Case 2

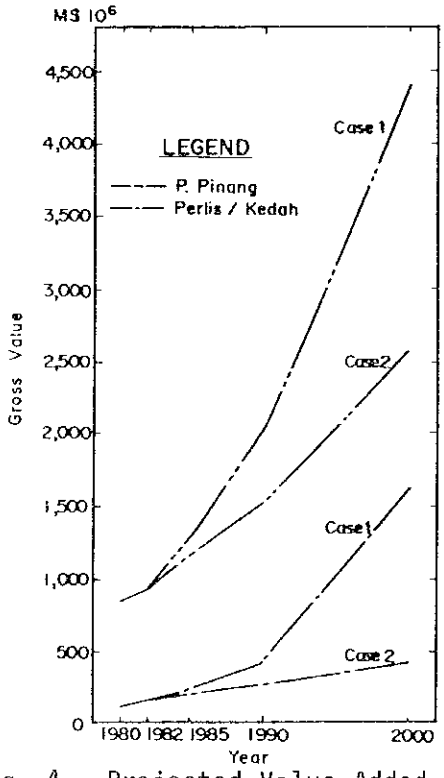

Fig. 4 Projected Value Added of Manufacturing Sector for the States in the Study Area for Case 1 and Case 2

GOVERNMENT OF MALAYSIA
NATIONAL WATER RESOURCES STUDY, MALAYSIA
PERLIS-KEDAH-PULAU PINANG
REGIONAL WATER RESOURCES STUDY
JAPAN INTERNATIONAL COOPERATION AGENCY

ANNEX B

DOMESTIC AND INDUSTRIAL WATER SUPPLY

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

This Annex was prepared to present the results of the domestic and industrial water demand (D&I water demand) study for the Study Area, i.e., the States of Perlis, Kedah and Pulau Pinang excluding Pulan Langkawi district and the major portion of Bandar Baru district in the Kedah State in 1985, 1990 and 2000 as well as to explain the methodologies adopted. Both water demand for public supply, i.e., PWD, PWA and Rural Environmental Sanitation Program (RESP) and private water demand, which were to be supplied either through surface or groundwater resources, were estimated. In addition, outline calculation was made for public fund needs and manpower requirement to roughly indicate the order of requirement expected in the public sector up to 2000. Overall economic cost required for the construction and operation and maintenance of the public and private water supply facilities was estimated to show the total cost of water supply from the national viewpoint.

The D&I water demand was classified into (1) domestic water demand including commercial and public water use (D water demand), (2) water demand of manufacturing industries (M water demand), (3) palm oil mills water demand, (4) rubber factories water demand and (5) tin mines water demand. All the demands were estimated in terms of source demand (S.D.) either at river intake points or wells as well as customer demand (C.D.). In order to serve for the water balance study and water polution study, source demand was estimated by water intake by type of supply and purpose of supply as well as by city/town and rural area by water supply region.

Adopting methodologies and assumptions similar to these used in NWRS, D&I water demand estimate was made for the following two different socio-economic conditions:

Case 1: 4MP/OPP target up to 1990 will be achieved. Thereafter 7.5%/y GDP growth rate was assumed up to 2000.

Case 2: Lower economic growth condition was assumed, i.e., 6.0% for 4MP period, 5.0% for 5MP period, 4.0% thereafter up to 2000.

In making the analysis, necessary data were gathered through the relevant ministries and agencies of the Government of Malaysia, state and district authorities and interviews with people in private sector. Some foreign statistics were also referred to including Japanese industrial water use statistics. Major references and data sources are listed in the last page of the text of this Annex.

2. PRESENT CONDITION OF D&I WATER SUPPLY AND USE IN THE STUDY AREA

2.1 Organization

Public water supply in the Study Area is administered by the following public organizations:

(1) Public Works Departments (PWDs) and Pulau Pinang Water Authority (PWA)

  (a) State Public Works Departments in the States of Perlis and Kedah.

  (b) Pulau Pinang Water Authority in Pulau Pinang State.

(2) Rural Environmental Sanitation Program

In principle, PWDs and PWA supply water to urban area and the adjacent area including suburban and rural areas. Water supplied by the public water supply organizations is usually treated through coagulation and sedimentation, rapid gravity filtering or pressure filtering and chlorination process. The reticulation systems are connected to individual taps and public standpipes in the urban area. In the rural area, however, house connection is rather seldom. Water sources are usually surface flow for PWD and PWA supply. For RESP, groundwater is more often used.

In the States of Perlis and Kedah, state PWDs administer public water supply. PWA is a state statutory body and practises commercial accounting. Water Supply Divisions of the state PWDs are obliged to adopt commercial accounting system in the future in compliance with the State Water Supply Fund Act which came into force in June 1980. The timing is at the discretion of each state government.

Through RESP, untreated water is supplied with the technical and financial assistance of MOH to the isolated rural area that will not be reached by PWD water supply systems within the coming 5 years. House connection is rather seldom.

2.2 PWD and PWA Water Supply and Use

Water supply by state PWDs and PWA in the Study Area as a whole has been rapidly improved in recent years. About 124 x 10^6 m^3/y of water was supplied in 1978 in terms of treatment plant output compared with 59 x 10^6 m^3/y in 1975 (Tables 1 and 2). However, no major improvement was observed for the States of Perlis and Kedah from 1975 to 1978, while progress was significant for P. Pinang State.

The population served by PWD and PWA water supply systems increased by 164 x 10^3 people from 1978 to 1980 or at the average growth rate of 5.6% p.a., reaching about 1,580 x 10^3 people in 1980 (Ref. 1).

PWD and PWA water supply per capita in the Study Area varies very much according to State (Table 3). The figure is the highest for the P. Pinang State with 293 l/d, being higher than the average figure of 250 l/d for the Peninsular Malaysia, while these for the States of Perlis and Kedah are lower than the average.

Water use data by purpose of use is obtainable by analysing revenue records in the light of past and present water tariff. Since water tariff is usually based on domestic comprising residential and part domestic/part commercial, and commercial use comprising trade and water use by manufacturing industries, water use data is obtainable under this classification. In case of P. Pinang State, more detailed data have been obtained (Table 4). In the Study Area, residential use was dominant among all the uses. However, in the Seberang Perai of the P. Pinang State, commercial use exceeded domestic use in 1979 as shown in Table 4.

Unaccounted-for water is defined as the balance between the total quantity of water supplied or treatment plant output and the total quantity of water metered, which comprises the followings:

(1) Leakage from service reservoirs, mains, service connections,

(2) Operation of hydrants and flushing mains,

(3) Losses due to metering inefficiency, and

(4) Unauthorized connection.

Unaccounted-for water ratio (UA ratio) is defined as unaccounted-for water divided by treatment plant output. Though UA ratio of P. Pinang State is the lowest among the States in Peninsular Malaysia, these of the States of Perlis and Kedah is lower than the average.

Treatment plant use is defined in this Sectoral Study as the amount of treatment plant water use for its own operation and loss between intake point and treatment plant. TP ratio (treatment plant water use ratio) is defined as the ratio of treatment plant use thus defined to the quantity of water abstracted at intake point. According to the information obtained from PWD, it lies in the range of 2 - 5% (Ref. 2). In this study, the ratio was assumed at 5%.

From the viewpoint of public water supply administered by State PWDs and PWA, the Study Area is divided into 31 regions including there of temporary systems (hereinafter called water supply regions) as shown in Fig. 2. In 1982, there were 51 river and MADA canal intakes including these for temporary water supply systems and wells. By 1985, 12 river intakes are planned to be constructed by State PWDs in the States of Perlis and Kedah (Tables 5 to 7). The total abstraction and treatment capacity of the PWD and PWA supply systems in the Study Area was about 197 x 10^6 m^3/y in 1982 and is planned to be reinforced to about 283 x 10^6 m^3/y by 1985. It is noted that although the P. Pinang State is divided into two water supply regions, i.e., water supply region 15 or Seberang Perai and 16 or Pulau Pinang, they are connected by submarine

pipeline and treated water is conveyed to the island. Except for small isolated systems, the whole Pulau Pinang State eventually can be considered as covered by a single water supply system.

2.3 Rural Environmental Sanitation Program

Isolated rural areas have been supplied untreated water through RESP with the technical and financial assistance of MOH. This type of water supply is herein called MOH water supply. Village people assist projects implementation by providing labor and operation and maintenance of the water supply facilities are carried out by them. In 1980, about 166×10^3 people were covered by RESP in the States of Perlis, Kedah and P. Pinang. Majority of the beneficiaries live in the Kedah State, accounting for 93% of the total (Table 8).

2.4 Processing Water Use in Palm Oil Mills and Rubber Factories and Tin Mine Water Use

Palm oil processing was quite limited in the Study Area in 1982, consuming only 38×10^3 m^3/y in total. In 1982, 39 rubber factories were located in the Study Area. The total water use in the Study Area amounted to about 5.8×10^6 m^3/y (Table 50). Water use of palm oil mills and rubber factories was recorded only for the States of Kedah and P. Pinang. No water use was recorded in the Perlis State.

Though no statistical data are available about the actual water use of tin mines, none of the 35 tin mines located in the States of Perlis and Kedah possessed water licenses issued by the Mines Department in 1980, indicating their river water use was negligible.

2.5 Water Tariff, Revenues and Expenditures

Within each state, the same water tariff is applied regardless urban or rural. Water tariff applied in the States of Perlis, Kedah and Pulau Pinang as of 1978 is tabulated in Tables 9 and 10. Though the tariff for the States of Perlis and Kedah ramain unchanged up to 1983, revision was made in 1981 and 1983 for the P. Pinang State, by which residential water charge was raised by about 30%. Historical average water charge for the States is shown in Table 11.

Revenues and expenditures of the Water Supply Divisions of PWDs of the Perlis and Kedah States in 1978 are shown in Table 12. Though the total revenues exceeded recurrent expenditures in the Kedah State, total revenues fell far behind of the recurrent expenditures in the Perlis State.

3. WATER DEMAND PROJECTION AND SUPPLY TARGET SET BY PWD

In preparation of 4MP, PWD projected the water demand for public supply excluding that by RESP including domestic, manufacturing, commercial and other uses for 1990 (Table 13). According to this projection, total water demand of States of Perlis, Kedah and Pulau Pinang in terms of treatment plant output will grow to 284 x 10^6 m^3/y by 1990. Supply capacity will accordingly be enhanced to 346 x 10^6 m^3/y.

4. PUBLIC WATER SUPPLY PROJECTS DURING 4MP

4.1 Midterm Review of 4MP

Midterm Review of 4MP is currently being carried out by EPU. Although significant revision is expected to be made for the projects contemplated in 4MP, final outcome has yet to be known. The major water supply projects originally planned in 4MP, therefore, are described hereunder.

4.2 Continuation and New Large-Scale Projects by PWD

Public water supply projects contemplated to be implemented during 4MP period by State PWDs and PWA are given hereunder.

(1) Ahning Water Supply Project, Stage I (New)

This project calls for the construction of the following facilities:

(a) a raw water intake and a pumphouse,

(b) a treatment plant with the capacity of 90.9×10^3 m^3/d,

(c) 2 high level reservoirs with the capacities of 18.2×10^3 m^3 and 9.1×10^3 m^3, respectively,

(d) 3 balancing reservoirs with the capacities of 9.1×10^3 m^3 (1 reservoir) and 4.6×10^3 m^3 (2 reservoirs), and

(e) trunk mains.

The project is the first stage of the 4-staged project and is scheduled to be completed by 1984 at the estimated capital cost of M\$60 $\times 10^6$.

A total of 275×10^3 people in the northern part of Kedah State will benefit from the project. With the implementation of the fourth stage, at least 85% of the rural people in the area will have access to water by 1990 (Ref. 45).

(2) Kedah Tengah/Selatan Water Supply Project (New)

This project calls for the construction of the following facilities:

(a) raw water intake and a pumphouse,

(b) a treatment plant with the capacity of 54.5×10^3 m^3/d,

(c) high level reservoirs and service reservoirs, and

(d) raw water mains and trunk mains.

The project is scheduled to be completed in 1984. The capital cost is estimated at M$29 x 10^6.

When completed, about 175 x 10^3 people in central and southern portion of Kedah State as well as the industrial estates in Tikam Batu, Bakar Arang and Lunas will benefit (Ref. 45).

(3) Muda River Water Project, Phase 2B (New)

This project is a continuation of Phase 2A of the Muda River Water Project which contemplates to supply a reliable yield of 455 x 10^3 m^3/d for the use in Pulau Pinang State.

The Phase 2B project involves the construction of the following facilities:

(a) 2 service reservoirs with the capacities of 4.6 x 10^3 m^3 and 27.3 x 10^3 m^3 respectively, and

(b) trunk mains.

The project, the capital cost of which is estimated at M$13 x 10^6, will augment water supply to meet the rapidly growing demand in Seberang Perai due to the intensive housing development and industrial growth (Ref. 45).

(4) Mengkuang Pumped Storage Project, Phase I (New)

This project is the first phase of the 2 phased project. The main objective of the whole project is to ensure that adequate water supply will always be availed for the Muda River Water Project which will be expanded to produce a reliable output of 455 x 10^3 m^3/d.

The 2 phased project comprises the construction of an earth fill dam and a reservoir with a full storage capacity of 23.7 x 10^6 m^3 at the Mengkuang river, pumping stations as well as water mains for conveying water from the Mengkuang reservoir to the Dua river treatment plant. Water will be conveyed from the Kulim river and the Muda river by pumping during high flow periods to the reservoir. The stored water will be released to the Dua treatment plant during low flow periods in the Muda river.

The Phase I with a storage capacity of 14.6 x 10^6 m^3 at Mengkuang reservoir is to be started during 4MP and completed at the end of 1983. The capital cost is estimated at M$40 x 10^6 (Ref. 45).

4.3 Rural Environmental Sanitation Program

According to the original plan for 4MP preliminarily made by MOH, about 185,000 people in the isolated rural area will be covered by RESP and provided untreated water during the 4MP period in addition to about 166,000 people currently covered by the program as shown in Table 14 (Ref. 58). Relatively undeveloped States of Perlis and Kedah are the major beneficiaries.

5. PROJECTION OF D&I WATER DEMAND

5.1 General

Domestic and industrial water demand is divided into 5 categories, i.e., (i) Domestic including commercial and public, (ii) Manufacturing, (iii) Palm oil mills and (iv) Rubber factories and Tin mines because of the following reasons:

(1) Household, commercial and public water demands have strong correlation with the size of population;

(2) Gross output and water demand of manufacturing industries are not necessarily proportional to the size of population;

(3) As it will be proved to be the case, the manufacturing water demand is likely to grow much faster than the others as manufacturing industries expands rapidly; and

(4) Though their shares in the total water demand are small, it is more appropriate to separate the water demands of palm oil processing plants, rubber processing plants and tin mines, to serve for river water quality study.

Considering the location of demand generation, D water demand (domestic water demand) and manufacturing water demand are classified into 2 categories as follows:

(1) Demand in cities/towns; and

(2) Demand in rural areas.

Where, cities/towns are defined as gazetted areas with equal to or more than 10,000 population and rural areas with less than 10,000 population. All the other demand centers comprising palm oil mills, rubber factories and tin mines are located in rural areas.

The cities/towns and districts defined in this Study are shown in Table 15. Administrative division is given in Fig. 1.

Domestic water demand is partly met by public supply systems and partly by private. In urban area, state PWDs and PWA are responsible for public water supply. In rural area, the responsibility is borne by the above water supply organizations and RESP (MOH).

Part of manufacturing water demand is satisfied by State PWDs in the States of Perlis and Kedah. In the State of Pulau Pinang, major portion is met by PWA water supply systems. The rest is supplied by private facilities.

All of the palm oil mills, rubber factories and tin mines are presumably dependent on direct abstraction of surface water and private wells for their water supply.

For PWD water supply, the following target was set to reduce UA ratio (unaccounted-for water ratio) for 1985 during the Senior Water Engineers' Conference (Ref. 25).

Supply Area	UA Ratio (%)
Individual Supply District	less than 20
Individual State	less than 25
Overall % for Peninsular Malaysia	less than 20

However, the set target seems not practicable, considering the current high UA ratio in Peninsular Malaysia and the ratio in Japan (Tables 1 and 2, Ref. 5). It is assumed that the 20% target will be achieved in 1990 and will remain constant until 2000. For these cities/towns which already achieved the target of 20% in 1978, the ratio in 1978 was assumed to remain constant up to 2000. TP ratio (treatment plant water use ratio) was assumed at 5% of the quantity of water abstracted at intake point.

Source demand (S.D.) is obtained as follows:

$$S.D. = C.D./(1 - UA\ Ratio) \times (1 - TP\ Ratio)$$

For the water supply other than State PWDs and PWA, UA ratio was assumed nil since intake points and consumption points of water are closely located and S.D. was assumed to be equal to C.D.

Projected D&I water demand includes that for surface water as well as groundwater. Since available data for water source of the current water uses are rather limited, the following assumptions were made, considering the required quality of water for each purpose and other factors:

(1) Water demand to be generated in urban area is fully dependent on surface water except Kangar town; and

(2) Water demand of palm oil mills, rubber factories and tin mines is met by surface water.

D&I water demand was projected by city/town and rural area by water supply region, within which an independent public water supply system provide treated water to the inhabitants. It is noted that the 8 water supply regions in the Perlis State will be integrated into 2, considering the unreliable supply sources of some of the present water supply regions and the proposed expansion of the Arau Canal abstraction facilities. It should also be noted that the whole of Pulau Langkawi and major portion of the Bandar Baru district lie outside of the Study Area and therefore excluded from D&I water demand projection.

5.2 Projection of Domestic Water Demand

5.2.1 Methodology

Domestic water demand for public supply and private was projected for cities/towns and the rural areas in the Study Area. Customer Demand (C.D.) for treated water was obtained for each area as follows:

Treated Water Demand = Population x Service Factor x PCDU (Per Capita Daily Use)

Accordingly C.D. for private water was estimated for each area as follows:

Private Water Demand = Population x (1 - Service Factor) x PCDU

S.D. can be obtained based on C.D., UA ratio and TP ratio as stated in Section 5.1.

5.2.2 Population projection

Population projection for cities/towns and rural areas in 1982, 1985, 1990 and 2000 and that under the condition of lower economic growth were made and the results were given in Annex Socio-Economy (Tables 16 to 21). These data were recompiled according to water supply region and used for domestic water projection.

5.2.3 Projection of service factor

The 1980's is the United Nations Water and Sanitation decade and it is proclaimed that all the inhabitants be served by water by public systems and sewerage systems by 1990. However, though the Government of Malaysia is going to put great efforts for improving the water supply condition in the coming years, the target seems too ambitious, considering the past achievements.

Service factors of cities/towns were determined based on their population size, taking into account the service factor for 1990 for the urban areas projected by PWD. Service factor in 2000 was assumed to be 100%, considering the strong desire and financial capability of the Government of Malaysia. The projected service factor is shown in Table 22. The projected service factor under the condition of lower economic growth was projected similarly but the service factor targets were assumed to be attained with 15 years delay as shown in Table 23.

Service factors of the rural areas, whichis covered by PWD and PWA water supply systems and RESP of the states were determined based on the PWD target for 1990 as well as the past achievement and preliminary program for 4MP of RESP with some modification, assuming the service factor of 100% in 2000 as shown in Table 24. The service factors under the condition of lower economic growth were estimated, assuming 15 years delay for achieving the 100% target as shown in Table 25.

5.2.4 Projection of per capita daily use

Though some data is available on the historical per capita daily use in Peninsular Malaysia, they are based on different water use categories from these adopted in this Study (Table 3). Though Government Departments and Agencies in charge of public water supply have made projections for per capita daily use for the future, they are based on different water use categories. Moreover, no correlation can be observed between population sizes of the cities and the projected per capita daily use figures.

Per capita daily use in Peninsular Malaysia including the Study Area was, therefore, projected considering its correlation with per capita GDP of the country based on the data given in Tables 26 and 27. Projected per capita daily use for cities/towns and rural area thus estimated is shown in Table 28. Per capita daily use under the condition of lower economic growth was projected similarly as shown in the same table.

Per capita daily use for private domestic use was assumed at 40 liters up to 2000.

5.2.5 Projected served population

Based on the projected population and service factor, population to be served by public supply systems including MOH was estimated. During 1982 - 2000 period, served population in the Study Area will grow at the average growth rate of 3.0% p.a. and the entire population of 3.0×10^6 will be served by public systems. Among the 3 States of Perlis, Kedah and Pulau Pinang, Kedah State will record the highest growth rate of population served with 3.1% p.a. on the average. P. Pinang State will mark 3.0% p.a. and 2.7% p.a. for the Perlis State.

Under the condition of lower economic growth, served population in the Study Area will grow at the average growth rate of 2.8% p.a. and about 96% of the population will be covered by public systems in 2000. Among the 3 States, Kedah and P. Pinang States will record the average growth rate of 2.9% p.a. and the Perlis State will mark 2.5% p.a.

Projected served population in the Study Area and that under the condition of lower economic growth are given in Tables 29 to 32.

5.2.6 Projected domestic water demand

SD of the total domestic water demand will grow at the average growth rate of 5.5% p.a. during 1982 - 2000 period, reaching 257×10^6 m^3/y in 2000, of which 54% will be generated in urban area and the rest in rural area. The total domestic water demand will account for 36% of the total demand in 2000.

Domestic water demand for public supply was projected to grow rapidly reflecting the followings:

(1) Population increase;

(2) Rapid improvement of service factor; and

(3) Increase of per capita daily use.

Total domestic water demand for public supply will grow at the average growth rate of 6.0% p.a. during the same period. In 2000, domestic water demand will fully be met by public supply systems, namely the total domestic water demand of 257 x 10^6 m^3/y will be supplied by public systems.

Among the cities/towns, Georgetown will claim the biggest quota of 30.8 x 10^6 m^3/y or 22% of the total urban demand in 2000.

The total demand for RESP (MOH) water supply will grow at the average growth rate of 2.2% p.a. during 1983 - 2000 period, reaching 14 x 10^6 m^3/y in 2000.

Reflecting the rapid improvement of public water supply, the private water demand in the Study Area will sharply decline from the estimated 8.5 x 10^6 m^3/y or about 8.7% of the total domestic water demand in 1982 to nil in 2000 when 100% service factor target will be attained.

Projected domestic water demand is given in Tables 33 to 40 and Figs. 3 to 6.

Under the condition of lower economic growth, SD of the total domestic water demand will grow at the average growth rate of 3.9% p.a. during 1982 - 2000 period, reaching 197 x 10^6 m^3/y in 2000, of which 46% will be generated in urban area and the rest in rural area. The total domestic water demand will account for 46% of the total demand in 2000.

Total domestic water demand for public supply will grow at the average growth rate of 4.4% p.a. during the same period, reaching 195 x 10^6 m^3/y in 2000, of which 46% will be generated in urban area and the rest in rural area.

Among the cities/towns, Georgetown claims the biggest quota of 21.0 x 10^6 m^3/y or 24% of the total urban demand in 2000.

The total demand for RESP (MOH) water supply will grow at the average growth rate of 2.2% p.a. during 1982 - 2000 period, reaching 14 x 10^6 m^3/y in 2000.

Reflecting the rapid improvement of public water supply, the private water demand in the Study Area will sharply decline from the estimated 8.5 x 10^6 m^3/y or about 8.7% of the total domestic water demand in 1982 to 1.7 x 10^6 m^3/y in 2000.

Projected domestic water demand is given in Tables 41 to 46 and Figs. 7 to 10.

5.3 Projection of Manufacturing Water Demand

5.3.1 Methodology

Manufacturing water demand was projected for the Study Area in 1982, 1985, 1990 and 2000 based on the gross output values of manufacturing industries and net unit manufacturing water use (NUIW) for producing unit gross output value for each industrial classification, considering the availability and reliability of the data which may be utilized for manufacturing water demand projection.

M water demand in terms of C.D. will be obtained as the sum of water demand of each industrial classification that is obtained as the product of gross output value and NUIW. S.D. for manufacturing water is obtained as follows:

$$S.D. = C.D./(1 - UA\ Ratio) \times (1 - TP\ ratio)$$

The methodology is explained further in the subsequent sections.

5.3.2 Projection of gross output value

Gross output value of the states in 1982, 1985, 1990 and 2000 has been projected in Socio-Economic Study. Gross output value of cities/towns were obtained by assuming the ratio of gross output value of each city/town to that of the state where the city/town lies based on the actual ratio in 1974 and the prospective economic structure of cities/towns on the assumption that the gross output value of the rural area would remain constant after 1982. Gross output value of the rural area in each state can be estimated by deducting the gross output values of the cities/towns which lie in each state from that of the state. Gross output values of the rural area in each water supply region was estimated based on the area and land use pattern of the rural area located in each water supply region.

The assumed gross output value ratios of cities/towns and rural area to state are given in Table 47. These under the condition of lower economic growth are given in Table 48.

5.3.3 Net unit industrial water use

Manufacturing water use was estimated based on NUIW by industrial classification, excluding the recyclic water use.

Industrial classification was determined based on the current Malaysian Industrial Classification as well as Japanese Industrial Classification.

NUIW declines as the recyclic water use develops. The industrial water use data of Japan from 1962 to 1974 show that the NUIW remained almost constant after 1970. During the period of 1980 - 1990 as well as the period of 1990 - 2000, manufacturing industries in Peninsular

Malaysia are expected to make sharp growth, accompanying the modernization of manufacturing technology including water use. It was assumed that, therefore, NUIW in Peninsular Malaysia including the Study Area in 1990 will reach the values of Japan in 1970. The projected NUIW is shown in Table 49. Malaysian data in the recent years are also shown in the table for reference.

5.3.4 Projected manufacturing water demand

Manufacturing water demand was projected to rise sharply due to the rapid growth of manufacturing industries.

SD of total manufacturing water demand will grow at the average growth rate of 10.2% p.a. during 1982 - 2000 period, reaching 452 x 10^6 m^3/y in 2000, of which 95% will be generated in urban area and the rest in rural area. The total manufacturing will account for 64% of the total demand.

Total manufacturing water demand for public supply will grow at the average growth rate of 9.8% p.a. during the same period, reaching 338 x 10^6 m^3/y in 2000, of which 94% will be generated in urban area and the rest in rural area. Total manufacturing water demand for public supply will account for 75% of the total manufacturing water demand, the rest, 25%, being met by private facilities.

Among the cities/towns, Bandar Seberang Jaya and Bandar Bayan Baru each will claim the biggest quota of 57.8 x 10^6 m^3/y or 18.2% of the total urban demand in 2000.

Projected manufacturing water demand is given in Tables 33 to 40 and Figs. 3 to 6.

Under the condition of lower economic growth, SD of total manufacturing water demand will grow at the average growth rate of 6.1% p.a. during 1982 - 2000 period, reaching 227 x 10^6 m^3/y in 2000, of which 91% will be generated in urban area and the rest in rural area. The total manufacturing will account for 49% of the total demand.

Total manufacturing water demand for public supply will grow at the average growth rate of 6.2% p.a. during the same period, reaching 187 x 10^6 m^3/y in 2000, of which 90% will be generated in urban area and the rest in rural area. Total manufacturing water demand for public supply will account for 82% of the total manufacturing water demand, the rest being met by private facilities.

Among the cities/towns, Bandar Seberang Jaya and Bandar Bayan Baru each will claim the biggest quota of 36.3 x 10^6 m^3/y or 21.5% of the total urban demand in 2000.

Projected manufacturing water demand is given in Tables 41 to 46 and Figs. 7 to 10.

5.4 Projection of Processing Water Demand in Palm Oil Mills and Rubber Factories

5.4.1 Methodology

The processing water demand of palm oil mills and rubber factories was projected based on the processing schedule of palm oil and rubber which was projected, in Annex Agricultural Study by multiplying the estimated unit water use per unit production of palm oil and rubber. The processing water demand per unit production of palm oil was estimated at 0.8 m^3 per one ton of fresh fruit bunch (FFB) of oil palm based on the data provided by DOE and SLDB. The processing water demand per unit production of rubber was estimated at 18 m^3 per one ton of dry rubber concentrate (DRC) based on the data provided by DOE and SLDB.

5.4.2 Projected palm oil and rubber processing water demand

Palm oil processing in the Study Area is not significant. The total water demand in the Study Area in 2000 will be only 220 x 10^3 m^3/y. The water demand for rubber processing in the Study Area will be about doubled by 2000, reaching 11 x 10^6 m^3/y. The projected palm oil and rubber processing water demand are given in Table 50.

5.5 Projected D&I Water Demand

Total D&I water demand was projected to rise sharply due to the combined effect of i) population increase, ii) service factor improvement, iii) per capita consumption increase and iv) growth of manufacturing industries.

SD of total D&I water demand including palm oil and rubber processing water demand will grow at the average growth rate of 7.9% p.a. during 1982 - 2000 period, reaching 720 x 10^6 m^3/y in 2000, of which 79% will be generated in urban area and the rest in rural area.

Total D&I water demand for public supply will grow at the average growth rate of 7.9% p.a. during the same period, reaching 595 x 10^6 m^3/y in 2000, of which 76% will be generated in urban area and the rest in rural area. In 2000, about 83% of the total D&I water demand will be met by public systems.

Total D&I water demand in 1982, 1985, 1990 and 2000 are given in Tables 33 to 40 and Table 50 and Figs. 3 to 6.

Under the condition of lower economic growth, SD of total D&I water demand including palm oil and rubber processing water demand will grow at the average growth rate of 4.9% p.a. during 1982 - 2000 period, reaching 435 x 10^6 m^3/y in 2000, of which 68% will be generated in urban area and the rest in rural area.

Total D&I water demand for public supply will grow at the average growth rate of 5.2% p.a. during the same period, reaching 382 x 10^6 m^3/y in 2000, of which 67% will be generated in urban area and the rest in rural area. In 2000, about 88% of the total D&I water demand will be met by public systems.

Total D&I water demand in 1982, 1985, 1990 and 2000 are given in Tables 41 to 46 and Table 50 and Figs. 7 to 10.

5.6 Projected D&I Water Abstraction at River Intakes

In order to serve for the water balance study and water pollution abatement study as well as cost allocation of source facilities, water abstraction volume for domestic and industrial use at each river intake was projected by purpose and by type of supply by water supply region in 1982, 1985, 1990 and 2000.

It is noted that the projected figures are assumptions made for the purpose of the above-mentioned studies rather than to serve for specific public water supply projects.

Water abstraction was estimated as the source water demand (S.D.) at each river intake. To derive the water abstraction, it was assumed that the water demand of city/town should fully be met by surface flow and that of rural should be satisfied first by groundwater up to the safe yield and the excess demand by surface flow. Rural water demand of each water supply region was derived based on the district rural water demand, taking into account the area and land use of the district rural area lying in the water supply region. Distribution of water demand of each district rural area in water supply region is shown in Table 51. Ratio of water demand depending on surface water at each intake was determined based on the present abstraction record and the intake and other water supply facilities plans contemplated by the state PWDs and PWA as shown in Table 52.

Projected D&I water abstraction at the intakes by purpose is given in Table 53 and that by type of supply is given in Table 54. These under the condition of lower economic growth are given in Tables 55 and 56. Except for water supply region 2 Cuping, D&I water demand will mostly be met by surface water.

5.7 D&I Water Projection Based on Midterm Review

Midterm Review of 4MP is currently being made by EPU. Reflecting the recent unfavorable economic environment, the original 4MP budget may be revised downward. Preliminary figures of population and GRP of the States of Perlis, Kedah and P. Pinang and these of Malaysia in 1980 and 1990 were made available to the Study Team as shown in Tables 57 and 58. Per capita GDP and per capita GRP were estimated accordingly and given in Table 59.

However, above data are not at all satisfactory for making a complete D&I water demand projection in line with the socio-economic framework preliminarily predicted by Midterm Review. Only the order of D&I water demand in 1990 for the Study Area, therefore, was assessed based on the available figures given in the Tables.

The outline estimation showed that the D&I water demand will fall between the figures projected in Case 1 and Case 2. Compared with that in Case 1, D&I water demand will be about 20% smaller in 1990.

6. PLANNING OF PUBLIC WATER SUPPLY FACILITIES

6.1 General

The main objective of planning public water supply facilities in this Study is to make an outline cost estimate of construction and O&M of the facilities in order to give a rough idea on the public fund requirement. Planning was carried out based on the existing data and information including 4MP available in Malaysia as well as in the advanced countries based on standardized methods (Ref. 1, 2, 5, 18, 19, 21, 22, 29 - 44, 49 - 51, 54, 55, 57, 58, 60). Where detailed water supply study was already conducted, the results were utilized to the maximum extent possible. Detailed investigation and study should, therefore, be conducted to formulate the framework and evaluate the feasibility of the water supply projects before starting construction of the projects.

Study results for water source facilities including dams and reservoirs, barrages and diversion facilities are not found in this report but given in the Annex proposed water source facilities.

It was assumed that water source for urban bulky water supply for cities/towns was surface flow, considering the present situation and the results of the Groundwater Resources Study.

It was also assumed that for manufacturing water supply public sector plans and constructs facilities only up to trunk mains, leaving these for distribution and reticulation systems to private developers. The cost for the distribution and reticulation systems was assumed to be borne by the private.

In this Study, the following classification for the water supply facilities was adopted:

(1) intakes and raw water and treated water mains including intake and booster pumps,

(2) treatment plants, and

(3) distribution and reticulation systems including elevated tanks, distribution ponds and pumping stations.

6.2 Intakes and Raw and Treated Water Mains

The quantity of water to be abstracted at the raw water intakes was estimated by the following formula:

Quantity of raw water (SD) = CD/(1 - UA ratio)/(d - TP ratio) x K

where UA ratio (unaccounted - for water ratio) is usually 0.2 and TP ratio (treatment plant water use ratio) is 0.05. K is the coefficient to adjust seasonal fluctuation of water demand which was determined at 1.1.

Water mains were assumed to be constructed along the existing public roads. Location of intakes and mains was determined considering the following factors based on 1 to 63,360 scale map:

(1) topography between the demand centers and intakes;

(2) existing road networks; and

(3) distance of sea water intrusion from the river mouth.

Mortal-lined ductile cast iron pipes of the diameters ranging from 600 to 1,800 mm were considered for water mains. Diameter was so selected that the total cost of pipes and water pumps was the minimum on the condition that the flow velocity remains in the range below 3 m/s and above 0.3 m/s in the case of raw water mains and below 3 m/s in the case of treated water mains.

Medium head water pumps of 20 to 50 m head were considered, assuming one stand-by unit per three units. Capacity of the intake and booster pumps where needed was determined based on the topography of the selected water mains route.

6.3 Treatment Plants

In order to purify the raw water for drinking and other uses, the following treatment processes were assumed:

(1) coagulation and sedimentation,

(2) rapid gravity filtering or pressure filtering, and

(3) chlorination.

Sedimentation pond capacity was determined at one third of the maximum daily water demand. The area of the sand filtration pond, was determined, assuming 120 m/d filtration rate.

Treatment own use was assumed at 5% of the treated water.

6.4 Distribution and Reticulation Systems

Networks of 300 m trunk lines interval and 100 m branch lines interval were considered for distribution and reticulation pipeline systems. Mortal-lined ductile cast iron pipes of 300 to 500 mm diameter for trunk lines and 100 to 300 mm diameter pipes for branch lines were assumed to be used, depending on the magnitude of the water demand.

Distribution ponds and distribution and reticulation pipelines were designed considering the hourly fluction of water demand. The capacity of the distribution pond was determined as equal to half the maximum daily demand. The pipelines diameters were determined so that 130% of

the maximum daily demand could be distributed. Elevated tank capacity was determined as equal to the maximum hourly demand.

Electric powered horizontal double suction volute pumps of the following characteristics were assumed to be employed:

(1) Head H = 20 - 100 m

(2) Flow rate Q = 10 - 200 m^3/min

(3) Power L = 40 - 400 kW

The water pump was designed so that 130% of the maximum daily water demand can be distributed. Their capacity was determined so that water pressure inside the pipes be kept in the range of 1.5 to 4 kg/cm^2, taking into account the pipe diameters.

7. CONSTRUCTION COST AND O&M COST FOR PUBLIC WATER SUPPLY SYSTEMS

7.1 Construction Cost

7.1.1 General

Construction cost (investment cost) was estimated in the four categories as follows:

(1) direct construction cost,

(2) engineering service and administration cost,

(3) land acquisition cost, and

(4) physical contingency.

Engineering service and administration cost was assumed at 10% of the direct construction cost. Physical contingency was assumed at 30% of the total of (1) through (3).

Costs of equipments, materials and labour locally available were estimated at 1982 end price level based on the data obtained from PWD and the relevant previous reports (Refs. 21, 29 - 44, 49 - 53). In order to undate the costs, the following escalation rates were assumed:

1976 through 1978	0% p.a.
1979 through 1980	27% p.a.
1981 through 1982	9% p.a.

The costs for internationally traded goods and services were estimated based on the international market price at 1982 end or the World Bank projection up to 1990 where applicable (Ref. 56).

Construction cost for public water supply projects widely varies depending on the topography, geology, land value, capacity and size of the facilities and the like. In this Study, however, standardized unit construction cost was assumed for all the projects.

7.1.2 PWD and PWA public water supply systems

State PWDs and PWA provide urban population with treated water.

Construction cost for raw and treated water mains comprises i) pipe and valve cost and, ii) civil works cost. The water mains were assumed to be constructed along the public roads and no land acquisition cost was assumed to be required. The unit direct construction cost for water mains is shown in Table 60.

The construction cost for pump stations comprises the costs for pumps including generators and pump houses, land acquisition and other relevant equipments. One stand-by pump unit was assumed per 3 pump units. The estimated construction cost is shown in Table 61.

Based on the past contract prices in Malaysia updated by the past escalation trend, unit direct construction cost for treatment plant was estimated at M$830/$m^3$/d of treatment capacity comprising M$225/$m^3$/d of treatment plant equipments with a generating set and M$605/$m^3$/d of civil works. Land acquisition cost was estimated at M$12 per m^3/d of capacity, assuming required area of 1,000 m^2 per 1,000 m^3/d of capacity and unit land acquisition cost of M$12/$m^2$ (Table 62).

Construction cost for distribution and reticulation systems comprises i) pipe and valve cost, ii) pump cost, iii) distribution pond and elevated tank costs, and iv) land acquisition cost. The unit direct construction cost was estimated as shown in Table 63.

Reinforced concrete reservoir was assumed as distribution pond. The unit direct construction was estimated at M$260 per m^3 of capacity. M$760 per m^3 of capacity was assumed for elevated tanks.

Distribution and reticulation pipelines were assumed to be constructed along the public roads and no land acquisition cost was to be necessitated. Land acquisition cost for distribution ponds was estimated at M$18 per m^3/d of capacity, assuming required area of 0.15 m^2 per m^3/d of capacity and unit land acquisition cost of M$120/$m^2$ (Table 62).

In the rural area, it was assumed that rural population gets water from public hydrants without house connection for simplicity. No distribution nor reticulation cost was, therefore, estimated for the rural water supply.

7.1.3 Public water supply systems through RESP in rural area

According to the data obtained from MOH, principal water source for RESP has been groundwater during the past decade (Ref. 55). The unit direct construction cost of M$940 per m^3/d of supply capacity was assumed based on the construction costs for tube wells under various geological conditions given in Annex Groundwater Resources with the following assumptions:

(1) Raw groundwater is used without going through any purifying process; and

(2) Served population gets untreated water from public hydrants.

7.2 O&M Cost

For PWD water supply, O&M cost was assumed at 2% of construction cost based on the O&M cost for water supply recorded by state PWDs and PWA as well as the corresponding figures in the advanced countries (Refs. 9, 10, 12).

Rural water supply systems under RESP (MOH) are operated and maintained by the beneficiaries and O&M cost was assumed nil.

7.3 Estimated Cost

The estimated investment cost (construction cost) and O&M cost for public water supply by water supply region by Malaysia Five-Year Plan period and these under the condition of lower economic growth are given in Tables 64 to 67.

8. CONSTRUCTION COST AND O&M COST FOR PRIVATE WATER SUPPLY

8.1 Construction Cost and O&M Cost

8.1.1 Construction cost

The unit construction cost for the distribution systems for manufacturing water supply to be implemented by private concerns were assumed to be identical with that for public water supply.

The unit construction cost for water supply for palm oil mills and rubber factories was assumed at M$940 per m^3/d of supply capacity based on the data obtained from SLDB.

The unit cost for private water supply for domestic use was estimated at M$55 per m^3/d of water fetched based on the expenditure on tools to get water from nearby water sources.

8.1.2 O&M cost

O&M cost was assumed at 2% of the construction given in the previous section.

8.2 Estimated Cost

The estimated investment cost (construction cost) and O&M cost for private water supply by water supply region by Malaysia Five-Year Plan period and these under the condition of lower economic growth are given in Tables 68 to 71.

9. ECONOMIC BENEFIT AND COST FOR D&I WATER SUPPLY

9.1 Economic Construction Cost and O&M Cost

9.1.1 Economic construction cost

Economic construction cost (investment cost) for PWD and PWA water supply was estimated by deducting the transfer payment from the financial cost. The transfer payment including taxes and local contractors' profit was assumed at 20% of the financial cost.

Unit economic construction cost for rural public water supply through RESP (MOH) was estimated at M$1,890 per m^3/d of supply capacity, taking into account the economic value of the labor provided by the rural inhabitants for the construction. Unit economic construction cost for water supply for palm oil mills and rubber factories was estimated at M$750 per m^3/d of supply capacity by deducting transfer payment from the financial construction cost based on the data obtained from SLDB. That for private water supply for domestic use was assumed at M$110 per m^3/d based on the expenditure on tools and economic cost of labor of the rural inhabitants to fetch water from nearby water sources (Tables 72 and 73).

9.1.2 Economic O&M cost

Economic O&M cost was assumed at 2% of the economic construction cost given in the previous section (Tables 74 and 75).

9.2 Economic Benefit

Economic benefit to be derived from water supply including both public and private ones for domestic and industrial uses was estimated by the equivalent economic cost of the least-costly alternative facilities.

For the water source facilities including dams and diversion facilities, various alternatives were planned and the least-costly alternative was selected. In case the source facilities serve for multiple purposes, appropriate cost attributable to D&I water supply was considered as alternative cost. The cost of direct facilities comprising intakes, water mains, treatment and distribution facilities, no alternatives were considered, i.e., least-costly alternative cost is identical with that of the proposed facilities.

10. MANPOWER REQUIREMENT

10.1 Methodology for Manpower Estimate

Manpower requirement in the water supply organizations including Water Supply Divisions in State PWDs and Water Authority was estimated for the 1983 - 2000 period. Only the manpower for the management offices and construction offices required for the construction and O&M of water supply facilities proposed in this Study was considered, excluding the staffs at the headquarters.

For 4MP period, manpower requirement for O&M was estimated nil because demand for public water supply up to 1985 would be met by the ongoing water supply projects which are not included in the proposed projects.

The following papers and publications were studied to work out appropriate staffing levels for the O&M and implementation of the proposed projects:

(a) Proposal for New Posts for 1982, Selangor Waterworks Department (Ref. 59),

(b) Preparatory Paper for 4 MP, PWD (Ref. 60), and

(c) Comparative Staffing Levels in the Waterworks Organization, PWD (Ref. 61).

The current staffing levels in the water supply organizations in the advanced countries were also taken into account.

The manpower classification given in Table 76 was adopted in line with the current practice in Malaysia. The formula adopted for O&M (management offices) and construction (construction offices) are given in Table 77.

10.2 Estimated Manpower

Estimated manpower requirement for public water supply for each State and the Study Area by Malaysia Five-Year Plan is given in Tables 78 to 81 and that under the condition of lower economic growth is given in Tables 82 to 85.

REFERENCES

1. DATA FOR THE PREPARATION OF FOURTH MALAYSIAN PLAN, 1980, PWD (unpublished)

2. INFORMATION ON TREATMENT PLANT WATER USE, 1989, PWD (unpublished)

3. HISTORICAL TIN MINE PRODUCTION, 1975 - 1980, Mining Department (unpublished)

4. TEBRAU AND SCUDAI RIVERS WATER AGREEMENT AND JOHOR RIVER AGREEMENT, 1961 and 1962, PUB and Johor State

5. K1 AND K2 Tables, 1970 - 1978, PWD

6. ANNUAL STATISTICAL BULLETIN, MALAYSIA, 1970 - 1978, DOS

7. INFORMATION ON PALM OIL PROCESSING, 1980, DOE (unpublished)

8. INFORMATION ON WATER SUPPLIED TO SINGAPORE, 1980, PUB (unpublished)

9. REVENUE RECORD, 1976 - 1979, Pulau Pinang Water Authority (unpublished)

10. REVENUE RECORD, 1970 - 1978, Selangor Waterworks Department (unpublished)

11. METER RECORD, 1978 - 1979, Melaka Water Authority (unpublished)

12. REVENUE RECORD, 1971 - 1973, Johor State PWD (unpublished)

13. METER RECORD, 1975 - 1978, Kelantan State PWD (unpublished)

14. WATER LICENSES OF TIN MINES, 1980, Mining Department (unpublished)

15. INFORMATION ON WASTE WATER OF PALM OIL AND RUBBER PROCESSING PLANTS, 1980, DOE (unpublished)

16. INFORMATION ON RAW WATER SUPPLIED TO PUB, 1980, Johor State PWD

17. POPULATION AND HOUSING CENSUS OF MALAYSIA, 1970, DOE

18. WATER SUPPLY AND RELATED SERVICES FOR DIFFERENT STATES IN PENINSULAR MALAYSIA

19. ANNUAL REPORT OF WATER RESOURCES DEVELOPMENT AND USE (JAPANESE), 1978 - 1979, WATER RESOURCES BUREAU, NATIONAL LAND AGENCY, GOVERNMENT OF JAPAN

20. SURVEY OF MANUFACTURING INDUSTRIES, 1970 - 1974, DOE

21. KEDAH/PERLIS WATER RESOURCES MANAGEMENT STUDY, 1980, EPU

22. EXISTING WATER SUPPLY FACILITIES MAP FOR PENINSULAR MALAYSIA, 1978, State PWD's and Water Boards (unpublished)

23. LOCATION OF PALM OIL AND RUBBER PROCESSING PLANTS, 1980, DOE (unpublished)

24. LOCATION OF TIN MINES IN PENINSULAR MALAYSIA, 1980, Department of Mines (unpublished)

25. INFORMATION ON SENIOR WATER ENGINEERS' CONFERENCE, 1980, PWD (unpublished)

26. INFORMATION ON THE DEVELOPMENT OF INDUSTRIAL ESTATES, 1980, MIDA (unpublished)

27. MALAYSIA INDUSTRIAL CLASSIFICATION, 1972, DOS

28. ECONOMIC REPORT, 1979 - 1980, Ministry of Finance

29. KEDAH/PERLIS WATER RESOURCES MANAGEMENT STUDY DRAFT FINAL REPORT, 1980, EPU

30. FEASIBILITY STUDY OF PROPOSED EXTENSION TO KUALA KANGSAR WATER SUPPLY, 1978, Perak State PWD

31. FEASIBILITY STUDY OF PROPOSED EXTENSION TO TAIPING AND GUNONG SEMANGGOR WATER SUPPLIES, 1978, Perak State PWD

32. INVESTIGATIONS FOR SUITABLE SOURCES OF WATER SUPPLY FOR THE KELANG VALLEY, 1979, Selangor Water Works

33. DEVELOPMENT PLAN FOR SEREMBAN AND PORT DICKSON WATER SUPPLY, 1979, Negeri Sembilan State PWD

34. DURIAN TUNGGAL WATER SCHEME, PHASE II, REVIEW OF DEMAND PROJECTIONS, YIELD OF SCHEME AND RECOMMENDATIONS FOR WORKS CONSTRUCTION, 1980, Melaka Water Board

35. FEASIBILITY STUDY JOHOR BAHRU NEW WATER SUPPLY SUNGAI LAYANG SCHEME, 1977, Johor State PWD

36. PAHANG RIVER BASIN STUDY, 1974 EPU and DID

37. STUDY OF WATER RESOURCE DEVELOPMENT, 1977, Government of Malaysia

38. FINAL REPORT ON THE NEW WATER SUPPLY SCHEME FOR KUALA TRENGGANU, 1978, Trengganu State PWD

39. SEGAMAT WATER SUPPLY, 1973, Johor State PWD

40. MUAR WATER SUPPLY, 1973, Johor State PWD

41. REPORT ON WATER SUPPLIES TO KOTA BHARU AND SURROUNDING DISTRICTS, 1975, Kelantan State PWD

42. FEASIBILITY STUDY FOR PROPOSED STORAGE SCHEME, DRAFT FINAL REPORT, 1978, Penang Water Authority

43. REVIEW OF REPORT ON BINDINGS WATER SUPPLY, 1978, Perak State PWD

44. WATER RESOURCE DEVELOPMENT IN THE KUANTAN REGION, 1977, EPU

45. INFORMATION ON THE PROJECTS DURING 4MP, 1980, State PWD's, Selangor Waterworks Department and Water Authorities (unpublished)

46. TRADE CLASSIFICATION AND CUSTOMS TARIFF, 1978, Ministry of Finance

47. THIRD MALAYSIA PLAN, 1976, EPU

48. MID-TERM REVIEW OF THE THIRD MALAYSIA PLAN, 1979, EPU

49. REPORT ON AN INDUSTRIAL WATER SUPPLY TO PETALING JAYA, 1969, Government of Selangor

50. WATER RESOURCES DEVELOPMENT IN THE KUANTAN REGION, 1977, EPU

51. KERAJAAN NEGERI KELANTAN, FINAL REPORT, 1979, Kelantan State PWD

52. INLAND TRANSPORTATION COST, 1980, Lian Heng Transport Co., Sdn. Bhd. and Malayan Lorry Service Co., Sdn. Bhd.

53. COST DATA FOR WATER SUPPLY FACILITIES OBTAINED FROM PWD, 1980 (unpublished)

54. DESIGN CRITERIA FOR WATERWORKS FACILITIES, 1978, JAPAN WATERWORKS ASSOCIATION

55. FOURTH MALAYSIA PLAN, 1981, EPU

56. PRICE PROSPECTS FOR MAJOR PRIMARY COMMODITIES, 1983, IBRD

57. RURAL ENVIRONMENTAL SANITATION PROGRAM, 1981, MOH

58. PRELIMINARY 4MP PLAN FOR RURAL ENVIRONMENTAL SANITATION PROGRAM PROPOSED BY MOH, 1981, MOH (unpublished)

59. PROPOSAL FOR NEW POSTS FOR 1982, Selangor Waterworks Department

60. PREPARATORY PAPER FOR 4MP, PWD

61. COMPARATIVE STAFFING LEVELS IN THE WATERWORKS ORGANIZATIONS, 1980, PWD

62. MAP FOR THE EXISTING AND PROPOSED WATER SUPPLY FACILITIES FOR PERLIS STATE, 1982, PERLIS STATE PWD

63. MAP FOR THE EXISTING AND PROPOSED WATER SUPPLY FACILITIES FOR KEDAH STATE, 1982, KEDAH STATE PWD

64. MAP FOR THE EXISTING AND PROPOSED WATER SUPPLY FACILITIES FOR P. PINANG STATE, 1982, PWA

TABLES

Table 1 PWD AND PWA WATER SUPPLY RECORD FOR 1975

State	Normal Operating Capacity (10^3 m^3/d)	Total Quantity of Water Supplied (10^6 m^3/y)	Total Quantity of Water Metered (10^6 m^3/y)	UA Ratio (%)
Perlis	9	3	2	33
Kedah	67	27	17	37
P. Pinang	107	29	25	14
Total	183	59	44	25

Source; Ref. 5

Table 2 PWD AND PWA WATER SUPPLY RECORD FOR 1978

State	Normal Operating Capacity (10^3 m^3/d)	Total Quantity of Water Supplied (10^6 m^3/y)	Total Quantity of Water Metered (10^6 m^3/y)	UA Ratio (%)
Perlis	6	3	1	67
Kedah	69	32	19	41
P. Pinang	N.A.	89	73	18
Total	N.A.	124	93	25

Remarks; N.A.: Not available

Source; Ref. 5

Table 3 PER CAPITA PUBLIC WATER SUPPLY BY PWD AND PWA IN 1978

Unit: lpcd

State	Domestic Supply per Capita/1	Total Pipe Water Supply per Capita
Perlis	32	48
Kedah	117	176
P. Pinang	192	293

Remarks; /1 : Including the uses of households, religious institutions, charitable organizations and public stand pipes

(1): The figures include unaccounted-for water.

(2): The figures are average values in the States including urban and rural areas.

(3): Supplied by State PWDs and PWA.

Source; Refs. 1 and 5

Table 4 WATER SUPPLY BY PURPOSE IN PULAU PINANG STATE IN 1979

Unit: 10^6 m^3/y

Area	Domestic	Commercial	Total
Pulau Pinang	29	14	43
Seberang Perai	18	20	38
Total	47	34	81

Remarks; (1): Figures are given in terms of metered water consumption.

(2): Supplied by the Pulau Pinang Water Authority.

Source; Ref. 9

Table 5 EXISTING AND PROPOSED ABSTRACTION AND TREATMENT CAPACITY OF PWD AND PWA PUBLIC WATER SUPPLY FACILITIES IN 1982 AND 1985 (1/3)

State	Water Supply Region		Intake	Existing Capacity in 1982 (mgd)	Existing Capacity in 1982 (10^6 m^3/y)	Proposed Capacity in 1985 (mgd)	Proposed Capacity in 1985 (10^6 m^3/y)
Perlis	1. Kangar	1	Arau Canal	2.50	4.15	2.50	4.15
		1000	Kaki Bukit	0.05	0.08	0.05	0.08
		1001	Padang Besar	0.25	0.42	0.25	0.42
		1002	Abi	0.40	0.66	N.A.	N.A.
		1003	Arau Well	1.30	2.16	N.A.	N.A.
		101	Arau Canal	-	-	6.50	10.79
			Sub-total	4.50	7.47	9.30/1	15.44/1
		5001	Bt. Way	0.06	0.10	-	-
			Sub-total	0.06	0.10	-	-
			Total	4.56	7.57	9.30/1	15.44/1
	2. Cuping	1004	Cuping	0.24	0.40	0.24	0.40
			Total	0.24	0.40	0.24	0.40
Perlis Total				4.80	7.97	9.54/1	15.84/1
Kedah	3. Changlun	2		1.00	1.66	1.00	1.66
		102		-	-	1.00	1.66
			Total	1.00	1.66	2.00	3.32
	4. Alor Setar	3		20.00	33.20	20.00	33.20
		103		-	-	10.00	16.60
			Sub-total	20.00	33.20	30.00	49.80
		5002		0.60	1.00	-	-
		5003		1.20	1.99	-	-
		5004		0.60	1.00	-	-
		5005		5.00	8.30	-	-
		5006		0.40	0.66	-	-
			Sub-total	7.80	12.95	-	-
			Total	27.80	46.15	30.00	49.80

Remarks; (1): N.A. signifies "data are not available"

(2): Existing river intake number = 1 - 100
Existing well as spring intake number = 1000 - 5000
Proposed intake number = 101 - 200
Number of intakes for temporary water supply systems = 5001 -

(3): Temporary public water supply systems are assumed to stop operation before 5MP.

/1 : Excluding these of intakes 1002 and 1003

Table 6 EXISTING AND PROPOSED ABSTRACTION AND TREATMENT CAPACITY OF PWD AND PWA PUBLIC WATER SUPPLY FACILITIES IN 1982 AND 1985 (2/3)

State	Water Supply Region		Intake	Existing Capacity in 1982 (mgd)	Existing Capacity in 1982 (10^6 m^3/y)	Proposed Capacity in 1985 (mgd)	Proposed Capacity in 1985 (10^6 m^3/y)
	5. Kuala Nerang	4		1.00	1.66	1.00	1.66
		104		-	-	0.30	0.50
		105		-	-	4.00	6.64
			Total	1.00	1.66	5.30	8.80
	6. Pendang	5	MADA Canal	4.00	6.64	4.00	6.64
			Sub-total	4.00	6.64	4.00	6.64
		5007	Yan	1.20	1.99	-	-
			Sub-total	1.20	1.99	-	-
			Total	5.20	8.63	4.00	6.64
	7. Jeneri	6	Sg. Pamoai	0.20	0.33	0.20	0.33
		7	Sg. Potat	0.05	0.08	0.05	0.08
		106		-	-	4.00	6.64
			Total	0.25	0.41	4.25	7.05
	8. Jeniang	8	Jeniang	0.06	0.10	0.06	0.10
		107		-	-	4.00	6.64
			Total	0.06	0.10	4.06	6.74
	9. Sik	9	Sik	0.10	0.17	0.10	0.17
		108		-	-	4.00	6.64
			Total	0.10	0.17	4.10	6.81
	10. Sg. Petani	10	Teroi Intake	0.10	0.17	0.10	0.17
		11	Perigi Intake	0.25	0.42	0.25	0.42
		12	Yan Intake	0.25	0.42	0.25	0.42
		13	Guron Intake	0.20	0.33	0.20	0.33
		14	Merbok H.W	0.25	0.42	0.25	0.42
		15	Tutah H.W	1.20	1.99	1.20	1.99
		16		7.20	11.95	7.20	11.95
		109		-	-	15.00	24.90
			Total	9.45	15.70	24.45	40.60
	11. Kuala Ketil	110		-	-	4.00	6.64
			Total	0.00	0.00	4.00	6.64

Remarks; (1): Existing river intake number = 1 - 100
Existing well as spring intake number = 1000 - 5000
Proposed intake number = 101 - 200
Number of intakes for temporary water supply systems = 5001 -

(2): Temporary public water supply systems are assumed to stop operation before 5MP

Table 7 EXISTING AND PROPOSED ABSTRACTION AND TREATMENT CAPACITY OF PWD AND PWA PUBLIC WATER SUPPLY FACILITIES IN 1982 AND 1985 (3/3)

State	Water Supply Region		Intake	Existing Capacity in 1982 (mgd)	Existing Capacity in 1982 (10^6 m^3/y)	Proposed Capacity in 1985 (mgd)	Proposed Capacity in 1985 (10^6 m^3/y)
	12. Baling	17	Sg. Chrok	0.15	0.25	0.15	0.25
		18	Sg. Baling	1.05	1.74	1.05	1.74
		111		-	-	6.00	9.96
		112	Sg. Baling	-	-	0.60	1.00
			Total	1.20	1.99	7.80	12.95
	13. Kulina/1	113		-	-	3.00	4.98
			Total	0.00	0.00	3.00	4.98
	14. Karangan	19	Karangan	0.06	0.10	0.06	0.10
			Total	0.06	0.10	0.06	0.10
Kedah Total				46.12	76.57	93.02/2	154.43/2
P. Pinang	15. Perai	20	Tahar Tiang	32.00	53.12	32.00	53.12
		21	Sg. Kulim	11.50	19.09	11.50	19.09
		22	Berapit	0.20	0.33	0.20	0.33
		23	Sg. Cherok Tokan	0.15	0.25	0.15	0.25
		24	Bt. Seraya	0.005	0.008	0.005	0.008
			Total	43.86	72.80	43.86	72.80
	16. P. Pinang	25 - 28		3.70	6.14	3.70	6.14
		29 - 39		8.30	13.78	8.30	13.78
		40 - 41		3.00	4.98	3.00	4.98
		42		0.08	0.13	0.08	0.13
		43 - 44		2.80	4.65	2.80	4.65
		45 - 46		1.70	2.82	1.70	2.82
		47	Ayer Itam Dam	4.00	6.64	4.00	6.64
		48		0.30	0.50	0.30	0.50
			Total	23.88	39.64	23.88	39.64
P. Pinang Total				67.74	112.44	67.74	112.44
P.K.P. Total				118.66	196.98	170.30/2	282.71/2

Remarks; (1): Existing river intake number = 1 - 100
Existing well as spring intake number = 1000 - 5000
Proposed intake number = 101 - 200
Number of intakes for temporary water supply systems = 5001 -

(2): Temporary public water supply systems are assumed to stop operation before 5MP

/1 : Water Supply Region 13 is provided with 3.0 x 10^6 m^3/y (1.8 mgd) of treated water by PWA.

/2 : Excluding these of intakes 1002 and 1003

Table 8 POPULATION COVERED BY RURAL ENVIRONMENTAL SANITATION PROGRAM IN 1980

State	Source		Total
	River	Well	
Perlis	281	7,550	7,831
Kedah	39,479	115,250	154,729
P. Pinang	-	3,000	3,000
Total	39,760	125,800	165,560

Source; Ref. 57

Table 9 WATER TARIFF OF THE STATES

Group	Type of Charges	State: Perlis	State: Kedah	State: P. Pinang
A.	DOMESTIC SUPPLIES:			
	1. Residential	$1.00/1,000 gal.	First 3,000 gal. @$1.00/1,000 gal. Over 3,000 gal. @$1.20/1,000 gal.	Up to 5,000 gal. @$0.60/1,000 gal. Over 5,000 gal. @$0.95/1,000 gal.
	2. Religious Institutions	- do -	- do -	- do -
	3. Charitable Organization	- do -	- do -	- do -
	4. Public Standpipes	-	-	- do -
	5. Min. Charge per Month	$1.00	$1.00	$2.00
B.	COMMERCIAL SUPPLIES:			
	1. Industrial (Bulk Supply Rate)	$2.00/1,000 gal.	$2.00/1,000 gal.	First 5×10^6 gal. @$1.30/1,000 gal. 5×10^6 to 10×10^6 gal. @$1.10/1,000 gal. 10×10^6 to 40×10^6 gal. @$0.90/1,000 gal. Above 40×10^6 gal. @$0.80/1,000 gal.
	2. Construction	- do -	- do -	$2.00/1,000 gal.
	3. Manufacturing	- do -	- do -	- do -
	4. Swimming Pool	- do -	- do -	-
C.	SPECIAL RATE:			
	1. Shipping	$2.00/1,000 gal.	$2.50/1,000 gal.	$3.00/1,000 gal.
D.	OTHER SERVICES:			
	1. Connection to Public Main	1"ø - $12.00 1-1/4"ø to 2"ø - $18.00 2-1/4"ø to 3"ø - $24.00 Over 3"ø - $36.00	$15.00 per Connection	Less than 3/4"ø - $60.00 More than 3"ø - Actual cost plus 25%
	2. Fixing Water Meter	$2.50		$2.00
	3. Disconnection of Water Meter	$2.50	-	-
	4. Reconnection of Water Meter	$4.00	$4.00	$2.00
	5. Meter Rent	-	-	Size of Meter — Rent (for 1 month/part of month) 1/2"-3/4"ø - $2.00 1"ø - $4.00 1-1/2"ø - $8.00 2"ø - $12.00 3"ø - $16.00 4"ø - $20.00 6"ø - $25.00 9"ø - $40.00 12"ø - $60.00 15"ø - $80.00 18"ø - $100.00 24"ø - $150.00
	6. Meter Test	$7.50	$7.50	$5.00
	7. Swimming Pool - Test Certificate - Annual Renewal	 $20.00 $5.00	 $20.00 $5.00	 $20.00 $2.00
	8. Plumber's Licence - Annual Renewal	$25.00 $2.00	$25.00 $2.00	$25.00 $2.00
	9. Pressure Test	-	-	$30.00
	10. Meter Repair	Actual cost plus 25% overhead charge	Actual cost plus 25% overhead charge	-

Remarks; In 1983 in case of Perlis and Kedah States and in 1978 in case of P. Pinang State.

Table 10 WATER TARIFF OF THE PULAU PINANG STATE IN 1983

A. Kadar-kadar Bayaran Rumahtangga

(a) Rumahtangga - Individu		
(i) Begi 20,000 liter yang pertama	$0.17 tiap-tiap 1,000 liter	
(ii) Lebin daripada 20,000 tetapi tidak melebehi 60,000 liter	$0.30 tiap-tiap 1,000 liter	
(iii) Lebin daripada 60,000 liter	$0.45 tiap-tiap 1,000 liter	
(iv) Bayaran Minima	$2.50 sebulan	
(b) Rumahtangga Pukal		
(i) Bagi 90,000 liter yang per tama atau sebahagian dari padanya (Bayaran Minima)	$20.00 sebulan	
(ii) Lebih daripada 90,000 liter	$0.28 tiap-tiap 1,000 liter	

(iii) Kadar-kadar bayaran pukal boleh diberi bagi tempat-tempat kediaman rumahtangga dimana terdapat lebih daripada 16 orang penghuni. Yayasan-yayasan dan sekolah-sekolah yang mana penggunaannya tidak di-anggap sebagai penggunaan perniagaan oleh Pihak Ber-kuasa dan dimana terdapat lobih daripada 16 orang penghuni, kadar-kadar pukal bolehlah dikenakan.

B. Kadar-kadar Bayaran Perniagaan

(a) Perniagaan : Biasa		
(i) Bagi 20,000 liter yang per-tama	$0.36 tiap-tiap 1,000 liter	
(ii) Lebih daripada 20,000 tetapi tidak melebehi 20,000,000 liter	$0.45 tiap-tiap 1,000 liter	
(iii) Lebih daripada 20,000,000 liter	$0.40 tiap-tiap 1,000 liter	
(b) Perniagaan : Khas		
Bekalan bagi Kontraktor, Pem-buatan Ais dan Air Galian dan Pengkalan Sampan	$0.66 tiap-tiap 1,000 liter	
(c) Perniagaan : Perkapalan	$1.00 tiap-tiap 1,000 liter	
(d) Bayaran minima bagi semua per-niagaan	$6.00 sebulan	

Table 11 HISTORICAL AVERAGE WATER CHARGES FOR THE STATES

Unit: M$/m^3

Year	States		
	Perlis	Kedah	Pulau Pinang
1970	0.25	0.26	0.16
1971	0.25	0.24	0.16
1972	0.20	0.23	0.16
1973	0.14	0.24	0.19
1974	0.14	0.21	0.22
1975	0.15	0.22	0.21
1976	0.19	0.24	0.09
1977	0.20	0.20	0.21
1978	0.23	0.26	-

Remarks; (1): Water charges of treated water supplied by state PWDs and PWA.

(2): Water charges as the average of all kinds of usage i.e., (revenue from metered supply)/ (total quantity of water metered)

Source; Ref. 5

Table 12 REVENUES AND EXPENDITURES OF WATER SUPPLY IN 1978

Unit: M$10^6/y

State	Revenues			Recurrent Expenditures /1
	From Metered Supply	From Other Sources	Total Revenues	
Perlis	0.31	NA	0.31	1.20
Kedah	4.82	0.04	4.86	3.94
P. Pinang	NA	NA	NA	NA

Remarks; /1: Consists of maintenance of water supplies other maintenance expenditures, administration and collection cost and capital charges

NA: Not available

Source; Ref. 5

Table 13 SERVICE FACTOR, WATER DEMAND PROJECTION AND SUPPLY CAPACITY PLANNED FOR 1990 BY PWD

State	Service Factor		Water Demand (10^6 m^3/y)				Planned Supply Capacity (10^6 m^3/y)
	Urban	Rural	Domestic	Industrial & Commercial	Others	Total	
Perlis	-	75	8	1	-	9	14
Kedah	100	84	76	13	33	122	166
P. Pinang	99	90	116	37	-	153	166

Source; Ref. 1

Table 14 INCREMENTAL SERVED POPULATION BY RURAL ENVIRONMENTAL SANITATION PROGRAM PRELIMINARY PLANNED BY MOH FOR 4MP RERIOD

State	1981	1982	1983	1984	1985	Total
Perlis	1,450	2,525	2,525	2,525	2,525	11,550
Kedah	38,420	39,125	32,345	32,345	28,725	167,840
P. Pinang	750	1,125	1,125	1,125	1,125	5,250

Soruce; Ref. 58

Table 15 CITIES/TOWNS AND DISTRICTS DEFINED IN THE STUDY

District		City/Town	
1.	Perlis	1.	Kangar
2.	Pulau Langkawi		
3.	Kubang Pasu	101.	Jitra
4.	Padang Terap		
5.	Kota Setar	2.	Alor Setar
6.	Pendang		
7.	Yan	102.	Guan Chempedak
		103.	Yan
8.	Sik		
9.	Kuala Muda	3.	Sg. Petani
		104.	Tikan Batu
10.	Baling	203.	Kuala Ketil
11.	Kulim	4.	Kulim
12.	Bandar Bharu		
13.	Seberang Perai Utala	5.	Butterworth
		109.	Kg. Pmtg Kuching
14.	Seberang Perai Tengah	6.	Bk. Mertajam
		110.	Perai
		201.	Bandar Seberang Jaya
15.	Selatan		
16.	Timur Laut	8.	Georgetown
		105.	Air Itam
		106.	Tg. Tokong
		107.	Gelugor
		108.	Tg. Bunga
17.	Barat Daya	202.	Bandar Bayan Baru

Remarks; Whole of the Pulan Langkawi district and major portion of the Bandar Bharu district has outside of the Study Area.

Table 16 HISTORICAL AND PROJECTED POPULATION OF DISTRICTS BY CITY/TOWN AND RURAL AREA IN PERLIS STATE

Unit: 10^3

District	City/Rural	Historical 1980	Estimated 1982	Projected 1985	1990	2000
1. Perlis	1. Kangar	14	15	17	21	29
	Rural	143	149	158	170	188
Urban Total		14	15	17	21	29
Rural Total		143	149	158	170	188
State Total		157	164	175	191	217

Remarks; 1982 population was estimated assuming constant growth rate during 1980 - 85 period.

Table 17 HISTORICAL AND PROJECTED POPULATION OF DISTRICTS BY CITY/TOWN AND RURAL AREA IN KEDAH STATE

Unit: 10^3

District	City/Rural	Historical 1980	Estimated 1982	Projected 1985	1990	2000
2. Pulau Langkawi	Rural	31	32	34	36	37
3. Kubang Pasu	101. Jitra	15	17	20	26	38
	Rural	125	126	128	130	130
District Total		140	143	148	156	168
4. Padang Terap	Rural	45	48	52	56	59
5. Kota Setar	2. Alor Setar	76	77	78	82	96
	Rural	228	238	254	273	279
District Total		304	315	332	355	375
6. Pendang	Rural	82	84	87	90	92
7. Yan	102. Guan Chempedak	9	9	10	11	14
	103. Yan	6	6	7	9	12
	Rural	49	49	50	50	50
District Total		64	64	67	70	76
8. Sik	Rural	47	48	50	52	53
9. Kuala Muda	3. Sg. Petani	49	51	54	61	75
	104. Tikan Batu	4	5	6	9	13
	Rural	156	161	170	177	181
District Total		209	217	230	247	269
10. Baling	203. Kuala Ketil	4	5	6	7	10
	Rural	111	111	112	113	113
District Total		115	116	118	120	123
11. Kulim	4. Kulim	29	31	33	39	50
	Rural	73	73	74	74	73
District Total		102	104	107	113	123
12. Bandar Bharu	Rural	34	34	34	33	33
Urban Total		169	176	195	219	308
Rural Total		1,004	1,029	1,064	1,109	1,100
State Total		1,173	1,205	1,259	1,328	1,408

Remarks; (1): 1982 population was estimated assuming constant growth rate during 1980 - 85 period.

(2): Whole of Pulau Langkawi district and major portion of Bandar Bharu district lies outside of the Study Area.

Table 18 HISTORICAL AND PROJECTED POPULATION OF DISTRICTS BY CITY/TOWN AND RURAL AREA IN PULAU PINANG STATE

Unit: 10^3

District	City/Rural	Historical 1980	Estimated 1982	Projected 1985	1990	2000
13. Seberang Perai Utala	5. Butterworth	82	82	82	82	82
	109. Kg. PMTG Kuching	11	11	11	11	11
	Rural	120	120	120	120	120
District Total		213	213	213	213	213
14. Seberang Perai Tengah	6. Bk. Mertajam	30	30	30	30	30
	110. Perai	10	10	10	10	10
	201. Bandar Seberang Jaya	7	13	34	64	250
	Rural	126	126	126	126	126
District Total		173	179	200	230	416
15. Selatan	Rural	78	78	78	78	78
16. Timur Laut	8. Georgetown	267	278	295	296	296
	105. Air Itam	39	39	39	39	39
	106. Tg. Tokong	15	15	15	15	15
	107. Gelugor	14	14	14	14	14
	108. Tg. Bunga	12	12	12	12	12
	Rural	76	76	76	76	76
District Total		423	434	451	452	452
17. Barat Daya	202. Bandar Bayan Baru	12	22	53	89	250
	Rural	71	71	71	71	71
District Total		83	93	124	160	321
Urban Total		492	526	595	662	1,009
Rural Total		478	471	471	471	471
State Total		970	997	1,066	1,133	1,480

Remarks; 1982 population was estimated assuming constant growth rate during 1980 - 85 period.

Table 19 HISTORICAL AND PROJECTED POPULATION OF DISTRICTS BY CITY/TOWN AND RURAL AREA IN PERLIS STATE UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Unit: 10^3

District	City/Rural	Historical 1980	Estimated 1982	Projected 1985	1990	2000
1. Perlis	1. Kangar	14	15	17	19	22
	Rural	143	149	158	172	195
Urban Total		14	15	17	19	22
Rural Total		143	149	158	172	195
State Total		157	164	175	191	217

Remarks; 1982 population was estimated assuming constant growth rate during 1980 - 85 period.

Table 20 HISTORICAL AND PROJECTED POPULATION OF DISTRICTS BY CITY/TOWN AND RURAL AREA IN KEDAH STATE UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Unit: 10^3

District	City/Rural	Historical 1980	Estimated 1982	Projected 1985	1990	2000
2. Pulau Langkawi	Rural	31	32	34	37	40
3. Kubang Pasu	101. Jitra	15	17	19	24	29
	Rural	125	126	128	130	132
District Total		140	143	147	154	161
4. Padang Terap	Rural	45	48	52	58	66
5. Kota Setar	2. Alor Setar	76	76	76	75	74
	Rural	228	240	262	287	319
District Total		304	316	338	362	393
6. Pendang	Rural	82	84	87	92	97
7. Yan	102. Guan Chempedak	9	9	10	10	11
	103. Yan	6	6	7	8	9
	Rural	49	49	50	50	51
District Total		64	64	67	68	71
8. Sik	Rural	47	48	50	52	55
9. Kuala Muda	3. Sg. Petani	49	51	53	56	57
	104. Tikan Batu	4	5	6	8	10
	Rural	156	161	169	180	193
District Total		209	217	228	244	260
10. Baling	203. Kuala Ketil	4	5	6	7	9
	Rural	111	111	111	112	112
District Total		115	116	117	119	121
11. Kulim	4. Kulim	29	30	32	36	38
	Rural	73	73	73	73	73
District Total		102	103	105	109	111
12. Bandar Bharu	Rural	34	34	34	33	33
Urban Total		169	174	190	201	219
Rural Total		1,004	1,031	1,069	1,127	1,189
State Total		1,173	1,205	1,259	1,328	1,408

Remarks; (1): 1982 population was estimated assuming constant growth rate during 1980 - 85 period.

(2): Whole of Pulau Langkawi district and major portion of Bandar Bharu district lies outside of the Study Area.

Table 21 HISTORICAL AND PROJECTED POPULATION OF DISTRICTS BY CITY/TOWN AND RURAL AREA IN PULAU PINANG STATE UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Unit: 10^3

District	City/Rural	Historical 1980	Estimated 1982	Projected 1985	1990	2000
13. Seberang Perai Utara	5. Butterworth	82	81	80	75	63
	109. Kg. PMTG Kuching	11	11	11	10	8
	Rural	120	116	111	114	149
District Total		213	208	202	199	220
14. Seberang Perai Tengah	6. Bk. Mertajam	30	30	29	27	23
	110. Perai	10	10	10	9	8
	201. Bandar Seberang Jaya	7	13	33	58	192
	Rural	126	131	140	159	215
District Total		173	184	212	253	438
15. Selatan	Rural	78	75	71	73	95
16. Timur Laut	8. Georgetown	267	275	287	271	227
	105. Air Itam	39	39	38	36	30
	106. Tg. Tokong	15	15	15	14	11
	107. Gelugor	14	14	14	13	11
	108. Tg. Bunga	12	12	12	11	9
	Rural	76	79	83	96	133
District Total		423	434	449	441	421
17. Barat Daya	202. Bandar Bayan Baru	12	22	52	81	192
	Rural	71	74	80	86	114
District Total		83	96	132	167	306
Urban Total		492	522	581	596	749
Rural Total		478	475	485	537	731
State Total		970	997	1,066	1,133	1,480

Remarks; 1982 population was estimated assuming constant growth rate during 1980 - 85 period.

Table 22 PROJECTED SERVICE FACTOR FOR URBAN AREA

Unit: %

Population Size (10^3)	1982	1985	1990	2000
More than 100	100	100	100	100
100 - 10	80	85	90	100

Table 23 PROJECTED SERVICE FACTOR FOR URBAN AREA UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Unit: %

Population Size (10^3)	1982	1985	1990	2000
More than 100	100	100	100	100
100-10	80	80	85	90

Table 24 PROJECTED SERVICE FACTOR FOR RURAL AREA FOR PWD AND PWA WATER SUPPLY AND MOH SUPPLY THROUGH RESP

Unit: %

State	Estimated 1982			1985			1990			2000		
	PWD	MOH	Total	PWD	MOH	Total	PWD	MOH	Total	PWD	MOH	Total
Perlis	75.0	8.0	83.0	75.0	12.5	87.5	75.0	18.0	93.0	75.0	25.0	100.0
Kedah	41.4	23.6	65.0	54.0	30.7	84.7	60.8	34.2	95.0	64.4	35.6	100.0
P. Pinang	81.0	1.0	82.0	84.0	1.5	85.5	89.4	2.6	92.0	95.2	4.8	100.0

Table 25 PROJECTED SERVICE FACTOR FOR RURAL AREA FOR PWD AND PWA WATER SUPPLY AND MOH SUPPLY THROUGH RESP UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Unit: %

State	Estimated 1982			1985			1990			2000		
	PWD	MOH	Total	PWD	MOH	Total	PWD	MOH	Total	PWD	MOH	Total
Perlis	75.0	8.0	83.0	75.0	12.5	87.5	73.0	17.5	90.5	72.8	24.2	97.0
Kedah	41.4	23.6	65.0	54.0	30.7	84.7	59.8	33.7	93.5	63.1	34.9	98.0
P. Pinang	81.0	1.0	82.0	84.0	1.5	85.5	86.0	2.5	88.5	90.9	4.6	95.5