GOVERNMENT OF MALAYSIA

NATIONAL WATER RESOURCES STUDY, MALAYSIA

MAIN REPORT

VOL. 1

MASTER ACTION PLAN

OCTOBER 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

It is with great pleasure that I present to the Government of Malaysia this report entitled National Water Resources Study, Malaysia.

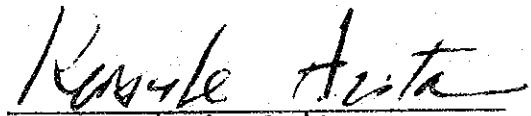
This report embodies the result of a multidisciplinary survey which was carried out from October 1979 to October 1982 by a study team commissioned by the Japan International Cooperation Agency following the request of the Government of Malaysia to the Government of Japan.

The study team, headed by Mr. Ichiro Kuno, had a series of discussions with the officials concerned of the Government of Malaysia and conducted a wide scope of survey and data analyses.

I sincerely hope that this report will be useful as a basic reference for development of the country.

I wish to express my deep appreciation to the officials concerned of the Government of Malaysia for their close cooperation extended to the study team.

October 1982



Keisuke Arita
President
Japan International
Cooperation Agency
Tokyo, Japan

JAPAN INTERNATIONAL COOPERATION AGENCY

NATIONAL WATER RESOURCES STUDY, MALAYSIA

October, 1982

Mr. Keisuke Arita
President
Japan International
Cooperation Agency
Tokyo

Dear Sir,

LETTER OF TRANSMITTAL

We are pleased to submit to you the Final Report of the National Water Resources Study, Malaysia, prepared for consideration by the Government of Malaysia in implementing water resources development and management in line with nation's socio-economic development objective.

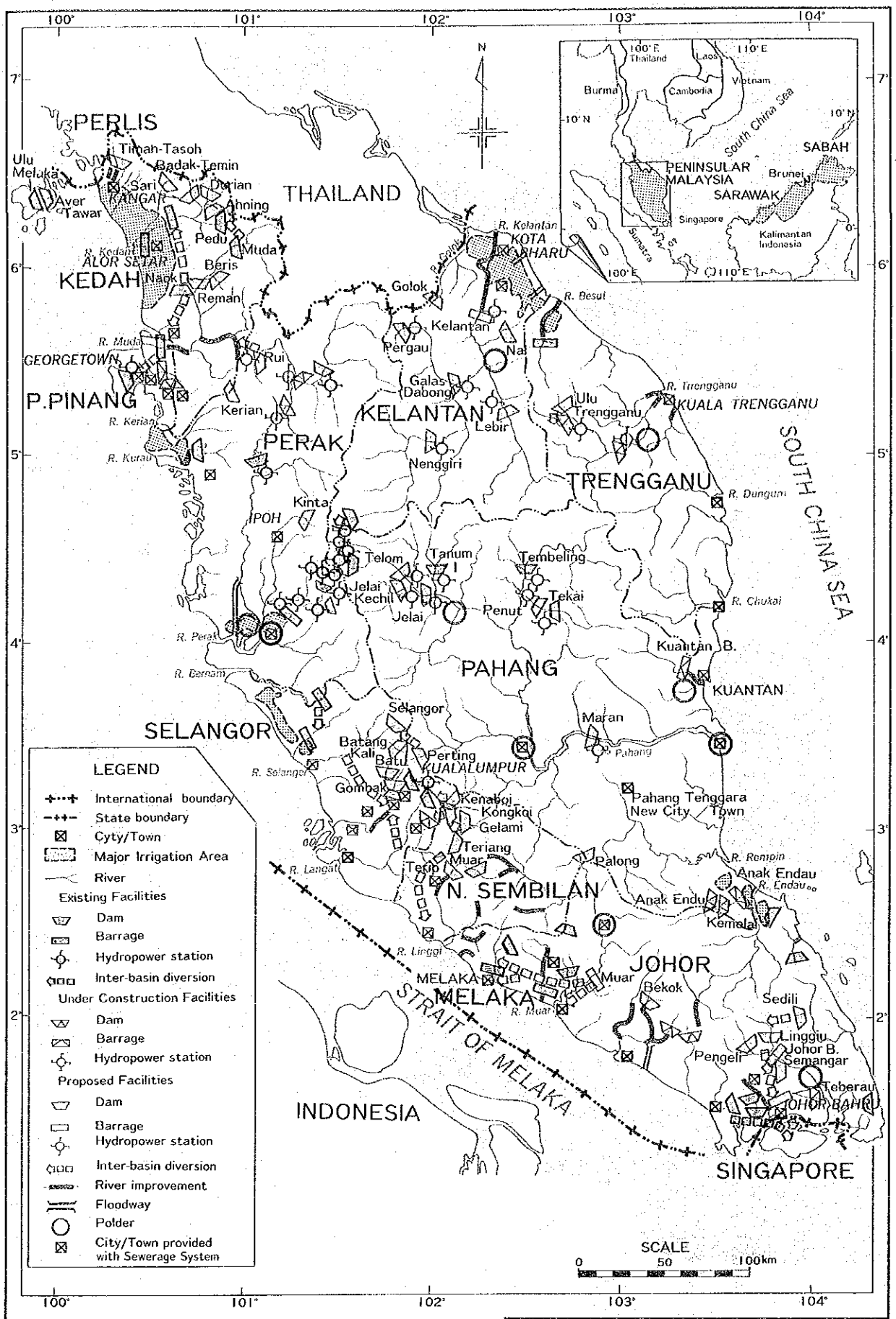
Volume 1 Master Action Plan deals with recommendations on the national water policy and actions to be taken by the Federal and State Governments to ensure the coordination of relevant activities towards integrated development and management of water resources, which are essential and most important among natural resources for the improvement of people's life and national economic development, while water stress has increasingly taken place in the regions of major water use.

Volume 2 Water Resources Development and Use Plan contains a master plan to show general direction of future water resources development based on the national water policy. The plan indicates that it is the time to expedite water resources development to a great deal if the declared goal of the national socio-economic development should be attained.

All members of Study Team wish to express grateful acknowledgement to the personnel of your Agency, Advisory Committee, Ministry of Foreign Affairs, Ministry of Construction and Embassy to Malaysia as well as officials and individuals of Malaysia for their assistance extended to the Study Team. The Study Team sincerely hopes that the study results would contribute to the future water resources development of Malaysia in particular and to her socio-economic development and well-being in general.

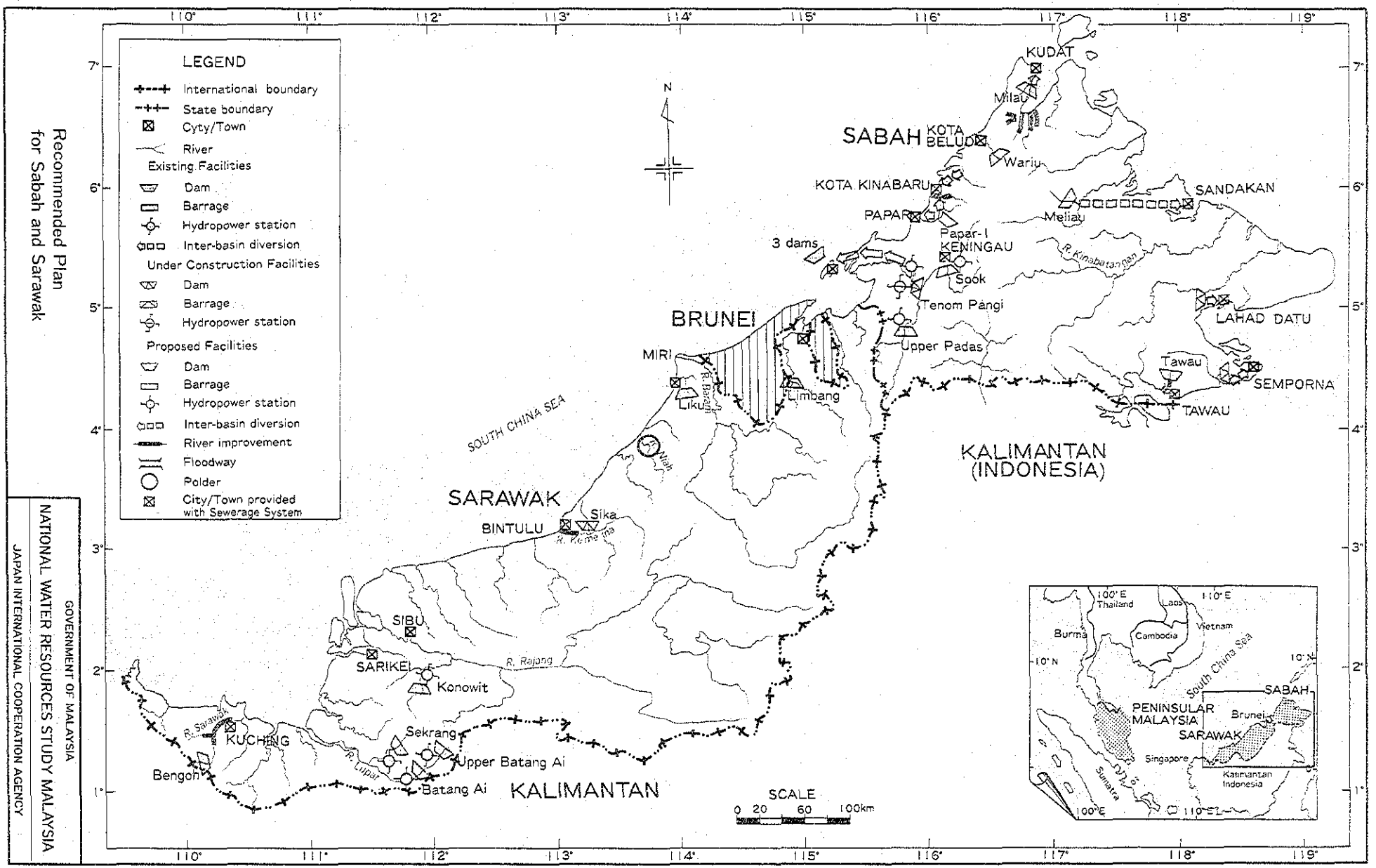
Yours sincerely,

Ichiro Kuno
Team Leader



Recommended Plan
for Peninsular Malaysia

GOVERNMENT OF MALAYSIA
NATIONAL WATER RESOURCES STUDY MALAYSIA
JAPAN INTERNATIONAL COOPERATION AGENCY


Recommended Plan
for Sabah and Sarawak
LEGEND
International boundary
State boundary
Cyty/Town
River
Existing Facilities
Dam
Barrage
Hydropower station
Inter-basin diversion
Under Construction Facilities
Dam
Barrage
Hydropower station
Proposed Facilities
Dam
Barrage
Hydropower station
Inter-basin diversion
River improvement
Floodway
Polder
City/Town provided with Sewerage System
SABAH
KUDAT
Milau
KOTA BELUD
Wariu
KOTA KINABARU
PAPAR
3 dams
Papar-I
KENINGAU
Sook
Tenom Pangi
Upper Padas
SANDAKAN
Meliau
R. Kinabatangan
LAHAD DATU
Tawau
SEMPORNA
TAWAU
BRUNEI
MIRI
R. Baram
Liku
Limbang
SOUTH CHINA SEA
KALIMANTAN (INDONESIA)
SARAWAK
BINTULU
Sika
R. Kemena
Niah
SIBU
SARIKEI
R. Rajang
Konowit
KUCHING
R. Sarawak
R. Lupar
Sekrang
Upper Batang Ai
Batang Ai
Bengoh
KALIMANTAN
SCALE
0 20 60 100km
N
110°
111°
112°
113°
114°
115°
116°
117°
118°
119°
7°
6°
5°
4°
3°
2°
1°
100° E
Thailand
Laos
110° E
Burma
Cambodia
Vietnam
South China Sea
10° N
PENINSULAR MALAYSIA
SABAH
Brunei
SARAWAK
Singapore
Kalimantan Indonesia
Sumatra
100° E
110° E
GOVERNMENT OF MALAYSIA
NATIONAL WATER RESOURCES STUDY MALAYSIA
JAPAN INTERNATIONAL COOPERATION AGENCY

SUMMARY

1. STUDY OBJECTIVE

Malaysia's rapid development has begun to strain her water resources. Increasingly water stress has occurred in places where previously water was found abundant for use. The responsibility for water resources development and management in Malaysia has traditionally been fragmented among various departments and agencies in accordance with their respective functions and activities related to water. In the absence of a comprehensive system to coordinate the multifarious activities in water resources development and management, these activities tend to take place in isolation. This may lead to competition in water use and even duplication of activities and functions. An integrated approach to water resources development and management is therefore necessary to ensure future efficient use of water and other resources, and a study in this regard has become necessary.

The National Water Resources Study, Malaysia, has been carried out by the Study Team of the Japan International Cooperation Agency (JICA) in collaboration with officials of the Government of Malaysia for 3 years since October, 1979 in order to establish a basic framework for the orderly planning and implementation of water resources development programs and projects and for rational water resources management consistent with the overall national socio-economic development objective.

2. OVERVIEW OF WATER RESOURCES IN MALAYSIA

Annual rainfall over the land of Malaysia is 990 billion m^3. Out of this, 360 billion m^3 returns to atmosphere as a result of evaporation and transpiration. The rest forms surface runoff of 566 billion m^3 and groundwater recharge of 64 billion m^3.

Water is used for domestic and industrial water supply, irrigation, hydropower generation, navigation, fisheries and mining. Public water supply system serves 66% of total population. Urban water supply systems are overloaded and rural water supply involves difficulty in access to water source. Self-sufficiency ratio of rice is 69% under normal climate. Out of 546,000 ha of wet paddy, 60% is irrigated but rice production is still subject to the vagaries of climate. Installed capacity of hydropower constitutes 29% of the total power supply. Potential in Peninsular Malaysia is rather small and potential in Sarawak, which could meet nation-wide requirements, still involves some aspects to be clarified. Water pollution in rivers has begun to affect water uses and environmental quality adversely, being caused by domestic and industrial sewage, effluent from rubber factories, palm oil mills and animal husbandry, mining operation, housing and road developments, logging and clearing forest. Flood prone area extends to 29,000 km^2.

Rapid growth in population and economy is expected according to the Fourth Malaysia Plan. Accordingly a large amount of water will be increasingly required especially for water supply and irrigation. The aggregate water demand will increase from 8.7 billion m^3 in 1980 to 11.6 billion m^3 by 1990 and 15.2 billion m^3 by 2000.

3. RATIONALE OF MASTER ACTION PLAN

Although surface runoff seems to be abundant for use, water shortage often occurs in regions of major water demand. This is because readily available water is not much more than the minimum river flow due to wide variation in rainfall. Major portion of runoff goes to waste as floods in wet season.

Retaining high flow in wet season for release in dry season by storage dam is necessary to increase available water. If no more storage development is possible, it is further necessary to divert water from another river basin located in either the same state or another state. Rapidly increasing water demand will need these undertakings with largely increased scale and cost.

Competition and conflict in water use and even duplicated commitment of water and other resources will tend to take place, because all of readily available water has actually been committed for use already in the regions of major water demand. An integrated approach to water resources development has become necessary.

The Master Action Plan contains recommendations on actions to be taken by the Federal and State Governments for water resources development and management in the future. It deals with (1) the national water policy to guide public actions to water resources development and management consistent with national development goal and resources availability, (2) implementation program derived therefrom, and necessary arrangements to ensure efficient and effective execution of the program such as (3) financial system, (4) administrative actions, (5) institutional arrangement, (6) legal provisions and (7) further studies.

4. THE NATIONAL WATER POLICY

The National Water Policy is formulated to guide the public actions in water resources development and management in support of development of all socio-economic sectors related to water resources consistent with national development goal and to adjust other policies to the limitation in availability and conservation of water resources.

The general objective of the National Water Policy is to free the nation from water resources constraints, and thereby to contribute to national economic development, regional development, improvement of environmental quality and social well-being.

Specific objectives are as described hereunder.

(1) The requisite quantity of flow will be maintained in main rivers in order to sustain normal water use and to preserve environmental quality.

(2) Public water supply will be developed to improve social well-being and to support industrial development. Irrigation development will be undertaken to attain the desired level of food self-sufficiency and to increase farmers' real income.

(3) Hydropower potential will be developed to provide self-reliance in energy to the extent possible.

(4) Water pollution will be abated from the standpoint of health and preservation of environmental quality.

(5) Flood will be mitigated to protect peoples' life and to reduce flood damage.

5. PRELIMINARILY QUANTIFIED TARGETS

The targets of the National Water Policy are preliminarily quantified as follows:

(1) The requisite quantity of river flow, called the river maintenance flow will be established for all major rivers in water-stress regions by 1987.

(2) Public water supply will be provided to all people by 2000 except for the rural areas in Sabah and Sarawak where a service factor of 90% is assumed because of remoteness and non-availability of suitable water source. Industries' own water supply will be encouraged but 50% of industrial water will be supplied from public system.

(3) Rice self-sufficiency ratio will be increased from 69% in 1980 to 85% by 1990 and onward, through irrigation development.

(4) Known potential of hydropower will be developed to the maximum extent in Peninsular Malaysia and to such extent that future power demand will require in Sabah and Sarawak.

(5) Standard concentration of biochemical oxygen demand in river will be set at 5 mg/lit. Where necessary to attain the standard, rubber factories and palm oil mills will be encouraged to improve their purification system and large towns will be provided with sewerage system.

(6) Flood mitigation work will be undertaken to protect 50% of people in flood-prone areas by 2000.

6. IMPLEMENTATION PROGRAM

For balancing water demand and supply in the regions of major water demand, water source development is necessary. The regions with urgent problem include the Perlis/Kedah/ Pulau Pinang region, Kelang valley region, Melaka/Muar region and south Johor region. Source development involves multi-purpose dams, inter-basin water transfer and inter-state transfer. As source development tend to be increasingly expensive, improvement of efficiency in water supply and irrigation is also important.

All known hydropower potential of 1,026 MW in Peninsular Malaysia should be developed in view of minimizing dependence on fossil fuels. Hydropower potential of 374 MW in Sabah and 204 MW in Sarawak should be developed to meet incremental power demand in major demand centers by 2000. Some hydro-power projects will be developed as multipurpose projects.

For the purpose of water pollution abatement in rivers, it is necessary to encourage improvement of purification system of effluent from rubber factories and palm oil mills. As domestic and industrial sewage is one of the major sources of organic pollution, sewerage development for 11 towns is recommended. Furthermore, for the purpose of public health improvement, sewerage projects for 20 major towns is also recommended, though not effective for river water quality conservation.

Flood mitigation measures such as channel improvement, bypass floodway, ring bund and flood control dam will be constructed and, where these measures are infeasible, non-structural measures will be undertaken.

7. FINANCING SYSTEM

Accelerated investment is necessary for future water resources development. Public development expenditure of the order of M$40 billion will be required for this purpose up to 2000.

Pricing policy in water resources sector should be directed to efficient and equitable allocation of financial resources: Entire costs of a public project should be paid by the beneficiaries rather than depending on general tax revenue collected from tax payers, if the beneficiaries are identifiable and confined to certain section of the community, while government grant should be provided only if the beneficiaries are to be encouraged to participate in development activities or if subsidies to lower income people are needed.

Cost allocation rule should be established to encourage multipurpose development. The cost allocation rule should be based not only on cost benefit consideration but also on social and political considerations. Government should consider providing soft loans to those sectors which have a slow economic return in order to encourage all water use sectors to participate in multipurpose development for the optimum allocation of resources.

Adverse effects inevitably induced by a water resources project should be compensated by the cost of the project. It may be desirable to make compensation with equivalent goods and services, if compensation in cash is not appropriate.

8. WATER ADMINISTRATION

The National Water Policy should be translated into a national water resources master plan to provide the necessary direction to sectoral water resources planning. The regional water resources master plan should be derived therefrom to demonstrate specific water resources projects, their priority ranking and implementation schedule in each region where water-related activities are affected one another.

Concept of the river maintenance flow should be established. For this purpose, an inventory should be maintained showing necessary details of water use and river flow. The Department of Environment should establish criteria for determining river water quality standard and should make recommendation on measures to be taken by various agencies responsible for controlling pollutants. Planning and design of urban drainage systems should be coordinated with relevant flood mitigation plans. Groundwater licence system should be introduced where hazardous exploitation may take place.

For planning a multipurpose project, consultation should be made among the agencies concerned on water allocation, risk in safe water supply to be accepted by individual sectors and technical standards to be applied. In formulating an inter-state project early consultation and close cooperation are necessary among the State Governments concerned. Federal Government should play a positive role in this respect. To reconcile the national objective and state interest to each other, consultation should be made between Federal Government and State Governments concerned in preparing the national and regional water resources master plans.

9. INSTITUTIONAL FRAMEWORK

Generally, existing institutions for water resources and management have been considerably established. However, the interface between urban drainage and flood mitigation has still to be clarified. It is recommended that all flood mitigation plans including those affecting urban areas should be prepared by the Drainage and Irrigation Department (DID). The planning, construction and maintenance of the trunk drains should also be under the control of DID. The Local Government should be responsible for the urban drainage except for the trunk drains.

To ensure coordination of various sectoral activities in water resources development and management and to execute administrative actions additionally required, the establishment of institutions is recommended: A National Water Resources Committee and a Federal Water Resources Division within the Economic Planning Unit of the Prime Minister's Department should be established to formulate and update the national water policy, to provide leadership and guidelines in preparing the national and regional water resources master plans. A State Water Resources Committee and a Water Resources Division within the State (Economic) Planning Unit should be established in each state to undertake the preparation of a regional water resources master plan and to institute and supervise water resources management. In addition, a federal statutory body, the Water Resources Development and Management Corporation should be established to implement and operate certain water source development projects.

10. LEGAL PROVISIONS

Present and future water resources development and management would require a series of integrated and co-ordinated actions by the Federal and State Governments in the planning, construction and operation stages. The existing legislation is inadequate to define the functions and responsibilities of the Federal and State Governments and there are no procedures and rules in relation to the actions to be taken by the Federal and State Governments in order to ensure coordinated actions.

The entire range of water-related matters cannot be dealt with by States alone. In practice, many of these require coordinated actions by the Federal, State and Local Governments in terms of jurisdiction, institutional arrangements as well as financing arrangements. Since law is an indispensable instrument for the efficient implementation of water resources policies and plans and since there is a need to promote uniformity among the water-related laws enacted by State Governments, it is recommended that a comprehensive national water resources code be enacted.

The national water resources code should contain policy statement, relationship to other public policies, responsibilities of Federal, State and Local Governments, institutions for coordination, planning system, basic rules for river water management, policy regarding adverse effects of development and financial arrangement.

11. FURTHER STUDIES

Further studies are recommended in order to clarify more details for the decision-making. The areas requiring immediate study are as follows:

It is necessary to formulate water resources master plans in four regions of major water demand: The Kedah/ Perlis/Pulau Pinang region needs source development including basin transfer from Perak to cope with the present water shortage and to meet increasing water demand for irrigation and in large towns. In the Kelang valley region, accelerated dam construction within Selangor and transfer of water from Negeri Sembilan and Pahang are required to meet rapidly increasing demand in large towns. An integrated water resources development should be undertaken for Melaka/Muar region, where Melaka is especially in short of water. A sizable development of rivers in the south Johor region is necessary to meet water demand in Johor Bahru, and to allow water to supply for Singapore.

Groundwater exploration should be carried out in the coastal area of Sarawak, where saline rivers hinder domestic water supply.

Power development master plan should be prepared for Sabah and Sarawak, where there is no power development program beyond 1990 and seemingly potential in the Rajang river will not be made available before 2000.

Feasibility studies including basin master planning should be carried out for Port Dickson, Kota Kinabalu and Labuan, where large water demand is expected but water resources are poor in the vicinities.

CONTENTS

TABLES

FIGURES

ABBREVIATIONS

(1) Plan

FMP	:	First Malaysia Plan
SMP	:	Second Malaysia Plan
TMP	:	Third Malaysia Plan
4MP	:	Fourth Malaysia Plan
5MP	:	Fifth Malaysia Plan
6MP	:	Sixth Malaysia Plan
7MP	:	Seventh Malaysia Plan
NEP	:	New Economic Policy
OPP	:	Outline Perspective Plan
RESP	:	Rural Environmental Sanitation Program

(2) Domestic Organization

DID (JPT)	:	Drainage and Irrigation Department
DOA	:	Department of Agriculture
DOE	:	Division of Environment
DOF	:	Department of Forestry
DOFS	:	Department of Fishery
DOM	:	Department of Mines
DOS	:	Department of Statistics
EPU	:	Economic Planning Unit
FAMA	:	Federal Agricultural Marketing Authority
FELCRA	:	Federal Land Consolidation and Rehabilitation Authority
FELDA	:	Federal Land Development Authority
ICU	:	Implementation and Coordination Unit
MARDI	:	Malaysian Agricultural Research and Development Institute
MIDA	:	Malaysian Industrial Development Authority
MLRD	:	Ministry of Land and Regional Development
MMS	:	Malaysian Meteorological Service
MOA	:	Ministry of Agriculture
MOF	:	Ministry of Finance

MOH	:	Ministry of Health
MOPI	:	Ministry of Primary Industries
MRRDB	:	Malaysia Rubber Research and Development Board
NDPC	:	National Development Planning Committee
NEB (LLN)	:	National Electricity Board
PORIM	:	Palm Oil Research Institute of Malaysia
PWD (JKR)	:	Public Works Department
RDA	:	Regional Development Authority
RISDA	:	Rubber Industry Small-holders Development Authority
RRIM	:	Rubber Research Institute of Malaysia
SEB	:	Sabah Electricity Board
SEBC	:	State Economic Development Corporation
S(E)PU	:	State (Economic) Planning Unit
SESCO	:	Sarawak Electricity Supply Corporation
UDA	:	Urban Development Authority

(3) International or Foreign Organization

ADAA	:	Australian Development Assistance Agency
ADB	:	Asian Development Bank
ASCE	:	American Society of Civil Engineers
FAO	:	Food and Agriculture Organization of the United Nations
IBRD	:	International Bank for Reconstruction and Development
ILO	:	International Labour Organization
IMF	:	International Monetary Fund
IRRI	:	International Rice Research Institute
JICA	:	Japan International Cooperation Agency
JSCE	:	Japan Society of Civil Engineers
MOC	:	Ministry of Construction, Japan
OECD	:	Organization for Economic Cooperation and Development
OECF	:	Overseas Economic Cooperation Fund, Japan
UK	:	United Kingdom
UNDP	:	United Nations Development Program

UNSF	:	United Nations Special Fund
US or USA	:	United States of America
US/AID	:	United States Agency for International Development
USBR	:	United States Bureau of Reclamation
WHO	:	World Health Organization
WMO	:	World Meteorological Organization

(4) Others

B	:	Benefit
BOD	:	Biochemical Oxygen Demand
C	:	Cost
CIF	:	Cost, Insurance and Freight
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
FOB	:	Free on Board
FSL	:	Full Supply Level
GDP	:	Gross Domestic Product
GNP	:	Gross National Product
H	:	Height, or Water Head
HWL	:	Reservoir High Water Level
LWL	:	Reservoir Low Water Level
O&M	:	Operation and Maintenance
Q	:	Discharge
Ref.	:	Reference
SITC	:	Standard International Trade Classification
SS	:	Suspended Solid
V	:	Volume
W	:	Width

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 1 km^2 = 0.386 sq.mile	1 sq.ft = 0.0929 m^2 1sq.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^2
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

Exchange Rate
(as average between July and December 1980)

$1 = M$2.22
¥100 = M$1.03

1. INTRODUCTION

1.1 Study Objective

Malaysia's rapid development has begun to strain her water resources. Increasingly water stress has occurred in places where previously water was found abundant for use. The responsibility for water resources development and management in Malaysia has traditionally been fragmented among various departments and agencies in accordance with their respective functions and activities related to water. In the absence of a comprehensive system to coordinate the multifarious activities in water resources development and management, these activities tend to take place in isolation. This may lead to competition in water use and even duplication of activities and functions. An integrated approach to water resources development and management is therefore necessary to ensure future efficient use of water and other resources, and a study in this regard has become necessary.

The objective of the National Water Resources Study is to establish a basic framework for the orderly planning and implementation of water resources development programs and projects and for rational water resources management consistent with the overall national socio-economic development objective.

1.2 Technical Cooperation

In early 1979 agreement was reached between the Government of Malaysia and the Government of Japan to undertake the National Water Resources Study as a technical cooperation project. A study team was subsequently appointed by Japan International Cooperation Agency (JICA) to carry out the Study over a period of three years commencing in October 1979.

Counterpart Officers were appointed by the Government of Malaysia to participate in the Study. The Government of Japan has seconded two officials as Colombo Plan Experts attached to the Study and despatched other officials for short-term visits to Malaysia, in order to support the Study. The Study Team members and the officials of the two Governments who directly participated in the Study were as listed in Table 1.

1.3 Steering Committee and Advisory Committee

To guide the Study, the Government of Malaysia established a Steering Committee chaired by Tan Sri Ishak bin Haji Pateh Akhir, Director General, Economic Planning Unit (EPU) of the Prime Minister's Department. The Steering Committee was assisted by a Water Law and Institution Committee also chaired by Tan Sri Ishak bin Haji Pateh Akhir, a Technical Committee chaired by Ir. Cheong Chup Lim, Deputy Director General of the Drainage and Irrigation Department (DID) and a Sub-committee on Environment chaired by Mr. S.T. Sundram, Director General of the Department of Environment (DOE). An Advisory Committee was established by JICA to review the findings by the Study Team. The Steering Committee and the Advisory Committee have maintained close liaison by meeting regularly to exchange views on the Study. The members of the Committees were as listed in Table 2.

1.4 Study Contents

The contents of the Study cover the following:

(1) assessment of present and future regional demand by the water use sectors and study on water resources development plans to meet them,

(2) assessment of hydropower potential from the viewpoint of balancing energy demand and supply,

Table 1 LIST OF DIRECT PARTICIPANTS IN THE STUDY

Colombo Plan Expert

T. Tanimoto (MOC)
A. Kimizuka (MOC)

Specialist from Government of Japan

I. Takeuchi (MOC)
K. Uchida (MOC)
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SPECIAL ABBREVIATIONS

MOC : Ministry of Construction
IECA: International Engineering Consultants Association
NK : Nippon Koei Co., Ltd.
SSC : System Science Consultants Inc.
CTI : CTI Engineering Co., Ltd.
CKC : Chuo Kaihatsu Corporation

Table 2 LIST OF MEMBERS OF COMMITTEES ESTABLISHED TO SUPPORT THE STUDY

Advisory Committee

Chairman
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H. Tamamitsu (MOC)**

Member
Y. Iwasa (Kyoto Univ.)
M. Aniya (MOC)
T. Takeuchi (MOC)
T. Iijima (JICA)
M. Imamura (MOC)
T. Nemoto (MOC)
S. Kamata (MOC)
T. Yamada (MOC)
Y. Nsmioka (MOC)
T. Nakao (MOC)
K. Takemura (MOC)
H. Fujita (MOC)
N. Murata (MOC)

Coordinator
H. Yaoi (JICA)
M. Hiratsuka (JICA)
K. Nakagawa (JICA)
Y. Sakurada (JICA)

* Up to June, 1981
** From July, 1981

Steering Committee

Chairman
Tan Sri Ishak bin Hj. Pateh Akhir (EPU)

Member
Members of Technical Committee
Representatives of Federal Departments and State Governments

Secretary
Rosmah bt. Hj. Jentra (EPU)

Technical Committee

Chairman
Cheong Chup Lim (DID)

Member
Chan Boon Teik (PWD)
Rosmah bt. Hj. Jentra (EPU)
Tay Soon Chuan (PWD)*
Mok Ah Kow (PWD)**
Th'ng Yong Huat (NEB)
A. Maheswaran (DOE)
Abu Bakar Jaafar***
Peter Ho Yueh Chuen (DOE)****
Jamil Hajar bin Muttalib (AGC)***
Chiah Bee Peng (AGC)****
Colombo Plan Experts

Secretary
Sieh Kok Chi (DID)

* Up to April, 1981
** From May, 1981
*** Up to May, 1980
**** From June, 1980

(3) study on water pollution and flood problems and measures to mitigate them, and

(4) study on existing legal and institutional arrangements and recommendations as to changes necessary to ensure effective and efficient execution of water resources development and management.

The Study has thus been organized to address the cardinal water issues and their implications based on an overview of water resources, present and future needs and problems rather than dealing with specific projects.

The Study has been conducted in three phases; Phase I was devoted to the definition of the scope of the Study, Phase II of the Study was confined to Peninsular Malaysia, and during Phase III the Study was extended to cover Sabah and Sarawak.

1.5 Study Reports

During the course of the Study, an inception report, progress reports, and sectoral reports relating to specific aspects of the Study were prepared. The Final Report which is submitted herein comprises 2 volumes: Volume 1 Master Action Plan and Volume 2 Water Resources Development and Use Plan. It is supported by the State Reports and Sectoral Reports.

The Master Action Plan represents the most important document of the Study and contains recommendations on actions to be taken by the Federal and State Governments to ensure efficient and effective execution of water resources development and management in the future. It includes the national water policy, implementation program, financial system, water administration, institutional framework, legal provisions and further studies.

1.6 Acknowledgement

In undertaking the Study, the study team has attached great importance to the incorporation of the views of departments and agencies of the Government of Malaysia relating to the various aspects covered by the Study. The contribution to the Study by the officials of both Federal and State Governments and other individuals who have provided information and data, participated in discussions, given valuable advices and provided other forms of assistance to the Study are gratefully acknowledged. A heartfelt gratitude is also made to the officials of the Ministry of Foreign Affairs, Ministry of Construction and Embassy to Malaysia of the Government of Japan who have given advices, directly participated in the Study and provided various supports in performing the Study. In reality the Study can be regarded as a joint effort by the Malaysian and Japanese officials and individuals concerned and the Japanese Study Team. The Study Team sincerely hopes that this joint effort would contribute to the future water resources development of Malaysia in particular and to her socio-economic development and well-being in general.

2. OVERVIEW OF WATER RESOURCES IN MALAYSIA

2.1 Water Resources in Existence

Water resources are water as immediate and potential sources of benefits to human being. They occur in a complex cycle through which water passes from water vapor in atmosphere through precipitation upon land or water surfaces and ultimately back into the atmosphere as a result of evaporation and transpiration. On land, water takes temporary phases on the surface of land, in the soil and underlying rocks, before it is lost to the air or sea.

Average annual rainfall on the total land mass of Malaysia of 330,000 km^2 amounts to 990 billion m^3, of which 360 billion m^3, or 40% returns to the atmosphere as evapotranspiration, 566 billion m^3, or 57% appears as surface runoff and the remaining 64 billion m^3, or 3% go to recharge groundwater. Of the total 566 billion m^3 of surface runoff, 147 billion m^3 is found in Peninsular Malaysia, 113 billion m^3 in Sabah and 306 billion m^3 in Sarawak.

2.2 Present Water Use

Water is used for a variety of purposes. Consumptive water use is largely for irrigation and domestic water supply and to a minor extent for fish culture and mining. Hydropower is generated utilizing potential energy of water. Instream water uses are navigation and fish catch.

The present domestic and industrial water use is estimated to be 1.3 billion m^3/y. At this level of utilization about 66% of the total population is served by public water supply, with the service factor for urban areas being 91% and that for rural areas being 50%. Due to rapid

population increase and the growth of industry, the annual demand growth rate now is about 12%. Rural water supply is faced with some problems, particularly in areas where a source of water is not readily available. In urban areas, many water supply systems are overloaded due to rapid growth in demand.

Irrigation development in Malaysia is devoted almost entirely to rice production. Until 1960, irrigation schemes were designed for single crop rice production during the wet season, providing water to supplement rainfall during short period of drought. In the early 1960s, irrigation was rapidly expanded to bring existing areas under double cropped paddy cultivation by building storage dams and pumping stations, raising the rice production from 0.6 million tons in the early 1960s to the present level of 1.17 million tons, or 69% of total rice demand. There are 546,000 ha of wet paddy land in Malaysia and 44% is capable of double cropping. A further 16% is provided with facilities for single crop cultivation.

In spite of recent efforts in irrigation development, rice production is still subject to the vagaries of climate. The occurrence of a severe drought event such as that experienced in 1977/1978 may adversely affect production in major rice growing areas. To stabilize production, further water resources development is necessary to provide a more reliable water supply in times of drought. Further irrigation development is also necessary in order to maintain a high self-sufficiency level in rice as additional rice must be produced to meet the requirements of the growing population.

Demand for power has been increasing rapidly over the past years with an annual growth rate between 10% and 16%. At present, about 29% of the total power supply is contributed by hydropower, which has a total installed capacity of 614 MW. Another 750 MW of hydropower is being developed and will be

available by 1985. Potential hydropower projects have been identified both in Peninsular Malaysia and in Sabah and Sarawak. The development of hydropower potential in Peninsular Malaysia alone is unlikely to maintain the present share of hydropower to the total power generation capacity by 2000. Vast hydropower potential in the Rajang River Basin in Sarawak, which could meet nation-wide requirement, still has some aspects to be clarified before it is developed.

Hydropower projects could also provide additional benefits, albeit incidental, such as augmenting low flows in rivers and flood mitigation.

Mining and fish culture are minor water consumers. Navigation and fish catch, both instream users, are generally of local importance, except in Sarawak and Sabah, where rivers are major means of transportation. Recreation water use is insignificant.

2.3 Water Pollution

Water pollution adversely affects the environment and renders water resources unfit for use. The main sources of pollution are domestic and industrial sewage, effluent from palm oil mills, rubber factories and animal husbandry, and effluent from tin mines. Organic pollution of water is represented by the biochemical oxygen demand (BOD), which is the oxygen used to meet the metabolic needs of aerobic micro-organisms in water rich in organic matter. The self-purification mechanism of a river is greatly reduced and the aquatic eco-system is affected when the BOD concentration exceeds 5 mg/lit. Odour occurs when the BOD concentration in a river is greater than 10 mg/lit. Mining operation, housing and road development, logging and clearing of forest are major causes of high concentration of suspended solid

in some rivers. The presence of heavy sediment load creates problems for the operation and maintenance of water supply systems and irrigation facilities.

Water pollution problems have begun to emerge in recent years. In several urban areas, organic pollution of water has resulted in environmental problems and has adversely affected aquatic lives. In some rivers, the BOD concentration has already increased high. Further deterioration can only be arrested if sewerage systems are installed in large population centers to treat the increasing volume of domestic sewage, and more stringent measures are introduced to control the disposal of effluent from the increasing number of palm oil mills and rubber factories as well as the effluent from tin mines.

2.4 Flood

Flood is a negative aspect of water resources. A large part of the flood problems is inherent in the fact that many population centers and settlements have developed in coastal lands and inland valleys prone to flooding. In some cases, the severity of flooding has increased as a result of land use changes such as the conversion of forest into agricultural land and the conversion of agricultural land into urban land, etc. Flood damage costs have increased with time due to the growth of prosperity and wealth in flood-prone areas. Flooded areas mapped for the recorded maximum flood events since 1963 amount to about 29,000 km^2, some 9% of the total land area. About 2.7 million people were affected. Annual flood damage varies from year to year, depending on the severity of floods during the monsoons. The total average annual flood damage for the country is estimated at M$100 million.

The implementation of flood mitigation works has been a comparatively recent undertaking. In areas prone to flooding, flood evacuation centers are set up to house flood victims, and to provide emergency relief. As part of the evacuation and relief machinery, a flood forecasting and warning systems have also been instituted.

2.5 Future Water Demand

According to the Outline Perspective Plan of the Fourth Malaysia Plan, the population in 1980 was 14.3 million and the population will increase to 18.1 million by 1990 at an average growth rate of 2.4%. At an assumed growth rate of 2.0% thereafter, the population is further projected to reach 22.1 million in 2000. The Fourth Malaysia Plan projects the gross domestic product (GDP) to grow at the rate of 7.7% between 1980 and 1985, and 8.4% between 1985 and 1990. A growth rate of 7.5% has been assumed for the period of 1990 to 2000. Based on these growth rates, the value of GDP at factor cost at 1970 constant price is estimated to be M$25.4 billion in 1980, M$54.9 billion in 1990 and M$113.1 billion in 2000.

The growth in population and GDP in the next two decades will cause heavy demand for water. Domestic and industrial water demand, estimated to be 1.3 billion m^3 for 1980, is expected to increase to 2.6 billion m^3 in 1990 and the demand is further projected to reach 4.8 billion m^3 by 2000. The share of industrial water demand will increase from 50% in 1980 to 56% by 2000. Irrigation area will be expanded from 329,000 ha in 1980 to 455,000 ha by 1990 and 545,000 ha by 2000, resulting in irrigation water demand increase from 7.4 billion m^3 in 1980 to 9.0 billion m^3 in 1990 and 10.4 billion m^3 in 2000. The aggregate total water demand is, therefore, estimated to be 11.6 billion m^3 by 1990 and 15.2 billion m^3 by 2000 as compared with 8.7 m^3 for 1980.

2.6 Significance of the Master Action Plan

Water is not only required to meet basic human needs but is also required as an essential input for the production of services, goods, and energy. Water resources development occupies a significant position in the overall socio-economic development plan of the country, and water resources development projects are undertaken in support of the development of several major socio-economic sectors.

The projected annual water demand of 15.2 billion m^3 by 2000 represents only 3% of the estimated annual surface runoff of 566 billion m^3. However, in spite of the seemingly available abundant quantity of water as compared with demand, shortage of water has occurred. This is because the occurrence of rainfall in the country varies from region to region, and for any region, it also varies from season to season, and from year to year. As a result of this uneven distribution both in time and in space, river flows fluctuate over a wide range. In areas of growing demand, low flows during the dry seasons are insufficient to meet all demands, while during wet seasons flooding occurs and a large quantity of water runs to waste. Because of this uneven distribution, the portion of water, which is readily available the year round, without having to regulate river flows by the construction of storage dams, is relatively low. This portion is estimated to be 10% of runoff in the river. To increase the portion of water for year round use, it is necessary to construct storage dams so that flood flows can be retained during the wet months and released during the dry months to augment low flows.

As the readily available portion of water resources has already been developed for use in practically all regions of major water demand, future water resources development will be characterized by the requisite of storage dams construction.

Furthermore, for regions of rapidly growing demand, the practicable limit of water resources development has been reached, it will be necessary to divert water from another river basin in the same state or from a river basin of another state.

Inter-basin and inter-state transfer of water and storage dams construction have been undertaken in the past, but the scale of undertaking will be considerably increased in the future. Needless to say, these are more costly forms of water resources development.

Development of water resources by major use sectors has until now taken place independent of one another. In the past, this was possible insofar as the combined demand of existing water users did not exceed the readily available portion of water resources in a region or the storage development by one water use sector would not conflict with the present and future requirements of other users. As the readily available portion of water resources in regions of major water demand has already been committed, an integrated approach to the development of water resources will be necessary to meet the requirement of all water use sectors, to avoid competition and conflict in water use, and to optimize the use of resources.

Since water resources are being depleted consequent upon increasing water use and more and more costly development, development and use of water in an orderly manner will require forward planning based on an assessment of long term needs, problems and constraints, and available resources. The needs for water resources development and the future program of development must necessarily be derived from a well defined national water policy and quantified targets for development in the water resources sector within the framework of overall national socio-economic development.

The essential elements of such a policy are discussed in Chapter 3. Out of the policy and targets will flow the programs and projects for water resources development. Related to the planning and implementation of these programs and projects are their financing, the necessary administrative actions, the institutional arrangements and legal provisions to enable these undertakings to take place in an effective and efficient manner. These will be dealt with in the subsequent Chapters 4 through 8.

3. THE NATIONAL WATER POLICY

3.1 Rationale and Scope of the National Water Policy

Water resources are among the basic resources essential for sustaining human life and for the production of goods and services. The significant role of water resources can be seen from the fact that water resources development programs and projects now form an integral part of the overall national socio-economic development plan that is formulated and implemented under the successive Malaysia Five Years Development Plans.

The formulation of a National Water Policy is necessary to provide a framework whereby the desired targets are set and necessary measures are prescribed to guide the entire range of public actions in the development and management of water resources consistent with national development goal. The objectives and targets of the National Water Policy bind all activities related to water resources; on the other hand these objectives and targets should be revised in accordance with changes in national development goal or in response to changing socio-economic conditions and requirements.

3.2 Relationship with Other Public Policies

The water resources of the nation should be developed in support of the development of all socio-economic sectors related to water resources. Water demand and supply balance, or the process of allocating and developing water resources to match water demand by all sectors in a region, is the adjustment of seasonal availability of water resources by engineering or other means to meet demands in the region, such demands being a function of national and regional development policies which determine specific industrial,

agricultural and other water-related infrastructural development programs and projects to be implemented. The development of public water supply contributes towards industrial development and public health and rural development objectives. Irrigation development is an integral part of the total development program guided by the National Agricultural Policy. Increasing importance has been attached to hydropower development in the National Energy Policy. Preservation of river water quality and maintenance of the requisite quantity of flow in rivers play a major role in attaining the environmental quality objective. In flood-prone areas flood mitigation contributes towards the social well-being of the people and provides a better physical environment to permit socio-economic activities to continue to take place.

Conversely, policies for the development of specific socio-economic sectors related to water may need adjustment in the light of limitation in water resources or the need to conserve these resources for a better alternative use. The example may be cited a good illustration. In locating new industrial estates within the framework of regional development, consideration should be given to the availability of water resources at the location and to the cost of developing public water supply to support the industrial development which should be balanced against the socio-economic benefits that can be derived. If necessary, the proposed estates should be resited. Thus a judicious balance between water resources development and the development of water-related socio-economic sectors would be necessary to achieve national socio-economic goal in the most efficient way. Actually, these consideration should be made for Pulau Pinang, Kelang valley, Port Dickson and Johor Bahru, where water demand can by no means be met if water intensive industries such as paper and chemical industries continue to increase beyond 1985.

3.3 Objectives

3.3.1 General objective

The general objective of the National Water Policy is to free the nation from water resources constraints, that is to say to promote national economic development, to enhance regional development, to upgrade environmental quality and improve social well-being by meeting water resources needs and by alleviating water resources problems.

3.3.2 Specific objectives

(1) Maintenance of requisite quantity of flow (low flow)

The requisite quantity of flow (low flow) will be maintained in main rivers at all times except during extraordinary dry periods in order to sustain navigation, fish catch, operation and maintenance of intakes for water supply and irrigation, maintenance of facilities in the rivers, checking sea water intrusion, prevention of estuary clogging, conservation of groundwater, preservation of riparian lands and peoples' amenities.

(2) Development of public water supply and irrigation

Public water supply will be developed to provide domestic water to urban and rural areas to improve social well-being and to supply water to support industrial development.

Irrigation development will be undertaken to attain and maintain the desired level of self-sufficiency in food and to increase farmers' real income.

(3) Hydropower development

Hydropower potential will be developed to contribute self-reliance in energy to the maximum extent consistent with the National Energy Policy.

(4) Preservation of water quality

Pollution of water in rivers will be abated and water quality in rivers will be brought to meet an appropriate standard which is set from the standpoint of public health and from the standpoint of conservation of environmental quality.

(5) Flood mitigation

Flood will be mitigated to protect peoples' life and to reduce flood damage. The final goal will be the protection of the whole population from major floods.

3.4 Preliminarily Quantified Targets

The targets of the National Water Policy should be set according to the overall national development objectives, the development goals of the related socio-economic sectors, and available financial and manpower resources. To the extent possible the Study has reviewed relevant documents and data made available by Malaysian Government departments and agencies and made assumptions as to the following targets which should be regarded as preliminarily quantified targets for the various water resources development and management sectors. The rationale or basis on which these assumptions are made are indicated in the ensuing paragraphs.

Needless to say, each target set and the prescribed rate of attaining the target for water resources development have implication to the financial, manpower and other resources to be allocated to that particular water resources sector; where competing use of manpower and financial resources exists, adjustment of the targets must necessarily be made based on social, economic and political considerations.

(1) Maintenance of low flow

In Malaysia over 90% of the water resources occur in the form of surface water resources. Consequently, surface water has been and will continue to be the main source of supply. Rivers perform the role of collecting surface water and conveying it through lands to the sea. In many cases it is from the rivers that water is abstracted or diverted for purposes of public water supply and irrigation as well as other uses. At the same time, rivers also provide for water transport, support fish life and form part of the eco-system.

For practical management purposes, it is necessary to introduce the concept of river maintenance flow. The river maintenance flow is the minimum river discharge to ensure such water depth, flow velocity, water quality, channel stability and aquatic eco-system as required for sustaining normal water uses and environmental quality. Such a minimum river discharge should obviously be determined for each river according to its natural conditions and water resources use and management requirements. A reasonable target will be to establish river maintenance flow for all major rivers in water-stressed regions by 1987.

(2) Domestic and industrial water supply

Malaysia has attained a relatively high service factor of public water supply. Taking into consideration the consistent effort made by both Federal and State Governments to progressively increase the coverage of public water supply, the Study has assumed that public water supply will be provided to all people by the year 2000 except for the rural area in Sabah and Sarawak where for reason of remoteness and the non-availability of suitable water source, a service factor of 90% has been tentatively assumed.

With regard to public water supply for industry, it is assumed that industries will be encouraged to develop suitable water supply facilities to serve their own needs and that 50% of the water demand will be supplied from public systems.

(3) Irrigation development

The self-sufficiency attained in rice production in Malaysia is 69%. As it is the declared policy of the Government to progressively increase the level of self-sufficiency it is assumed that the level of self-sufficiency to be attained by 1990 and to be maintained onward is 85%.

(4) Hydropower development

Consistent with the Government policy for self-reliance in energy, it is assumed that known hydropower potential that can be economically developed will be totally developed in Peninsular Malaysia and to the extent that future power demand in Sabah and Sarawak will require by 2000.

(5) River water quality

Domestic and industrial sewage and effluent from palm oil mills and rubber factories have been and will continue to be the main source of river pollution. Organic pollution by these sources will cause degradation of water if BOD concentration exceeds 5 mg/lit, as described in Sub-section 2.3. Measures to control BOD concentration in rivers include the installation of sewerage system to treat domestic and industrial sewage and treatment of effluent from palm oil mills and rubber factories. It is assumed that a standard BOD concentration of 5 mg/lit in rivers will be attained by 2000.

(6) Flood mitigation

Significant flood damage has been experienced in many parts of the country. Flood events in the past were recorded with disruption of economic activities, human misery and loss of life and property. Consequently, floods and the effects of floods should be mitigated by both structural and non-structural measures. The former includes flood control dam, channel improvement, bypass floodway and the like while the latter includes restriction of development in flood-prone areas and resettlement. It is assumed that 50% of the people in the flood prone area will be protected by 2000, based on an alternative study which is described in Section 4.5.

4. IMPLEMENTATION PROGRAM

4.1 Scope of Implementation Program

In this chapter, the policy and targets as stated in Chapter 3 are translated into an implementation program for water resources development and management up to the year 2000. The program reflects not only the needs based on socio-economic development goals but also the characteristics of the water resources in terms of its availability and the extent of stresses to which the resources are subject.

The essential components of the program are:

(a) development of water source to meet water demands for domestic and industrial uses and irrigation,

(b) development of hydropower as a contribution towards meeting the nation's energy requirement,

(c) enforcement of measures to maintain water in suitable quality for use including construction of sewerage works, and

(d) construction of flood mitigation works.

In preparing the implementation program, an assessment is made of the demands by water use sectors and by regions. Alternative plans are then considered for the development and management of water resources to meet the demands. The selected plan resulting from a comparison of the alternative plans forms the recommended implementation program.

While the presented program includes water source development to meet the demands by all water use sectors as a whole it does not define specific water resources development projects for domestic and industrial water supply, irrigation and other water use sectors.

The implementation program as presented represents a sketch plan for water resources development and management up to the year 2000. It serves to indicate broadly the allocation of water and financial resources to meet the various water demands and for water resources management to ensure its availability for use. The program also serves to indicate the need for new administrative arrangements and legal provisions to be made in the field of water resources development and management.

4.2 Water Source Development

At present, the overall shortage of water exceeds 1.2 billion m^3/y during a moderate drought which may occur on the average once in five years. The shortage is principally due to low river flows during dry seasons which are inadequate to meet water demand. On the other hand, during wet seasons river flows far exceed the demand and excessive waters run to waste into the sea. Although storage dams were built in the past to augment river flows in the dry seasons to meet demand, storage dam development has not been undertaken at a sufficiently rapid rate to cope with the expanding demand. In view of the fact that water demand will increase rapidly from now on, water storage development or the development of water source has to be undertaken on a much bigger scale than in the past. The need for developing water source is urgent for regions which are faced with water shortage at the moment. Such regions include the Perlis/Kedah/Pulau Pinang region, the Klang valley including the Federal Territory, the Melaka/Muar region and the south Johor region.

To overcome water shortage in the Perlis/Kedah/Pulau Pinang region, 10 storage dams need to be constructed including one in the State of Perak to enable water to be diverted from a tributary of Perak river for use in the region.

Table 3 RECOMMENDED DAMS

No.	Name of Dam	State	Purpose	Type of Project	Present Status	Construction Period
1	Ulu Melaka	Kedah	IR	1	Notional	1985 - 1989
2	Aver Tawar	Kedah	IR	1	Notional	1985 - 1989
3	Timah-Tasoh	Perlis	WS,IR,FM	1	Feasibility	1983 - 1987
4	Badak-Temin	Kedah	IR	1	Notional	1985 - 1989
5	Sari	Kedah	IR	1	Notional	1987 - 1991
6	Durian	Kedah	IR	1	Notional	1991 - 1995
7	Ahning	Kedah	WS,IR	1	Design	1983 - 1987
8	Beris	Kedah	WS,IR	1	Notional	1988 - 1992
9	Naok	Kedah	WS,IR	2	Notional	1983 - 1987
10	Reman	Kedah	WS,IR	2	Notional	1983 - 1987
11	Mengkuang	P. Pinang	WS	1	Construction	1981 - 1985
12	Rui	Perak	WS,IR	3	Notional	1985 - 1989
13	Kerian	Kedah/Perak	WS,IR	1	Notional	1985 - 1989
14	Kinta	Perak	WS	1	Notional	1985 - 1989
15	Selangor	Selangor	WS	2	Notional	1985 - 1989
16	Batang Kali	Selangor	WS	2	Notional	1985 - 1989
17	Batu	Selangor	WS,FM	1	Design	1983 - 1987
18	Gombak	Selangor	WS,FM	1	Notional	1986 - 1990
19	Semenyih	Selangor	WS	2	Construction	1981 - 1985
20	Perting	Pahang	WS	3	Notional	1994 - 1998
21	Kenaboi	N. Sembilan	WS	3	Notional	1988 - 1992
22	Kongkoi	N. Sembilan	WS	3	Notional	1992 - 1996
23	Gelami	N. Sembilan	WS	2	Notional	1990 - 1994
24	Teriang	N. Sembilan	WS,IR	2	Notional	1985 - 1989
25	Terip	N. Sembilan	WS,IR	1	Design	1985 - 1989
26	Muar	N. Sembilan	WS,IR	1	Notional	1990 - 1994
27	Palong	N. Sembilan/ Pahang	WS	3	Notional	1985 - 1989
28	Bekok	Johor	WS,FM	4	Design	1983 - 1987
29	Pengeli	Johor	WS	2	Notional	1985 - 1989
30	Semangar	Johor	WS	2	Notional	1985 - 1989
31	Linggiu	Johor	WS	2	Notional	1985 - 1989
32	Sedili	Johor	WS	2	Notional	1987 - 1991
33	Anak Endau	Pahang	IR	1	Construction	1983 - 1987
34	Kemelai	Pahang	IR	1	Construction	1983 - 1987
35	Nal	Kelantan	IR	1	Notional	1985 - 1989
36	Nenggiri	Kelantan	WS,IR,HY	1	Notional	1983 - 1987
37	Golok	Kelantan	IR	1	Feasibility	1985 - 1989
38	Tawau	Sabah	WS	1	Notional	1987 - 1991
39	Meliau	Sabah	WS	2	Notional	1986 - 1990
40	Milau	Sabah	WS	1	Notional	1987 - 1991
41	Wariu	Sabah	WS,IR	1	Notional	1985 - 1989
42	Papar	Sabah	WS,IR,HY	2	Notional	1985 - 1989
43	Limbang	Sarawak	FM	4	Notional	1986 - 1990
44	Liku	Sarawak	WS	1	Notional	1985 - 1989
45	Bengoh	Sarawak	FM	4	Notional	1986 - 1990

Remarks; Type 1 : Intrabasin, Type 3 : Inter-state water transfer
Type 2 : Interbasin, Type 4 : Flood mitigation as major purpose
WS : Water supply, IR : Irrigation, FM : Flood mitigation
HY : Hydropower

For the Klang valley region 8 storage dams are proposed including 2 dams to be constructed in the State of Negeri Sembilan and a dam in the State of Pahang. To meet the requirements of the Melaka/Muar region, 2 storage dams on tributaries of Muar River, one across the boundary between the States of Negeri Sembilan and Johor the other in the State of Negeri Sembilan are proposed and the stored water is to be diverted to meet the demand of the region. Four storage dams are required to be built in the south Johor to provide supply to this region as well as Singapore with which the State Government of Johor has agreements for Singapore to extract raw water from rivers in the State of Johor. Elsewhere 18 storage dams are required to be built to meet incremental water demand for various uses. The list of dams proposed for source development including 3 dams for flood mitigation as major purpose are shown in Table 3.

Some of the storage dam projects are for single purpose while others are multipurpose. In 24 projects, water is used within a basin (intra basin), water developed by 13 dams will be transferred from one basin to another within a state (inter-basin), and 5 dams are proposed to regulate water in one state and transfer to another state (inter-state water transfer). Several projects are already in either feasibility study, design or construction stage but large number of the projects are only notional i.e. projects which have been identified from desk study.

Based on the targets set for the development of domestic and industrial water supply and irrigation development, the source development projects are required to be completed in an appropriate schedule up to 2000. The implementation of irrigation projects and water supply projects should be undertaken to keep abreast of water demands by the respective water use sectors and coordinated with the implementation of the source development projects.

Water use efficiency of existing water resources projects is generally low. In irrigation, the efficiency of water use scarcely exceeds 50% while water losses in most public water supply systems are as high as 30%. In view of the fact that storage sites are seldom readily available for development and that water source development projects tend to be more and more expensive, water use efficiency should be improved through better irrigation water management and better management and operation of public water supply systems. In this regard, the extent of water source development from now on through the year 2000 is based on the assumption that efficiency in water use will be progressively improved and the target is to achieve more than 50% efficiency in irrigation water use and to reduce losses in public water supply systems to 20% in the future.

4.3 Hydropower Development

Potential hydropower projects identified in Peninsular Malaysia can develop 1026 MW. If all these projects identified are developed, the total installed capacity of hydropower plants in Peninsular Malaysia will account for approximately 20% of the total installed capacity required for power generation in 2000. These projects should be developed with a view to reducing dependence on fossil fuels for power generation. Hydropower potential in the States of Sabah and Sarawak should be developed to meet incremental power demand in main demand centers in the two states. Five projects in Sabah and three projects in Sarawak are recommended for development. The development of these projects will increase the total installed capacity in these states by 374 MW and 204 MW respectively.

The hydropower projects recommended for development up to the year 2000 are shown in Table 4. Of the 20 projects, most projects can contribute to water supply, irrigation and

Table 4 RECOMMENDED HYDROPOWER PROJECTS

Project	Purpose	Installed Capacity (MW)	Annual Energy (GWh)	Year of Commission
PENINSULAR MALAYSIA				
1 Telom	HY	98	480	1991
2 Jelai Kechil	HY,FM	60	300	1992
3 Tanum	HY	5	14	1997
4 Jelai	HY	10	34	1996
5 Tembeling	HY,FM	110	440	1988
6 Tekai and Penut	HY,FM	74	370	1990
7 Maran	HY	130	680	1993
8 Ulu Trengganu	HY	100	360	1988
9 Nenggiri	HY,WS,IR	82	430	1988
10 Galas	HY,FM	97	530	1994
11 Lebir	HY,FM	120	410	1991
12 Pergau	HY	100	540	1989
13 Kelantan Barrage	HY	40	275	1995
SABAH				
14 Tenom Pangi Stage III				
- Sook	HY	40	172	1990
- Pangi extension	HY	44	137	1990
15 Upper Padas	HY	170	742	1996
16 Pangi No. 2	HY	90	547	1994
17 Papar Multi-purpose	HY,WS,IR	30	130	1990
SARAWAK				
18 Konowit	HY	110	485	1990
19 Batang Sekrang	HY	46	210	1996
20 Upper Batang Ai	HY	48	225	1998
Total for Malaysia		1,604	7,511	

Remarks; IR: Irrigation, WS: Water supply, FM: Flood mitigation
HY: Hydropower

flood mitigation. This aspect should be taken into account in developing hydropower projects, because multipurpose development can result in not only optimum use of resources but also benefit to people in the areas where the projects are located.

4.4 Water Pollution Abatement and Sewerage Development

Increased water use by the growing population and growing manufacturing and processing industries will result in a corresponding increase in the discharge of effluent and sewage into rivers and waterways. Without increasing the present level of sewage treatment and in the absence of stringent control on effluent discharge from palm oil mills and rubber factories, the BOD load discharged into rivers and waterways will increase markedly, and the BOD concentration in a number of major rivers is expected to increase so high that it will not only adversely affect aquatic life but also will render the water unfit for use.

The Palm Oil Research Institute of Malaysia and Rubber Research Institute of Malaysia encourage disposal of effluent on land whereby BOD load is subject to disintegration into inorganic matters by aerobic bacteria. In 1980, about 25% of the palm oil mills applied the method of disposing effluent on land. It is expected that 50% of palm oil mills will adopt the land disposal method by 1990 and 75% of the mills by the year 2000. Similarly, in the case of rubber factory effluent it is assumed that 10% of the factories will adopt the method by 1990 and 20% by 2000. With the extensive adoption of this land disposal method, the total BOD loads in rivers will be reduced by more than 50%.

In spite of these measures, the BOD load in rivers will remain high. It is estimated that the BOD load discharged into river will still be as high as 533 tons/d by 1990 and 680 tons/d by 2000.

Having paid a serious attention on water pollution in the rivers, the Department of Environment (DOE) intends to limit BOD concentration in the palm oil mill and rubber factory effluent into rivers to 50 mg/lit. It is necessary to improve the purification method in rubber factories and palm oil mills further to meet this limit in the areas where BOD load is still high.

In some areas a large proportion of BOD loads is due to urban sewage. In order to reduce the BOD concentration in rivers to an acceptable level, it is further necessary to construct 11 sewerage projects in cities and towns which are located along rivers.

In addition to these, 20 projects are also recommended in large cities and towns from the standpoint of public health. Table 5 gives the list of sewerage projects recommended for implementation.

4.5 Construction of Flood Mitigation Works

Three alternative plans have been considered for flood mitigation. These plans are to provide protection to 90% of the affected population, to provide protection to 50% of the affected population, and to develop all flood mitigation projects which are economically viable. The cost appears to be prohibitive to provide protection to the flood affected population up to 90%, while the costs for the other two alternatives seem to be in an acceptable range. It is recommended that the plan to provide protection to 50% of the affected population should be adopted, because it can distribute more evenly among the states than the plan to develop all flood mitigation projects which are economically viable. On this basis the recommended plan includes flood mitigation projects for 31 locations which are given in Table 6.

Table 5 RECOMMENDED SEWERAGE PROJECTS

City/Town	1990 Service Factor (%)	1990 Population Served (10^3)	2000 Service Factor (%)	2000 Population Served (10^3)
(A) For River Water Pollution Abatement and Public Health				
Sungai Petani	80	50	100	79
Kulim	65	26	100	54
Shah Alam	60	40	100	141
Petaling Jaya	45	218	100	927
W. Persekutuan	50	710	100	2,039
Kajang/Semenyih	35	15	100	58
Seremban	45	95	100	290
Segamat	50	32	100	104
Kulai/Senai	50	24	100	78
Kluang	40	27	80	67
Pengkal Kalong	85	32	100	56
Total for (A)	-	1,269	-	3,893
(B) For Public Health				
Alor Setar	50	43	60	60
Butterworth	35	36	80	97
Bukit Mertajam	35	12	80	30
Georgetown	70	183	80	235
Taiping	45	111	80	250
Ipoh	45	111	80	357
Telok Anson	45	27	80	55
Klang	20	72	50	307
Port Dickson	40	26	80	51
Melaka	50	49	80	90
Johor Bahru	40	176	80	549
Kuantan	60	200	80	522
Kuala Trengganu	50	189	60	367
Kota Bharu	70	241	80	454
Sub-total for Peninsular Malaysia	-	1,476	-	3,424
Tawau	70	57	80	120
Lahad Datu	70	27	80	67
Sandakan	75	95	80	178
Kota Kinabalu	75	101	80	217
Bintulu	75	26	80	41
Kuching	55	155	80	398
Sub-total for Sabah & Sarawak	-	461	-	1,021
Total for (B)	-	1,937	-	4,445
Total for Malaysia	-	3,206	-	8,338

Table 6 RECOMMENDED FLOOD MITIGATION PROGRAM

Name of River	Canal Improvement (km)	Dam (Number)	Floodway (km)	Ring Bund (Number)	Resettlement (10^3person)	Number of People Protected (10^3person)
Peninsular Malaysia						
Perlis	34	1	-	-	-	25
Kedah	-	-	-	-	-	-
Muda	75	-	-	-	-	54
Perai	4	-	-	-	-	3
Pinang	2	-	-	-	-	11
Kurau	13	-	-	-	-	3
Perak	-	-	50	1	-	256
Buloh	-	-	-	-	-	-
Kelang	36	2	-	-	-	215
Langat	-	-	-	-	-	-
Linggi	41	-	-	-	-	53
Melaka	-	-	5	-	-	52
Kesang	38	-	-	-	-	20
Muar	53	1	-	1	-	45
Batu Pahat	93	1	19	-	-	28
Pontian Kechil	25	-	-	-	-	19
Johor	-	-	-	1	-	5
Mersing	6	-	-	-	-	23
Endau	11	-	-	-	-	18
Pahang	-	3	-	4	10	63
Kuantan	6	-	-	1	-	27
Kemena	-	-	-	1	-	14
Trengganu	29	-	-	1	-	77
Setiu	9	-	-	-	-	2
Besut	33	-	-	-	-	55
Kemasin	-	-	-	-	-	116
Kelantan	65	2	-	1	-	406
Total	573	10	74	11	10	1,590
Sabah						
Tawau	-	-	3	-	-	17
Bongan	56	-	-	-	-	25
Kadamaian	16	-	-	-	-	13
Putatan	12	-	-	-	-	22
Total	84	-	3	-	-	77
Sarawak						
Limbang	-	1	-	-	-	5
Miri	-	-	5	-	-	28
Niah	-	-	-	1	-	1
Kemena	30	-	-	-	-	17
Rajang	21	-	-	-	-	9
Sarawak	142	1	-	-	-	62
Total	193	2	5	1	-	122
Total for Malaysia	850	12	82	12	10	1,789

Flood mitigation measures include structural and non-structural measures. Structural measures are channel improvement to enlarge the discharge capacities of rivers; bypass floodway whereby a bypass channel is provided to discharge the excess water which cannot be handled by the existing river channel; poldering which is generally in the form of a flood protection bund surrounding the area to be protected; and flood control dam which is to retain flood waters temporarily upstream of the protected area. Construction of storage dams solely for flood control purposes can seldom be economically justified. For this reason it is necessary to consider flood control along with other purposes in storage dam development.

Where it is not possible to effectively reduce floods and flood effects by structural measures, non-structural measures such as the restriction of development in flood prone areas to reduce potential damage and resettlement of flood affected people in areas frequently subject to severe flood damage will have to be resorted to.

5. FINANCING SYSTEM

5.1 Financing Water Resources Development Projects

5.1.1 Magnitude of financing

The estimated cost for implementing the water resources development and management projects as outlined in Chapter 4 has been prepared to show the order of public investment up to the year 2000 in four segments coinciding with the Fourth, Fifth, Sixth and Seventh Malaysia Plan periods. In addition, estimated recurrent expenditure for operating and maintaining newly completed projects has also been prepared. These are shown in Table 7 and Table 8 respectively.

The investment cost and recurrent expenditure have been prepared at 1980 constant price. It is to be noted that accelerated investment will have to be made during the Fifth and Sixth Malaysia Plan periods to meet the requirements of the various water use sectors.

Total public development expenditure required for water resources development up to 2000 is of the order of M$40 billion which gives an order of magnitude equal to the total development expenditure of the Fourth Malaysia Plan. In addition, public recurrent expenditure required for the operation and management of newly developed water resources projects over the same period amounts to M$8 billion.

5.1.2 Existing financing arrangements

Water resources development projects are financed as direct federal projects, federally reimbursable projects and state projects. This classification is in accordancw with the respective and joint responsibilities of the Federal and State Governments. Financing, operation and maintenance of

Table 7 INDICATIVE ESTIMATE OF PUBLIC DEVELOPMENT EXPENDITURE FOR WATER RESOURCES DEVELOPMENT

Unit: M$10^6

Sector	4MP	5MP	6MP	7MP	Total
Source Development	976	3,859	1,031	177	6,043
Irrigation	273	1,748	1,115	870	4,006
Inland Fishery	26	90	447	400	963
Public Water Supply	2,363	4,675	5,131	2,077	14,246
Public Water Supply; Pre-treatment facilities	182	197	122	47	548
Public Sewerage (Effective for river water pollution abatement)	573	953	952	382	2,860
Public Sewerage (Others)	672	1,188	1,226	490	3,576
Flood Mitigation	131	487	856	1,077	2,551
Hydropower	774	3,026	2,506	190	6,496
Total	5,970	16,223	13,386	5,710	41,289

Remarks; (1): At 1980 constant price
(2): The amount shown for public water supply and irrigation in 4MP does not include the amount required to provide necessary supply capacity by 1985.

Table 8 INDICATIVE ESTIMATE OF PUBLIC RECURRENT EXPENDITURE FOR WATER RESOURCES DEVELOPMENT

Unit: M$10^6

Sector	4MP	5MP	6MP	7MP	Total
Source Development	0	32	120	145	297
Irrigation	0	20	152	235	407
Inland Fishery	0	3	26	65	94
Public Water Supply	0	415	909	1,342	2,666
Public Water Supply; Pre-treatment facilities	0	128	160	168	456
Public Sewerage (Effective for river water pollution abatement)	0	191	382	542	1,115
Public Sewerage (Others)	0	230	469	675	1,374
Flood Mitigation	0	101	274	556	931
Hydropower	0	23	97	153	273
Total	0	1,143	2,589	3,881	7,613

Remarks; (1): At 1980 constant price
(2): The amount shown is operation and maintenance cost of facilities which are proposed to be commissioned after 4MP.

public water supply projects are the responsibility of State Governments. Drainage and irrigation appears in the Concurrent List of the Constitution. Drainage and irrigation projects are therefore financed as direct federal projects, federally reimbursable projects as well as state projects. As water power is a federal matter in Peninsular Malaysia but a concurrent matter for the States of Sabah and Sarawak, the Federal Government undertakes hydropower development in Peninsular Malaysia through the National Electricity Board, a statutory body, while the State Governments of Sabah and Sarawak undertake hydropower development projects through the state statutory bodies, Sabah Electricity Board and Sarawak Electricity Supply Corporation respectively. As for sewerage projects, the responsibility rests with Local Authorities.

As in the case of other development projects, water resources development projects are financed from the Federal Consolidated Fund, the receipt of which is derived from tax revenue, non-tax revenue and non-revenue receipt sources. Similar to the Federal Government system, each state also has a consolidated fund which is used to finance development projects. In the case of public water supply projects, the State Government also establishes a water supply fund which consists of a transfer payment from the State Consolidated Fund, federal loan and water charges collected from consumers.

Although Article 82 of the constitution which provided for the distribution of financial burden relating to matters on the Concurrent List appears to imply that Federal Government pays for federal matters and State Governments for State matters, there are in fact sufficient provisions under the existing constitutional framework for Federal Government to finance the development expenditure on State matters. The Federal Government has undertaken to finance some State projects on a reimbursible basis, while the Development Fund Act and the Revenue Growth Grant Act allow Federal Government to

finance state projects specified in a scheduled list. For recurrent expenditure, Federal Government may cover deficits in State accounts through the State Deficit Grant under the State Reserve Fund.

5.1.3 Financial situations relating to water resources development projects by sector

(1) Public water supply

In most states, public water supply is undertaken by either the Water Supply Division of the State Public Works Department (SPWD) or a State Waterworks Department. The exceptions in Peninsular Malaysia are Pinang and Melaka where a water authority is established for undertaking public water supply projects. In Sarawak, the Kuching and Sibu Water Boards are responsible for the water supply in these two towns and their environs. In Sabah, the Sabah Water Authority will be established under the Sabah Water Authority Enactment 1982.

As noted above, public water supply projects are financed from fund transferred from the State Consolidated Fund, loan from the Federal Government, water charges collected and also since 1974, federal grant in respect of rural water supply.

Average water charges differ from state to state ranging from 22 cents/m^3 in the State of Perak to 88 cents/m^3 in the State of Sabah. Generally, the charge rates have not been revised for a long time; the water charge rate in Sabah was revised in January 1981 after a period of more than 20 years. Although public water supply projects are supposed to be self-financing, in the great majority of cases, water charges only cover the operation and maintenance expenditure and do not cover the cost of capital works. Pinang Water Authority, Kuching and Sibu Water Boards are among the few self-paying concerns.

Apart from the above-mentioned urban and rural water supply, two rural water supply systems have been implemented. One is the system integrated in FELDA and the other is untreated water supply system under the Rural Environmental Sanitation Program (RESP), the capital costs of both systems being fully financed by federal grant. The former is constructed and managed by the state water supply agency and the latter is constructed by the community with financial and technical assistance from the Ministry of Health (MOH) and managed by the community served.

(2) Drainage and irrigation projects

Irrigation, agricultural drainage and flood mitigation projects are largely financed by the Federal Government as direct federal projects or federally reimbursable projects. Once completed, the projects are handed over to the State Governments concerned for operation and maintenance. The exceptions are the Muda irrigation project and the Kemubu irrigation project which are operated by MADA and KADA respectively, both these authorities having been established by the Federal Government.

In the great majority of cases, irrigation water rates and drainage rates are nominal; the rates collected do not cover even operating and maintenance expenditure. Consequently, the O&M cost of many completed projects are heavily subsidized by the State Governments. No rate has been levied for flood mitigation projects.

(3) Sewerage projects

Sewerage projects are undertaken by local authorities which impose a charge (sewage charge) for the use of public sewerage systems in the form of a surcharge to the water charge levied by a water supply agency. In addition, for the purpose of recovering operating expenditure and depreciation cost of sewerage systems, either an additional house assessment rate is levied or a part of the assessment rate collected is transferred for the purpose.

In new development, developers of housing and industrial estates are required to construct at their own expense the necessary sewerage systems or meet the cost for expanding existing public sewerage systems to serve the estates. In existing development, the construction cost of trunk and branch sewers is either borne by the local authority or by individual users. The cost of house connection to a public sewer is borne by the house owner concerned.

(4) Hydropower projects

Power generation is self-paying. The National Electricity Board and Sarawak Electricity Supply Corporation have shown reasonable surplus but the Sabah Electricity Board account has been in deficit since 1974, its operation being affected by rising fuel prices.

External loans have been raised to finance hydropower development. Although SEB and SESCO are both state statutory bodies, external loans to finance them are raised through the Federal Government.

5.2 Recommended Financing System

5.2.1 General criteria for charging

In water resources development and management projects, the mode and extent of cost recovery in respect of public facilities and services provided in different countries are many and varied. They range from zero recovery to full cost recovery including the recovery of interest. In between, partial cost recoveries are made in accordance with different criteria and socio-political considerations.

An accelerated and a large amount of investment will be required in developing water resources keeping up with rapid socio-economic development guided by the Malaysia Five Years Development Plan. To meet this requirement, not only effective investment but also efficient one including recovery on public expenditure should be ensured.

Two general criteria are recommended here for formulating water charging policy. The first is that the beneficiaries are required to share, according to the benefits they receive, the entire cost of the public facilities including construction, operation and maintenance costs if the beneficiaries are identifiable and are confined to certain section of the community; this cost should not be covered by tax revenue collected from general tax payers who include non-beneficiaries but should be recovered from the beneficiaries as a separate charge. This criterion is based on the free market economy principle and the principle of equity which encourages economic efficiency and optimum allocation of national resources.

The second criterion is that government grant in water resources development and management projects should be provided only if it is necessary in order to encourage the beneficiaries' participation in development or to provide social amenities from the standpoint of subsidizing low income people.

5.2.2 Charging policy for public water supply

The benefit of public water supply systems is only extended to those who are served by the systems. In principle, all cost of water should be collected from that section of the population benefited by the systems rather than depending on tax revenue. However, rapid expansion in water supply facilities will have to be undertaken from now on and will be continued for some time, during which the self-paying operation may not be practicable due to increasing burden for repayment of heavy loans and interests. In such a case, it may be necessary to consider providing grant to partly finance public water supply projects. In respect of rural water supply projects, federal grant for such projects should be continued for the time being in view of low level income in the rural areas. The federal grant for rural water supply could be

justified by the constitutional provision that Federal Government may from time to time, after consultation with the National Finance Council, make grant for the purpose of development or generally supplement the revenues of the states (Article 109 (6)) or it could be justified by the fact that health and sanitation are concurrent matters.

Effort should be made to encourage sound financial management in public water supply projects. Water tariff should be reviewed regularly. Until the time when self-paying operation can be established at each water supply system, it is desirable to apply a common water tariff throughout a state with the exception that the areas operated by a self-paying water supply agency be excluded.

One of the objectives of public water supply is to provide essential amenity for general social well-being. Water tariff should be so designed as to impose a low water charge rate for the minimum consumption to meet basic needs. To encourage water saving, a progressive water charge rate should be introduced. In the case of FELDA and RESP water supply systems which are provided to meet basic needs, the beneficiaries should only meet the cost of maintenance and operation of the project.

5.2.3 Charging policy for sewerage projects

The benefits of public sewerage system accrue mainly to the direct users of the facilities. Non-users living in the area may only benefit by the improved public health environment attributable to the sewerage works. The charging system in sewerage projects should be based on self-paying principle and separately accounted for. Sewerage charge in the form of a surcharge to the public water charge should be determined in accordance with this principle taking into account the capacity of the beneficiaries to pay. House assessment revenue may be considered as another revenue source of sewerage account for supplementing the revenue accruing from sewerage charge in

the event that such a charge alone cannot fully recover costs. House assessment revenue accrues from the assessment rate imposed on the whole area regardless whether it is entirely served by the sewerage system or otherwise. Allocating certain portion of the revenue accruing from house assessment rate to the sewerage account is considered acceptable if the public sewerage system is ultimately to be extended to serve the whole area for reason of public health improvement and for administrative efficiency. In new development the developers of housing or industrial estates should either construct the necessary sewerage system at their own expense or bear the cost of extending the existing facilities to serve the new area.

To encourage the development of public sewerage system Federal Government should continue to extend loan to local authorities for the construction of such systems. In respect of areas where sewerage development is urgently needed from the standpoint of public health improvement and river water pollution abatement, it is recommended that the Federal Government extend a soft loan to the local authorities concerned.

5.2.4 Charging policy for irrigation, agricultural drainage and flood mitigation projects

As noted above, cost recovery in respect of irrigation and agricultural drainage projects is minimal. In a number of projects, no attempt has been made to recover even the operation and maintenance cost. Although irrigation and agricultural drainage projects are constructed to benefit solely the farmers concerned, in view of the fact that income of farmers is still low at the moment and that a large number of them may not be drawing an income above the level of sub-sistence, no full cost recovery is recommended. Irrigation water rate and drainage rate should be charged to recover operation and maintenance cost taking into consideration

the farmers' real income. A part of the rates chargeable may also be offset by direct participation in operation and maintenance by farmers.

It is difficult to quantify the entire monetary benefits and to define precisely the beneficiaries of flood mitigation project. Probably because of this difficulty no flood mitigation charge has been imposed as such in other countries. It is not recommended that a flood mitigation charge be levied. Federal and State Governments should continue to finance flood mitigation projects.

5.2.5 Charging policy for urban drainage projects

An urban drainage system is a network of main, secondary and tertiary drains, primarily serving the purpose of collecting and conveying drainage water from discrete areas in a town. Very often no simple relationship can be established between individual beneficiaries and that part of the drainage facilities serving them. However, it should be borne in mind that an urban drainage system in the aggregate, serves all the people in the town concerned. The cost of main, secondary and tertiary drains should be financed from tax revenue of local authorities and the cost of infrastructure drains in the discrete areas should be borne by those individuals who directly benefit from them.

5.3 Financing of Multipurpose Projects

A number of water source development projects recommended by this Study are multipurpose projects. A multipurpose development project is usually more economical than a single purpose development project because of the merit of scale and the joint use of facilities. Furthermore such a multipurpose project permits the use of available resources to the optimum. However, there are as yet no rules established for cost sharing

of multipurpose development projects among the water use sectors or the agencies representing the water use sectors concerned.

Multipurpose projects often serve more than economic development objective; they may also provide social and environmental benefits. For example, a water source development project may also serve concurrently the function to ensure the maintenance of minimum flow in the river; an irrigation development that depends on a water source development project may be based on both economic and social consideration; a flood mitigation project involving detention storage which forms a component of the multipurpose water source development is often implemented from the standpoint of social well-being rather than economic development. Because of this, all the possible effects and benefits of a multipurpose water source development project cannot be precisely quantified in monetary terms for cost allocation purpose. However, to the extent possible, it is necessary to establish rules for cost allocation which should be based not only on cost and benefit consideration but also on social and political considerations. Finally in order to encourage all water use sectors to participate in multipurpose projects with a view to achieving a higher economic efficiency and the optimum use of resources, Government should consider providing soft loans to those sectors which have a slow economic return.

5.4 Compensation for Adverse Effects

The implementation of water resources development projects often has adverse effects such as the submergence of agriculture lands and houses by a storage reservoir. The parties (be it the states or the individuals) affected by such adverse effects should be equitably compensated and the cost for compensation should be counted as part of the project cost.

All adverse effects cannot be quantified in monetary terms. Compensation in cash may not be appropriate in all cases. It may be desirable to make compensation in goods and services, for example, in equivalent land and housing to permit a farmer to continue to be productive, rather than in cash.

6. WATER ADMINISTRATION

6.1 Existing Administrative Arrangements

The existing administrative system affecting water resources development and management covers various aspects and administrative actions take place at Federal, State and District levels. These actions have evolved over a period of time. A review of the existing administrative system has shown that, in a number of aspects, the administrative arrangements are not adequate to meet the requirements for present day water resources planning and management. Integrated and coordinated planning and management of water resources is in particular lacking. Accordingly, the following additional administrative actions are recommended.

6.2 Recommendation on Water Administration Systems

6.2.1 Planning and allocation of resources

The planning of water resources development projects and the allocation of development funds for their implementation are undertaken as part and parcel of the preparation of the Malaysia Five Year Development Plans. The inclusion of additional development projects is also made during the mid-term review of a Development Plan. The planning of programs and projects is essentially coordinated by federal departments and agencies responsible for the various water use sectors mainly from the technical standpoint and is adjusted by the Economic Planning Unit (EPU) of the Prime Minister's Department from the overall socio-economic and financial standpoint. The various sectoral plans for water resources development are seldom coordinated from the standpoint of maximizing efficiency in water resources development and management, as these plans are prepared independently.

In order to achieve integrated planning for optimum use of resources and conservation of water resources for long-term exploitation, it is necessary to institute an overall planning for water resources development at the national level, i.e. the preparation of a national water resources master plan, which will translate the National Water Policy and targets into long-range programs to facilitate allocation of resources. Such programs should be coordinated with other socio-economic development programs related to water resources. Many water resources development projects have long gestation periods. The national water resources master plan should be prepared with future problems and needs in view, in order to provide the necessary direction to sectoral water resources planning in a meaningful way.

All acts in water resources development and use in a river basin affect one another through the river systems of that basin. Thus rivers and water resources facilities such as dams and water control structures etc. together constitute an integrated water resources system. The water resources system may include more than one river basin in the case where water is transferred from one or several basins in order to balance supply and demand. In practice, in areas of heavy demand, therefore, there are many cases that more than one river basin should be regarded as one region in water resources development and management. At the regional level, regional water resources master plans should be prepared within the framework of the national water resources master plan. The regional master plan should be prepared to the extent to demonstrate specific water resources projects to be implemented, their priority ranking for implementation and implementation schedule. Thus it should provide the conditions for the feasibility study of the specific projects.

6.2.2 Management and control of resources

(1) Low flow management

The major part of water resources appears as river flow. Simple control of these resources has existed since early days. Under the Waters Enactment which is enforced in many states in Peninsular Malaysia, District Offices issue a water licence to permit any private individual to divert water from a river for use. Mines Department also issue licences for the diversion of water from a river for mining purposes. Government departments and agencies are exempted from this requirement of obtaining a licence for diverting water for their respective use. District officers and Inspectors of Mines consult the Drainage and Irrigation Department and generally rely on the latter's judgement as to whether or not water is available in a river and whether or not further withdrawal of water will affect existing users. Although the Drainage and Irrigation Department has undertaken hydrological observation at a number of hydrological stations, the flow data available are not adequate to attain accuracy in judgement. Besides the Drainage and Irrigation Department (DID) has not maintained record of existing water use by Government agencies and private individuals.

As water use increases more and more, there will be a need to maintain a minimum river flow to permit water to be allocated to all legitimate users. Such a low flow should be established for each river and will serve as an indicator of the allowable limit of water withdrawn taking into account existing water use, the need to maintain operation of intake structures and other river facilities as well as hydrological and environmental conditions. As a requisite for this, an inventory should be maintained showing locations, purposes of water structures, quantities of all water withdrawals from a river as well as quantities and quality of all discharges into the river so that a complete account of the water use can be made. Strengthening hydrological observation is also a requisite.

(2) Water quality management

Direct and indirect control of pollution of rivers is at present exercised by a number of government departments including Department of Environment (DOE), Mines Department, Forestry Department, etc. Actions by these departments are taken independent of one another and are not coordinated. In order to exercise effective control, river water quality standard should be established for each important river. River water pollution control requires technical knowledge of a specialized nature. It is therefore necessary that DOE, which is responsible for environmental quality, establishes criteria for determining river water quality standard and makes recommendation on measures to be taken by agencies responsible for controlling pollutants from the respective sectors affecting river water quality.

(3) Flood mitigation and urban drainage

Flooding in urban areas is partly due to the lack or the inadequacy of urban drainage systems. In an environment of active urbanization which is taking place in a number of major towns and cities, the rapid conversion of forest and agricultural lands into urban land use has resulted in a drastic increase in surface runoff following a storm. Existing streams and drainage channels in towns and cities undergoing rapid urban development and expansion become inadequate to contain these increased storm runoffs and in consequence the incidence of flash floods increases. The worsening condition is often compounded by the fact that due to inadequate measures to control soil erosion at building and road construction sites, silting of existing stream and drainage channels takes place thereby aggravating flooding conditions.

An urban drainage system generally consists of an existing stream which serve as the main drainage channel to collect and convey all drainage water from a defined drainage basin to a river and it is generally termed a trunk drain, and a

system of secondary and tertiary drains, either natural or man-made, with ancillary structures for water control purposes. The tertiary drains are generally connected with infrastructure drains such as housing estate drains, town drains, road side drains, etc.

The drainage of a town is generally by gravity drainage and this is governed by the water level of the river into which a trunk drain discharges. River floods may therefore cause inundation in a town; on the other hand, a drastic increase in the discharge from an urban drainage system may overload a river to cause upstream or downstream flooding in other areas.

The planning and design of urban drainage systems for town drainage or with flood mitigation in view should therefore be coordinated with the plans for the improvement and maintenance of rivers which are affected by and affect town drainage and other developments.

(4) Groundwater management

Groundwater resources are comparatively limited in Malaysia. In the next two decades, it is unlikely that groundwater will be extensively exploited, because of the comparative advantage of using surface water resources except in areas such as Kota Bahru, Sandakan, Labuan and certain coastal areas in Sarawak. Problems may occur in areas where overexploitation of groundwater takes place. Such problems include reduction in yield in existing wells, sea water intrusion and land subsidence. Groundwater problems are difficult to predict but their effects are often irreversible. The resort generally is to prohibit new development once a problem has been detected.

At present there is no control over groundwater withdrawals. As a positive step towards introducing control over groundwater resources, it is necessary that a permit system

be introduced whereby all withdrawals of groundwater are licensed in the areas where overexploitation is expected. At the same time a monitoring system should be established in respect of areas where groundwater is being used with a view to preventing overexploitation.

6.3 Coordination System in Water Resources Development and Management

Coordinated actions are in existence to some extent between central agencies and the relevant technical departments, between Federal and State Governments, and between State Governments concerned in the field of water resources development and management. In undertaking water resources activities in future within the framework of water resources development and management as discussed in this Master Action Plan, it is necessary to strengthen certain aspects of coordination, which are discussed as follows.

6.3.1 Inter-agency coordination

A number of water source development projects to be developed from now on will be multipurpose projects. In such projects, water resources will be allocated for use by the relevant sectors. The allocation of water resources to the sectors concerned will be based on consideration not only for the water demands of the individual sectors but also for the different levels of risk to be accepted by the individual sectors in the event of water shortage. These issues need to be considered at project planning as well as project operation stages, and agreement on them should be reached among agencies concerned. In addition, consultation should also be held with regard to technical standards for the design and management of water source development facilities including criteria to be used to determine the risk levels for differnt water users.

6.3.2 Inter-state coordination

Future water resources development, use and management will more and more be undertaken on the regional basis. In order to match supply with demand it would be necessary to transfer water from a river in one state to a river in another state, to share water between two or more states from one common river, or to store water in one state to be diverted for the use by another state. Indeed inter-basin and inter-state transfers of water will be an important feature in the national water resources master plan. The formulation of water resources development and management projects will require early consultation and close cooperation among the State Governments concerned. Federal Government leadership and appropriate participation in such consultation is necessary.

Among the matters that need to be discussed in inter-state transfer of water are water allocation, land ownership and right-of-way, ownership of facilities, respective responsibilities in project implementation and management, cost allocation and charging system. In all these matters the Federal Governments may fulfil a very positive role by way of coordination, preparation of water transfer plan and if necessary, arbitration.

6.3.3 Federal-State coordination

In implementing water resources development projects, especially water source development and hydropower development projects, it may be necessary to reconcile the national objective and the interests of State Governments to each other. Difference in interest may occur when a project implemented in accordance with national water policy conflicts with the plan of a State Government. To overcome such difficulties, consultation between Federal Government and State Governments concerned in formulating national and regional water resources

master plans would be necessary, so that the state interest can be taken into consideration in project planning and so that the plans of the state can be adjusted to the project's requirements.

7. INSTITUTIONAL FRAMEWORK

7.1 Existing Institutional Arrangements

Existing institutions in water resources development and management have been developed to undertake activities in the major water use sectors in accordance with needs and in conformity with federal and state responsibilities under the constitution. Generally, these institutions have been considerably established over time. They include the departments and agencies concerned with public water supply, irrigation and drainage, hydropower, and sewerage.

7.1.1 Public water supply

Water supply organizations including the Water Supply Division of the Federal Public Works Department headquarters, State Public Work Departments in Peninsular Malaysia, Public Waterworks Departments in the States of Perak, Selangor and Negeri Sembilan, Pinang and Melaka Water Authorities, Public Works Departments in the States of Sabah and Sarawak, Sabah Water Authority (to be established), Kuching and Sibu Water Boards in the State of Sarawak are responsible for public water supply. In addition, the Engineering Services Division and State Directors of Medical and Health Services of the Ministry of Health assist rural water supply in certain areas. The respective responsibilities and spheres of activities of the departments and agencies are fairly well defined.

7.1.2 Drainage and irrigation

Drainage and irrigation is the responsibility of the Federal Drainage and Irrigation Department headquarters (the Division of Drainage and Irrigation of the Ministry of Agriculture) and the 13 State Drainage and Irrigation Departments.

Apart from irrigation and agricultural drainage, these departments are also responsible for river conservancy, flood mitigation, both these functions relating to water resources control and management, and hydrology and water resources assessment. The responsibilities of the Drainage and Irrigation Departments are well defined except that in the case of flood mitigation their responsibility in urban areas needs to be clarified (see paragraph 7.1.5 below).

7.1.3 Hydropower

The National Electricity Board, the Sabah Electricity Board and the Sarawak Electricity Supply Corporation are responsible for hydropower development in Peninsular Malaysia, Sabah and Sarawak, respectively.

7.1.4 Sewerage development

Existing sewerage schemes were constructed by Local Authorities, which are also responsible for operating and managing the completed systems. Federal assistance is given to State Governments and Local Authorities in the study and design of sewerage projects through the Ministry of Housing and Local Government, which takes initiative to promote sewerage development in cities and towns from the standpoint of health and sanitation.

7.1.5 Flood mitigation and urban drainage

The Local Authority is responsible for urban drainage, so far as existing laws provide, and flood mitigation is under the responsibility of the Drainage and Irrigation Department. It appears, however, that the interface between urban drainage and flood mitigation has yet to be designated. In the past the Drainage and Irrigation Department implemented flood mitigation projects affecting urban areas. At present this department continues to implement such projects and also urban drainage projects in some cases on an ad hoc basis.

Since flood mitigation plans to alleviate flooding in urban areas often affect rivers and entail river improvement works and the construction of major water control structures including flood detention dams on rivers outside the boundaries of cities and towns and such plans affecting rivers have to be prepared on the basis of an entire river basin, and since river conservancy is already one of the technical functions of the Drainage and Irrigation Department, it is recommended that all flood mitigation plans including those affecting urban areas should be prepared by the Drainage and Irrigation Department; the planning, construction and maintenance of trunk drains in urban area should also be undertaken by this department taking into consideration present and future development. Other than trunk drains, urban drainage plans should be prepared as an integral part of town planning and implemented by the Local Authorities. In this way, the responsibilities can be rationally defined and compatibility between flood mitigation measures and town drainage plans maintained through coordination between the Drainage and Irrigation Department and Local Authorities.

7.2 Need for Strengthening Existing Institutional Framework

As noted above responsibilities and technical competence have been developed in the departments and agencies of water use sectors, so far required in the past when water problems in one sector generally took place not affecting another sector. However, due to rapid expansion of their development programs in recent years and the lack of adequate funds in some cases to maintain the completed water resources projects, coupled with the shortage of experienced personnel, the performance and efficiency in certain sectors has been below optimum. The agencies and departments concerned are fully aware of the need for improvement and are taking actions in this regard.

There are as yet no proper institutional arrangements to coordinate the various sectoral activities in water resources development and management with the view to achieving greater national socio-economic efficiency in the field of water resources as a whole, to optimizing the use of water, financial and manpower resources and to preventing or forestalling competition and conflict among water use sectors in the sharing and use of water resources in a river bain or in a region having the same water resources system. It is therefore necessary that the existing institutional framework be extended and strengthened to overcome this inadequacy and to undertake the various additional administrative actions discussed in Chapter 6.

7.3 Recommended New Institutions

The expanded framework recommended includes institutions to be established at federal and state levels. At the federal level, a National Water Resources Committee (NWRC) and a Federal Water Resources Division (FWRD) within the Economic Planning Unit of the Prime Minister's Department should be established to formulate and update the national water policy, to provide leadership and guidelines in the preparation of the national water resources master plan and the regional water resources master plans. At the state level, a State Water Resources Committee (SWRC) and a Water Resources Division (SWRD) within the State Economic Planning Unit should be established in each state to undertake the preparation of a regional water resources master plan and to institute and supervise water resources management and control. In addition, a federal statutory body, the Water Resources Development and Management Corporation (WRDMC) should be established to implement and operate certain water source development projects. The relationship of these institutions is shown in Fig. 1.

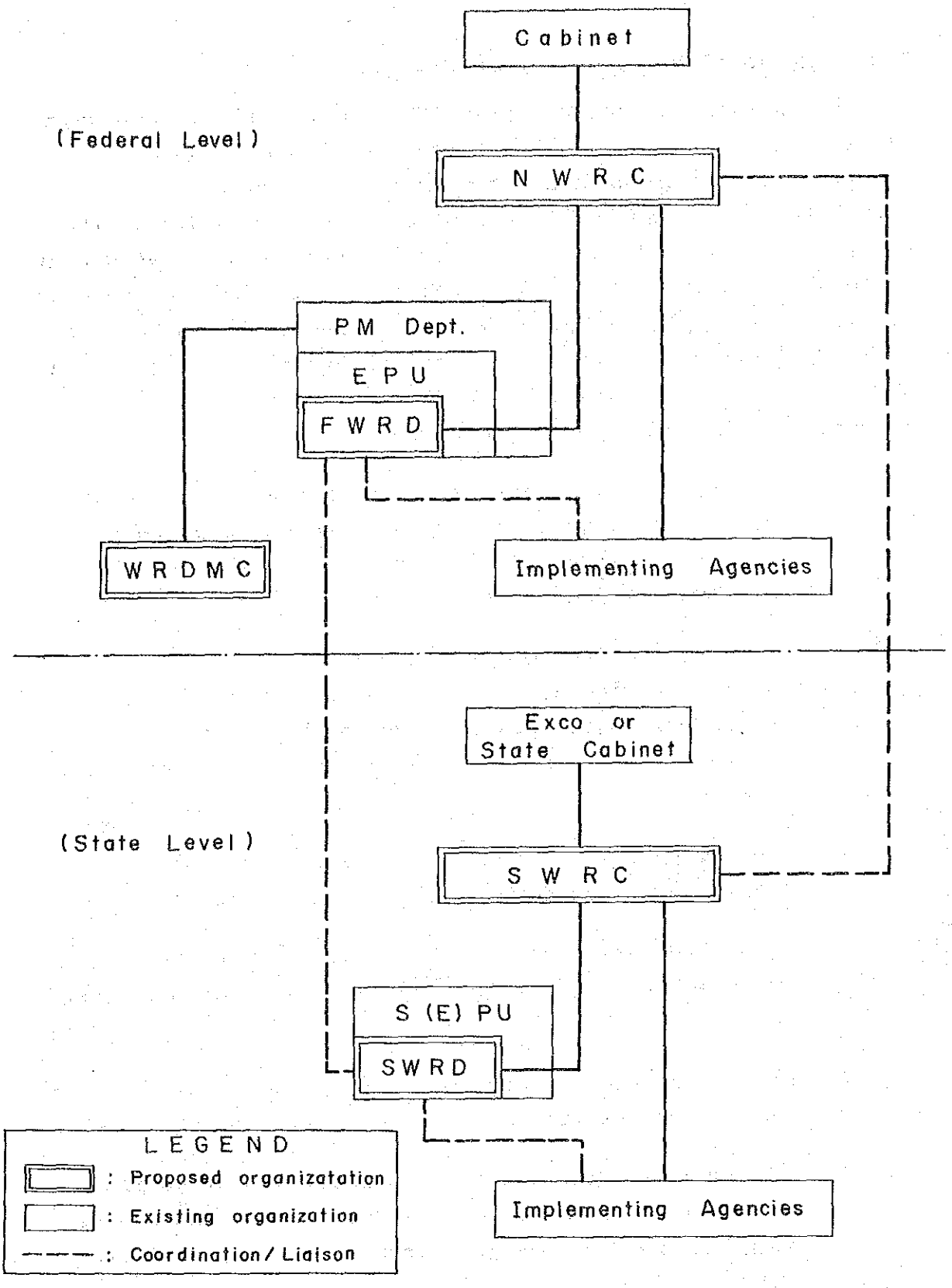

Fig. 1 Relationship Among Existing and Recommended Organizations

GOVERNMENT OF MALAYSIA
NATIONAL WATER RESOURCES STUDY MALAYSIA
JAPAN INTERNATIONAL COOPERATION AGENCY

7.3.1 National Water Resources Committee

The National Water Resources Committee will be responsible for appraising the national water policy and water resources master plans and for submitting these to Cabinet for approval. In so doing it should not only coordinate the programs and projects for the various water use and management sectors but also reconcile the national policy and the interest of State Governments to each other. It should be capable of exercising highly technical and administrative value judgements which should not be biased by any sectoral interests. Its functions should include the following:

(1) to appraise in consultation with State Governments the national water policy and the national water resources master plan prior to obtaining the approval of Federal Government;

(2) to appraise in cooperation with State Water Resources Committees concerned regional water resources master plans prior to obtaining the approval of Federal Government and State Governments concerned;

(3) to advise the Cabinet on policy matters related to water resources development and management;

(4) to coordinate water resources development and management programs for the various water use sectors;

(5) to coordinate the activities of State Water Resources Committees;

(6) to consider and to approve guidelines for macro planning in water resources development and management in order to maintain consistency and uniformity; and

(7) to designate water resources development projects to be undertaken by the Water Resources Development and Management Corporation.

The National Water Resources Committee should comprise the Director General of the Economic Planning Unit as Chairman and the Director Generals or their representatives of federal departments and agencies related to water resources as members. Representatives of State Water Resources Committees should be included in the committee as necessary as co-opted members. The secretariat for this committee should be provided by the Federal Water Resources Division.

7.3.2 Federal Water Resources Division

The Economic Planning Unit of the Prime Minister's Department being the central planning and coordinating agency is well placed to undertake the task of preparing the national water policy and national water resources master plans not only from the standpoint of maintaining consistency between the policy and plans for the water resources sectors and those for the other socio-economic sectors but also from the standpoint of overall allocation of resources for the optimum development. Although the Economic Planning Unit has coordinated water resources development plans prepared by technical departments and agencies, it is not equipped to undertake the preparation of long-term water resources master plans and to provide leadership to federal departments and agencies as well as State Governments in this regard. It is therefore recommended that a Federal Water Recourses Division staffed with personnel competent for integrated water resources planning and water resources engineering should carry out the following functions:

(1) to prepare the national water policy and national water resources plan for appraisal by the National Water Resources Commitee;

(2) to prepare regional water resources master plans for appraisal by the National Water Resources Committee and State Water Resources Committees concerned;

(3) to prepare guidelines for water resources planning, development and management in order to maintain consistency and uniformity;

(4) to appraise major water source development and management projects; and

(5) to assist State Governments in matters related to water resources.

7.3.3 State Water Resources Committee

At the state level, a State Water Resources Committee should be established in each state to undertake the following functions:

(1) to appraise in cooperation with the National Water Resources Committee the regional water resources master plan for approval by the State Government;

(2) to coordinate the preparation of water resources development programs and projects by State Departments and agencies concerned;

(3) to appraise water resources projects to be implemented in the State;

(4) to approve plans for low flow management and water quality management and to coordinate emergency actions to be taken in the event of a drought or a flood; and

(5) to advise State Governments on policy matters related to water resources.

The State Water Resources Committee should comprise the Director of State Economic Planning Unit as Chairman and State Directors of departments and agencies, district officers as members. Its secretariat should be provided by the State Water Resources Division.

7.3.4 State Water Resources Division

In parallel with the Federal Water Resources Division, a State Water Resources Division should be established within the State Economic Planning Unit in each state and should be staffed with water resources engineers to undertake the following functions:

(1) to coordinate the planning of water resources development and management projects in the State;

(2) to prepare plans for low flow management and for river water quality management;

(3) to appraise applications for water licence and make appropriate recommendation; and

(4) to appraise applications for abstraction of groundwater and make appropriate recommendation.

7.3.5 Water Resources Development and Management Corporation

As discussed in Chapter 4, Implementation Program, a number of water source development projects need to be implemented. The implementation of these projects requires forward planning and consultations with the departments and agencies concerned as well as State Governments concerned. For systematic implementation of these projects, it is desirable that a specialized agency be established. Such an agency can also bear the responsibility to operate and manage water source facilities which are jointly used by two or more water use sectors because of its neutral position.

The functions of the Water Resources Development and Management Corporation should include the following:

(1) to undertake the construction of water source development projects such as dams, barrages and diversion facilities designated by the National Water Resources Committee;

(2) to undertake the construction of dams, barrages and diversion facilities of state/inter-state water resources development projects at the request of the state/states concerned; and

(3) to undertake the operation of a series of dams, barrages and diversion facilities within a water resources region in accordance with rules established by agencies/states concerned.

7.4 Alternative Arrangements

There are several alternative forms for the proposed new institutions. One of them is that, in order to facilitate decision making, the National Water Resources Committee should be chaired by the Chief Secretary to the Government and a State Water Resources Committee should be chaired by the State Secretary concerned and State Secretaries are made members of the National Water Resources Committee. Should it be desirable to facilitate consultation at policy level the National Water Resources Committee can be replaced by a National Water Resources Council which should be established in similar line as the National Land Council. On the other hand, in order to accord greater executive power to this body, a National Water Resources Commission may be established.

It is however recommended that the new institutions be arranged as presented in Section 7.3 above as such an arrangement could be superimposed upon the existing institutions without much difficulty. The required staff for the new

institutions can be built up progressively in accordance with actual needs. It is recommended that for a start, experienced and competent staff be seconded from existing departments and agencies.

8. LEGAL PROVISIONS

8.1 Constitutional Consideration

Articles 73 - 81 of Part VI of the Federal Constitution define the legislative and executive powers in Malaysia. In general, the Federal Parliament may make laws for the whole or any part of the Federation, whereas the Legislature of a state may make laws for the whole or any part of that State. With regard to the distribution of executive powers between the Federation and the States, this is in consonance with their respective legislative powers, but there are provisions for the delegation of executive authority from one to the other.

The Ninth Schedule of the Constitution contains the Legislative List, the Federal, State and Concurrent Lists, which specify in detail the subjects of legislative competence. The residuum of legislative powers belongs to the State. The subjects which are explicitly related to water resources are enumerated in the respective list as follows:

Federal List

Federal works and powers, including:-

(a) .....,

(b) Water supplies, rivers and canals, except those wholly within one State or regulated by an agreement between all the States concerned;

.....

(c) .....

State List

State works and water, that is to say:

(a) .....,

(b) ....., and

(c) Subject to the Federal List, water (including water supplies, rivers and canals); control of silt; riparian rights.

Concurrent List

Drainage and Irrigation

Subjects which are partly but essentially related to water resources, such as hydropower, navigation and estuarine fishing and fisheries are enumerated in the Federal List (the Concurrent List in the case of Sabah and Sarawak), while riverine fishing is in the State List. Subjects relevant to water pollution are distributed among the three lists, whereas functions on watershed management, which have influence on water resources, are enumerated in both the Concurrent and State Lists. Flood mitigation and urban drainage are not explicitly enumerated in the Ninth Schedule, but they should be regarded to be concurrent matters, because relevant subjects such as town and country planning and drainage are enumerated in the Concurrent List.

With regard to financial provisions, Articles 96 - 112 of Part VII of the Constitution set out the methods by which public funds are to be administered and accounted for at the Federal level, the division of revenue between the Federal and State Governments and the disbursement of grants, such as Capitation Grant, State Road Grant and grants from the State Reserve Fund by the Federal Government to the States.

Given these provisions, the various administrative actions and institutional arrangements recommended in this Study can be implemented within the existing Constitutional framework.

8.2 Existing Legal Provisions

There are about 20 laws directly related to water in Malaysia. Most of these were enacted some time ago as either Federal Laws or State Laws. With respect to river water management, the Waters Enactment is the fundamental law containing provisions governing property in rivers, prohibition of diversion of water from rivers except under licence, and the protection of river banks and flood channels.

Management of sectoral water use is given under the Water Supply Enactment for domestic and industrial water supply, the Electricity Act for hydropower generation, the Irrigation Areas Ordinance and the Drainage Works Ordinance which have provisions for the establishment and regulation of irrigation areas and drainage areas respectively, and the Fisheries Act which regulates riverine, marine and estuarine fishing as well as fisheries.

On water pollution control, the Waters Enactment was amended in 1971 to provide for the prohibition of pollution of river water, while the Environmental Quality Act, the Mining Enactment, the Local Government Act and the Street, Drainage and Building Act, all have provisions for water pollution control for their own specific purposes.

With regard to watershed management, the National Land Code, the Land Conservation Act, the Forest Enactment, and the Town and Country Planning Act, all contain provisions governing control of land conversion, control of silt and erosion and conservation of hill land and forest areas.

As a result of difference in the demarcation between Federal and State Laws, almost all water related laws valid in Peninsular Malaysia are not applicable in the States of Sabah and Sarawak, with the exception of the Environmental Quality Act, the Geological Survey Act, the Fisheries Act and the Merchant Shipping Ordinance. Nevertheless, being

complemented by various other State Laws, the water-related legal provisions of these two States as a whole have no major differences from those of Peninsular Malaysia.

8.3 Deficiency of Existing Legal Provisions

Most of the water related laws were enacted when water was considered to be in abundance and water-related problems and needs were few. The existing laws were formulated mainly for the purposes of regulating and managing sectoral water use and water pollution control. No established concepts of water resources development and management are found in these laws. With the rapidly increasing water demand and high cost of water resources development and management, the importance of adequate coordination and integration for conservation and optimum use of water resources, cannot be overemphasized. As such, the principles, procedures, criteria, and financing of water resources development and management, and their relationship to other public policies should be established by law.

In the area of inter-state water supplies, there is only one existing agreement and it is between the States of Pulau Pinang and Kedah for the supply of water to Kulim signed in 1964. For inter-state water transfer, the Asahan dam located in Johor State is for the supply of water for domestic and industrial purposes to the State of Melaka, while some water supply systems in some states cover areas in other states. Both these transfers are not regulated by any agreement between the states concerned. There are a number of inter-state rivers which are either flowing across or flowing along the boundary of two or more states. However, none of these rivers is regulated by an agreement between the states concerned. Neither has Federal power been extended to cover these rivers. There are as yet no established principles and procedures by laws for inter-state water supplies, rivers and canals as well as inter-state transfer of water to facilitate consultation and implementation of these matters.