REGIONAL COORDINATING UNIT
EAST ASIAN SEAS ACTION PLAN

UNEP UNITED NATIONS ENVIRONMENT PROGRAMME

REGIONAL PROGRAMME OF ACTION ON LAND-BASED ACTIVITIES AFFECTING COASTAL AND MARINE AREAS IN THE EAST ASIAN SEAS

By
Dr. Lawrence C.C. Koe
Dr. M.A. Aziz

RCU/EAS TECHNICAL REPORTS SERIES NO. 5

Prepared in cooperation with:

MINISTRY OF THE ENVIRONMENT, SINGAPORE

UNEP
Bangkok, 1995

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PREFACE

The work on the **Action Plan** for the protection and development of the marine environment and coastal areas of the **East Asian Seas Region** began as early as April 1976 with the holding of an **International Workshop on Marine Pollution in East Asian Waters** in Penang, Malaysia. This Workshop reviewed the major environmental problems related to marine pollution and identified activities which may contribute to pollution control. This, together with other studies on various aspects of the marine environment carried out by FAO, UNESCO, WHO, IMO and ESCAP formed the basis of the **Action Plan**.

The first draft of the **Action Plan** was prepared by the Secretariat of UNEP in co-operation with Specialised Organisations of the United Nations System. The draft was reviewed and revised by Two Meetings of experts designated by the countries of the region. The **Action Plan** was adopted by the representatives of Indonesia, Malaysia, the Philippines, Singapore, and Thailand at the Intergovernmental Meeting on the Protection and Development of the Marine Environment and Coastal Areas of the East Asian Region at Manila, 27-29 April 1981. A second Intergovernmental Meeting held at Bangkok, 9-11 December 1981, attended by the representatives of the same countries, determined and adopted the institutional and financial arrangements for the implementation of the **Action Plan**. In brief, the Bangkok Intergovernmental Meeting in addition to (i) adopting the programme priorities for the **Action Plan**, (ii) endorsing the establishment of the East Asian Seas Trust Fund, and (iii) requesting UNEP to continue to provide the secretarial services to the **Action Plan**, also established the **Coordinating Body of the Seas of East Asia (COBSEA)**. The **COBSEA,** comprising of representatives of the participating countries in the **Action Plan** was envisaged as "**the overall authority to determine the content of the Action Plan, to review its progress and to approve its programme of implementation, including the financial implications**".

The First Meeting of the **COBSEA** held in Bangkok on 3 April 1982, decided to initiate the implementation of the **Action Plan** through Six Priority Projects (EAS-12, 13, 14, 15, 16 and 17). One of the significant decisions of the **COBSEA** was the adoption of a "**long term strategy for the period 1987-1996**" at its Sixth Meeting held at Bangkok, 27-29 April 1987. The Project EAS-27 (Assessment of Land-based Sources of Pollution) was in response to the relevant recommendations of Chapter 17 of Agenda 21 which reflected the recommendations of the Meeting of Government Designated Experts on Land-based Sources of Pollution (presented to UNCED) as well as the 14th UNEP Governing Council decision to convene the 1995 International Conference on LBS. The EAS-27 is a follow-up of the EAS-21 (Assessment of Land-based Urban, Industrial and Agricultural Sources of Pollution, Their Environmental Impacts and Development of Recommendations for Possible Control Measures).

Major land-based sources of pollution in the East Asian Seas region are identified as domestic sewage, municipal solid waste, agricultural waste, agro-industrial and manufacturing wastes, mining waste, refinery waste and sediment loads. Major categories of pollutants which have adverse impacts on the marine and coastal environment are organics, nutrients, heavy metals, pathogenic microorganisms, oily discharges, petroleum

hydrocarbons, halogeneted hydrocarbons, nitrophenols, chlorophenols, and other highly persistent organics. Adverse impacts of these pollutants on marine and coastal ecosystems, living resources, human health and amenities have been alarming and well-documented in the region. Therefore, there is an urgent need of a **Regional Programme of Action** to control the pollution of the marine and coastal environment of the East Asian Seas Region from various land-based sources.

This report highlights the characteristics of the East Asian Seas Region, current state of pollution from land-based sources, impacts of pollution, pollution control strategies of each participating country and the recommended **Country Specific Programme of Action and Regional Programme of Action** to control land-based sources of pollution.

The contents of the report were discussed at the Regional Meeting held in Singapore on 1-2 September 1994. The comments and suggestions of the participating country representatives were duly incorporated.

Various project activities proposed for the **Regional Programme of Action** can be considered to be an integral part of the overall integrated management of the coastal zones of the East Asian Seas Region.

Project activities for the **country specific programme of action** and **regional programme of action** have been prepared keeping in view of the immediate needs of the region and hopefully, they will serve the purpose of controlling the land-based sources of pollution into the East Asian Seas region.

CONTENTS

EXECUTIVE SUMMARY

Degradation of the marine and coastal environment of the East Asian Seas Region results from a wide range of land-based activities. Major land-based pollutions originate from municipal, agricultural and industrial activities. Other land-based activities like human settlements, landuse, construction of coastal infrastructure, forestry, urban development and tourism are also the contributor of marine and coastal pollution. Coastal erosion and siltation also are of particular concern.

Major land-based pollution sources are domestic sewage, solid waste, agricultural waste, industrial waste, toxic chemicals and hazardous waste. Land based sources contribute 75 percent of the marine and coastal pollution. The pollutants that pose the greatest threat to the marine and coastal environment are (in variable order of importance and depending on differing national situations): organics, nutrients, sediments, litter and plastics, metals, radionuclides, oil/hydrocarbons and polycyclic aromatic hydrocarbons (PAHs). Many of the polluting substances originating from land-based sources are of particular concern to the marine and coastal environment since they exhibit at the same time toxity, persistence and bioaccumulation in the food chain.

Major source of marine and coastal pollution in the region is the sewage, much of which is discharged raw into coastal waters either directly or through rivers and waterways. Sewage is a major source of organic pollution and nutrients enrichment in the region's coastal waters. Their impact is usually in coastal waters which are used for growing and/or havesting of shellfish as well as for recreation such as bathing and boating. Eutrophication due to nutrient enrichment in some coastal waters of the region has led to increased blooms of toxic phytoplankton and altered benthic communities thereby posing serious risks to ecosystems, fishery and public health.

Most garbage and some industrial solid waste are dumped directly into the sea, typically in nearshore waters. The solid waste, however, is eventually deposited in wetlands, coral reefs and seagrass beds. In some cases, these ecologically fragile habitats are used as disposal sites. The solid waste clogs up water conveyance structures and litters tourist beaches causing aesthetic losses. Discharge of industrial wastewaters in the coastal waters have resulted in severe pollution problems.

Agricultural waste, mostly from livestock farms, pesticides and fertilizers is another major cause of organic pollution of coastal waters in the region. In addition, mining waste, forestry waste, soil erosion and siltation have added to the coastal pollution.

To control the pollution of the marine and coastal environment of the region from various land-based sources, a concrete **Programme of Action** is urgently needed for efficient waste management systems. The **Programme of Action** must have four fold objectives namely:

- Assessment of the severity of the environmental threats posed by waste disposal to the coastal zones of the region.

- Exploration and demonstration of the availability of technologies (especially low-cost ones) and methodologies in waste management that are appropriate for the countries of the region.

- Exploration of ways in which international organizations and donor agencies could assist the region in developing and implementing waste management schemes.

- Soliciting the commitment of political leadership of the nations of the region in the effective implementation of environmental regulations and waste management schemes.

Waste management in the coastal zone is imperative because this zone is the most vulnerable and most heavily utilized among the major resource systems. Waste management requires strong political will, public support and multilateral cooperation. Each nation can build a framework of initiatives to reduce the amount of waste requiring disposal. It can promote source reduction, reuse and recycling as viable management strategies that cut waste and foster more resilient, diverse, self-reliant and sustainable economies. Low-cost technologies have to be explored and adopted. Some technologies may even turn waste management into a profitable enterprise. Other potential benefits include reduction in polution and imports, employment generation, and the conservation of raw materials and energy.

This report covers issues related to the pollution of marine and coastal environment of the East Asian Seas Region from land-based sources. It has been divided into nine main parts. Part one, two and three describe the background of the UNEP's regional seas programme and the characteristics of the East Asian Seas Region and the participating countries in the COBSEA EAS-27 Project. Part four and five present various land-based sources of pollution, and their assessment. Part six discusses the impacts of land-based sources of pollution on marine and coastal environment. Part seven highlights the current status of pollution control strategies of the participating countries. Recommended **country specific programme of action** and **regional programme of action** to control land-based sources of pollution have been outlined in parts eight and nine. In conclusion, major issues and challenges of the **programme of action** to control land-based sources of pollution into the East Asian Seas Region are highlighted.

COBSEA PROJECT EAS-27

A. Project Details

1. Title of Project

Programme of Action to Control Land-based Sources of Pollution in the East Asian Seas Region.

2. Project Proposal Number

PP3091

3. Subject Area

5101 Regional Seas

4. Geographical Scope

a.	Region	: 70 Asia and the Pacific
b.	Sub-region	: 18 East Asian Seas
c.	Participating countries	: Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore, and Thailand

5. Implementation

Supporting Organization : Ministry of the Environment, Singapore
Environment Building
40 Scotts Road
Singapore 0922

6. Project Duration

Commencement : November 1993
Completion : September 1994

B. Background

1. In response to UNEP's Governing Council decision 16/26, the Meeting of Government-designated Experts on Land-Based Sources of Pollution was convened in Nairobi during 9-13 December 1991 in order to discuss the stratgegy for the reduction of the degradation of the marine environment from land-based sources of pollution and activities in coastal areas.

2. The Meeting was attended by representatives from 52 countries and six United Nations bodies. The report of the meeting was sent by the Executive Director of UNEP to trhe Secretary General of the UNCED Secretariat for submission to Prepcom IV. The recommendations of these meetings were induced and reflected in chapter 17 of Agenda 21 of the Earth Summit held on 3-14 June 1992, Rio de Janeiro, Brazil.

3. The Action PLan for the Protection and Development of the Marine and Coastal Areas in the East Asian Seas (EAS) region was adopted in 1981 by the Government of Indonesia, Malaysia, Philippines, Singapore and Thailand as part of UNEP Regional Seas Programme. The way was left open, however, for other countries in the region to participate later. On the basis of a decision of the Coordinating Body on the Seas of East Asia (COBSEA) in 1987 and within the framework of this Action Plan, EAS-21 Project on the " **Assessment of Land-based Urban, Industrial and Agricultural Sources of Pollution, Their Environmental Impacts, and Development of Recommendations for Possible Control Measures** " was implemented and completed in 1989 by the Ministry of the Environment, Singapore.

4. In line with decision 17/20 of the Governing Council of UNEP and the recommendations from the Meeting of Government-designated Experts on Land-based Sources of Pollution (1991), the 10th COBSEA meeting decided to develop a follow-up activity in the wake of the EAS-21 Project. Essentially, the present follow-up project aims to prepare an up-date on the assessment of the land-based sources of pollution.

C. Objectives

1. To prepare a regional input to the planned 1995 intergovernmental meeting on land-based sources of pollution.

2. To assist Governments of the region in the implementation of Agenda 21, paragraphs 17.25 and 17.26 of the Earth Summit regarding the prevention, reduction and control of degradation of the marine environment from land-based activities, by identifying major sources and priority areas.

D. Outputs

1. Report of a regional meeting on land-based sources of pollution in EAS region

2. Regional overview reflecting the land-based sources of pollution loads

3. Report of regional meeting to review and refine the draft programme of action

4. Regional programme of action to control the land-based sources of pollution

E. Use of Outputs

1. A regional input into the 1995 intergovernmental meeting on land-based sources of marine pollution

2. A decision-making tool and guideline for the Governments of the region to prepare national strategies for the reduction of the degradation of the marine environment from land-based sources of pollution.

F. Follow-up Actions

Recommendations for necessary follow-up actions are expected to be identified and outlined in the regional meetings and the desk evaluation by the RCU/EAS. Further actions leading to pollution prevention, reduction and control by participating countries would depend on the decisions of the Coordinating Body on the Seas of East Asia (COBSEA).

1. INTRODUCTION

The Regional Seas Programme was initiated by UNEP in 1974. Since then the Governing Council of UNEP has repeatedly endorsed a regional approach to control marine pollution and the management of marine and coastal resources and the development of regional action plans (UNEP 1982). More recently, Chapter XVII of Agenda 21 of the United Nations Conference on Environment and Development (UNCED) as adopted by the Plenary in Rio de Janeiro, Brazil, on 14 June 1992 reaffirmed the need to strengthen, and extend, where necessary, intergovernmental regional cooperation, citing in particular the Regional Seas Programme of UNEP (UNCED 1992). The Regional Seas Programme at present includes 13 regions involving nearly 140 participating states, 16 UN agencies and more than 40 other international and regional organisations, all working with UNEP to protect and to improve the marine environment and make better use of its resources (UNEP 1994). Thirteen regional seas regions are **Meditterranean, Kuwait Action Plan region, Black Sea, West and Central Africa, Wider Caribbean, East Asian Seas, South Asian Seas, South-East Pacific, South-West Pacific, North-West Pacific, Red Sea and Gulf of Aden, East Africa and South-West Atlantic** (UNEP 1994).

The marine environment especially the coastal area contains diverse and productive habitats important for human settlements, development and local subsistence. More than half the world's population lives within 60 km of the shoreline, and this could rise to three quarters by the year 2020. Many of the world's poor are crowded in coastal areas. Coastal resources are vital for many local communities and indigenous people. The exclusive economic zone (EEZ) is also an important marine area which is managed by respective countries to develop and conserve natural resources for the benefit of their people. For small island countries, these are the areas most available for development activities. Despite national, subregional, regional and global efforts, current approaches to the management of marine and coastal resources have not always proved capable of achieving sustainable development. Coastal resources and coastal environment are being rapidly degraded by various human activities in many parts of the world.

The Regional Seas Programme is conceived as an action-oriented programme having concern not only for the consequences but also for the causes of environmental degradation, and encompassing a comprehensive approach to combating environmental problems through the management of marine and coastal areas. Each regional action plan is formulated according to the needs of the region as perceived by the Governments concerned (UNEP 1982). It is designed to link assessment of the quality of the marine environment and the causes of its deterioration with activities for the management and development of the marine and coastal environment. The action plans promote the parallel development of regional legal agreements and of action-oriented programme activities.

2. EAST ASIAN SEAS REGION AND ITS CHARACTERISTICS

The East Asean Seas region (Fig. 2.1) is one of the most diverse of the regional seas regions (Gomez et al 1990). This region covers an area which include six ASEAN countries, namely Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore and Thailand, and other countries bordering the East Asian seas, namely Australia, Cambodia, China, Myanmar and Vietnam. The main sea in the region is the South China Sea which adjoins almost all these countries. In addition to the South China Sea, the other components of the East Asian Seas region are the Gulf of Thailand, Straits of Malacca, Java Sea, Flores Sea, Banda Sea, Sulawesi Sea, Sulu Sea, Andaman Seas, portions of the Indian Ocean and the Western Pacific Ocean. The whole body of water covers about 9 million km^2 in area which represents about 2.5 percent of the world's ocean surface. The East Asian Seas region is divided into 11 zones as shown in Fig. 2.2. The East Asian marine realm includes shallow continental shelves, deep sea basins, troughs trenches, continental slopes and volcanic and coral islands. The numerous large and small islands divided the waters into different seas connectted by many channels, passages and straits (Gomez et al 1990).

Located between the Asian and the Australian continents, the East Asian seas region is strongly influenced by monsoons. The water mass of the East Asian Seas region originates from the Pacific Ocean. This is clearly indicated by surface current patterns in the region. The tides of the East Asian Seas waters are affected by both the Pacific and the Indian Oceans. Diurnal tides predominate in the South China and Java Seas, whereas mixed tides prevail in the eastern Indonesian archipelago, Philippine waters, the Andaman Sea, Straits of Malacca, and the shelf areas northeast of Australia. Since the Southeast Asian region straddles the equator, the surface water is characterizing by high temperature. This property combined with the influence of low salinity reduces the density of the surface water rather markedly. The salinity in the East Asian Seas waters is extremely variable. The effects of high rainfall, run-off of many large rivers, and geographical subdivisions of the seas are responsible for this characteristic. The distribution of discharges from land, presence of large bays and channels with little water exchange contribute to the general lowering of the salinity. The monsoons cause rainy and dry seasons which then also affect the annual variation of salinity.

Coastal zone of the East Asian Seas region is probably one of the most productive areas (ESCAP 1985, UNEP 1985). The ecology of the region is very diverse. Blessed with a warm humid tropical climate and high rainfall, extensive coral reefs and dense mangrove ecosystems flourish along the coastline. In the inland seas, the annual productivity is quite high compared to other seas. The high productivity of the inland seas is due to the high nutrient load from volcanic activities and soil erosion, the warm weather and equatorial sunlight intensity. The area is also characterized by large mangroves and swamps which border the inland seas. The mangroves have good ability to retain silt. Some stage of development of some marine organisms, such as prawns, milkfish, etc. take place in the swamp. The productivity of the swamps and marshlands are much higher than the open sea due to their high nutrients concentration. Aside from retaining the soil, the swamp is a vital link between terrestrial and aquatic life. The ecology of swamps and marshlands is the most complex in nature due to periodic drying and flooding with the tide cycle.

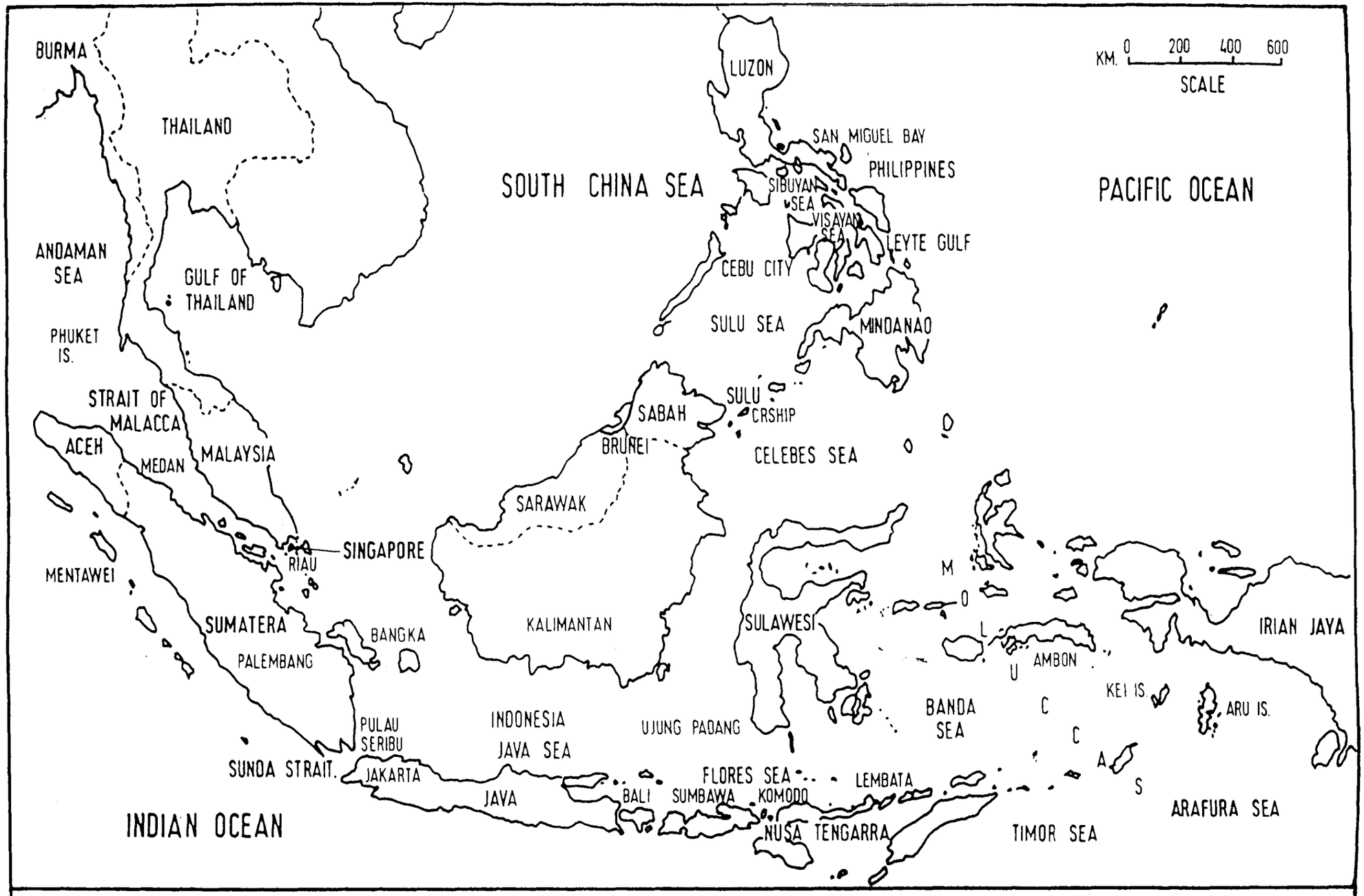

FIG. 2-1 EAST ASIAN SEAS REGION

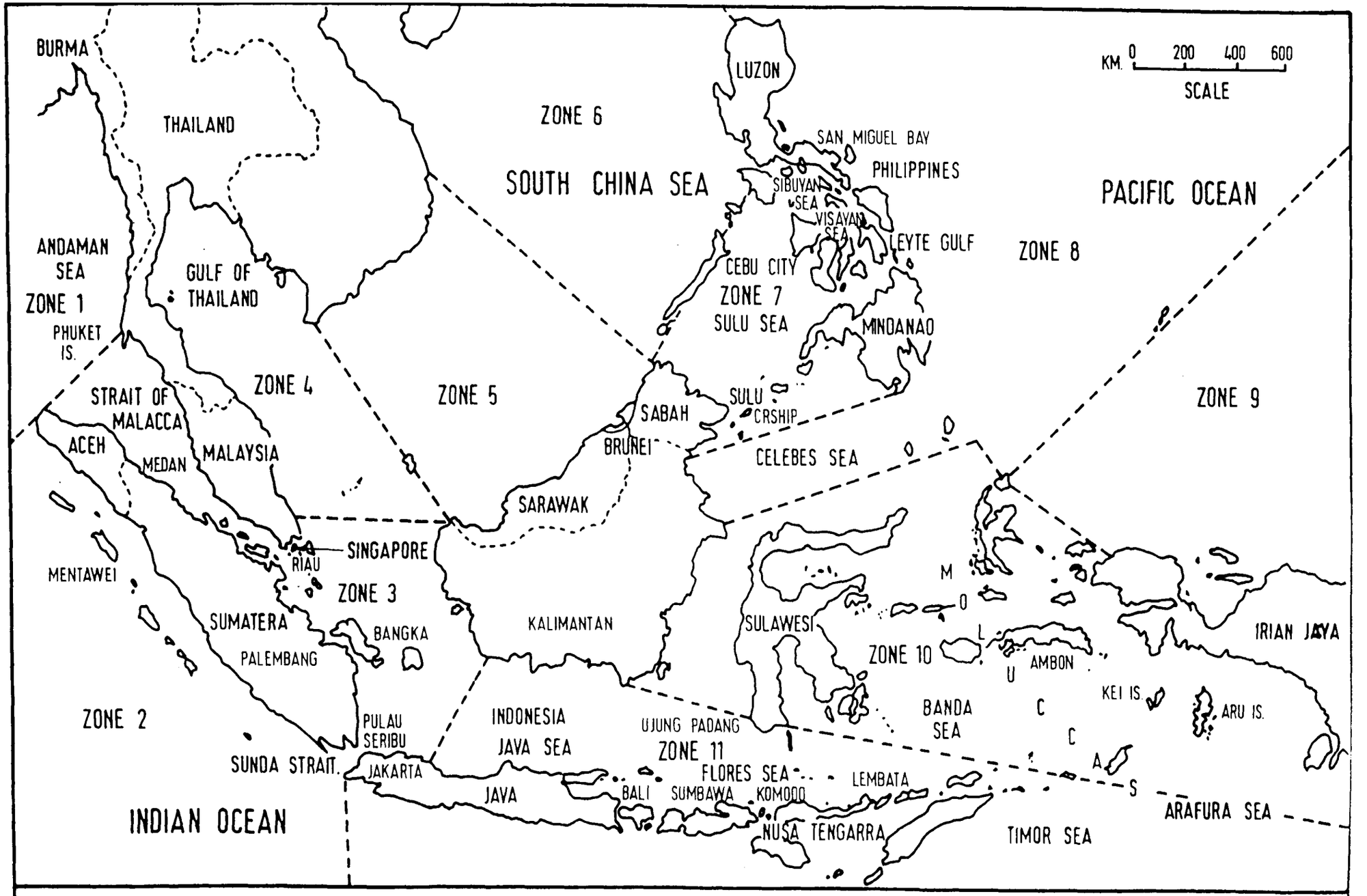

FIG. 2-2 ZONING OF THE EAST ASIAN SEAS REGION

The East Asian Seas region is richly-endowed with marine resources of two distinct types. These are (a) non-renewable and non-living resources and (b) living and renewable resources. The first category includes petroleum and natural gas, manganese and phosphate nodules, metalliferrous sediments, common salts and construction materials like sands, gravels, limestones and coral rock, whereas the second category includes mangroves, corals, fisheries (various fish types, crustaceans, vertebrates e.g. turtles, marine mammals, and other invertebrates), and other flora and fauna (ESCAP 1985).

The region is developing and predominantly agricultural with industries concentrated around a limited number of cities which characteristically have high population densities. Figures 2.3 and 2.4 show the locations of major settlements and major industries in the countries of the East Asian Seas Region. The land mass of the region which is very fertile due to volcanic activities and abundant rainfall, is the site of some of the oldest human settlements. Agriculture is able to sustain high population density due to abundant rainfall, sunshine and fertile colvanic soils. Due to the economic benefits that could be derived from rich and diverse ecosystems, the coastal zones of the East Asian seas region are densely populated. Over 70 percent of the population in the region live along the coastal areas resulting in rather high levels of exploitation of natural resources and degradation of the marine environment. Under the circumstances, the marine environment of the region has been influenced more and more by human activities with the degree of pollution being most pronounced near coastal population centres. Although the usefulness of the marine resources of this region has long been recognised, their continued existence is being threatened in a number of ways, and degraded by (a) silting, sedimentation and erosion; (b) land reclamation for industries, development works, housing, agriculture and recreational facilities; (c) over exploitation of resources; (d) pollution from domestic and industrial wastes, oil spills, thermal discharge, pesticides, etc; (e) mining operations; and (f) natural calamities (UNEP/WHO 1981, Aziz and Jalal 1986, COBSEA 1988, Aziz and Ng 1989, COBSEA/UNEP 1989, ESCAP 1990).

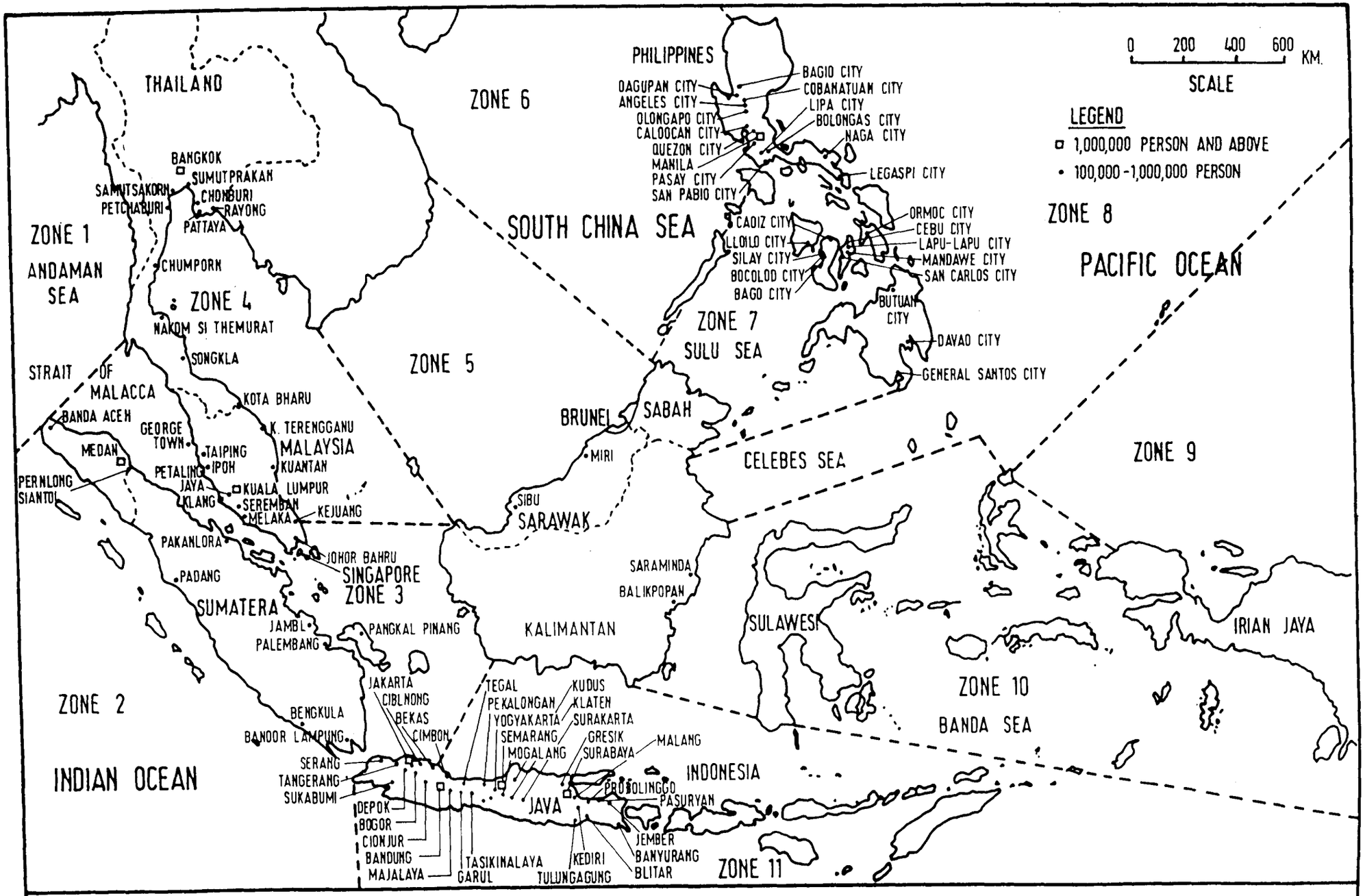

FIG. 2-3 MAJOR SETTLEMENTS IN THE EAST ASIAN SEAS REGION

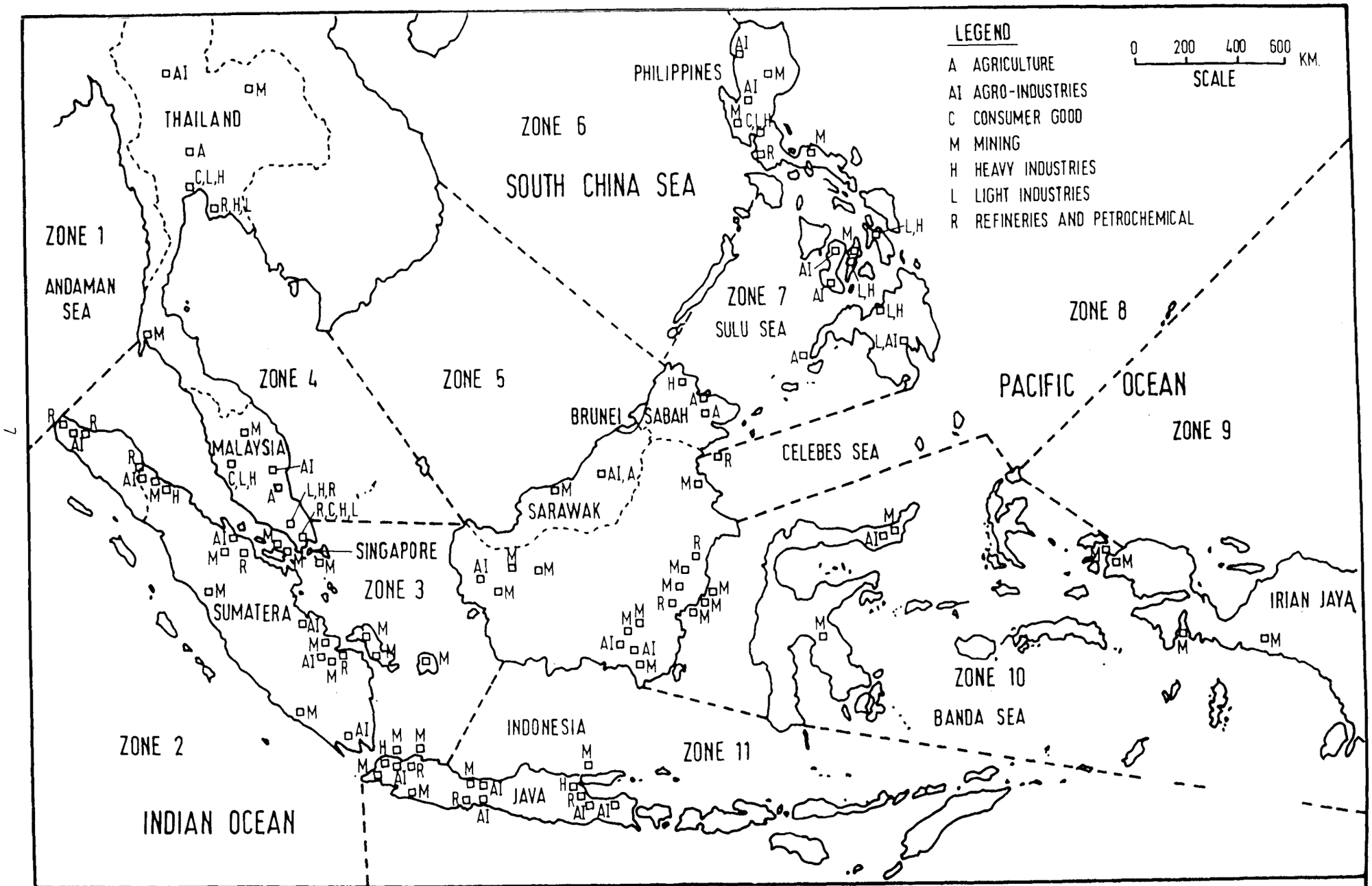

FIG. 2-4 LOCATION OF MAJOR INDUSTRIES, AGRO-INDUSTRIES AND MINES IN THE COUNTRIES OF THE EAST ASIAN SEAS REGION

3. PARTICIPATING COUNTRIES IN COBSEA PROJECT EAS-27

Participating countries in the COBSEA Project EAS-27 are Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore and Thailand. These countries belong to ASEAN (Association of Southeast Asian Nations). Of these countries, only Brunei Darussalam is not the member of COBSEA (Coordinating Body for the Seas of East Asia).

Table 3.1 gives the marine area, coastline and other information of the participating countries (ESCAP 1990). Total land area, land-use, physical features, vegetation, climate and some socio-economic data are presented in Tables 3.2 and 3.3 respectively (Lee and Troxler 1991).

Table 3.1 Some Important Information of Participating Countries

Participating Country	Marine Area (km^2)	Length of Coastline (km)	Area of Mangrove (ha)	Percent of Population Living in Coastal Zone
Brunei Darussalam	700	161	19,000	86
Indonesia	6,815,000	54,716	4,250,000	77
Malaysia	139,000	4,675	West-144,000 East-539,000	62
Philippines	551,000	22,540	106,000	64
Singapore	300	150	1,800	100
Thailand	95,000	3,219	287,000	60

Table 3.2 Physical and Climatic Features of ASEAN Member-Countries

Country	Land area (km^2)	Land use (%)	Physical features	Vegetation	Climate
Brunei Darussalam	5,765	Cultivated 0.3 Forest 85 Pasture 1	• Rugged and hilly except for narrow coastal plains • Mountain territory heights of 300 m • Highest point is Bukit Pago at 1,841 m	• Covered by tropical forest with large variety of hardwood species	• Governed by equatorial monsoons • Hot and humid • Heavy rainfall (2,500 mm on coast; 5,000 in interior) • Heaviest rainfall in November and March • Average temperature is 27°C
Indonesia	1,904,569	Cultivated 31 Forest 31 Pasture 6	• Consists of 13,600 islands • 6,000 inhabited islands • Pronounced mountain ranges and extensive lowlands on larger islands • Little coastal plains on smaller islands that rise steeply from the sea • Volcanic eruptions common	• Variable dense tropical forests and tidal swamps, normal lowlands and savannah • Forests thinner towards the east	• Heavy rainfall all year-round with peak periods in the west and greatest amounts from December to March • Little variation in high temperatures (26-27°C) • Dry season in the south (June-October) • Maritime equatorial climate
Malaysia	329,758	Cultivated 15 Forest 80 Pasture 2	• Mountain ranges reach 2,100 m and run north to south, swampy forests and lowlands to the east of Peninsular Malaysia, Sabah and Sarawak • Wider lowlands and longer rivers in Sabah and Sarawak; outstanding feature is Mt. Kinabalu at 4,101 m	• Equatorial forest cover • More dense and continuous on Sabah and Sarawak than in the peninsula	• Variable rainfall in Sabah and Sarawak • Rainfall average 2,540 mm/year in the peninsula • Average temperature is 21-32°C • Equatorial climate
Philippines	300,000	Cultivated 41 Forest 53 Pasture 1.4	• Consists of 7,107 islands • More than one dozen active volcanoes • Interior mountain ranges reach 2,400 m in larger islands • Extensive lowlands in a few islands	• Both hard- and softwood species in forest cover	• Regional variation in rainfall • Mean annual temperature is 27°C • More exposed parts of country subject to typhoons • Maritime tropical climate
Singapore	626	Cultivated 3.2 Forest 4.6 Pasture -	• Island's granite core reach heights of 100 m • Surrounded by marshy lowland • Height rarely exceeds 15 m	• Remaining rainforests being preserved	• Hot and humid • No defined seasons • Average rainfall is 2,367 mm/year • Average temperature is 27°C
Thailand	513,115	Cultivated 50 Forest 29 Pasture 8	• Mainly narrow coastal lowlands backed by low mountain ranges in Peninsular Thailand • North consists of uplands at varying heights surrounding a large central plain	• Includes tropical monsoon forests • Denser in the uplands, thinning in the lowlands	• Tropical temperature range of 24-30°C throughout the year • Rainfall below 1,500 mm/year • Hot and dry season from October to February • Rainy season from May to September

Table 3.3 Some Socioeconomic Data of ASEAN Member-Countries

Regional performance figures	Brunei Darussalam	Indonesia	Malaysia	Philippines	Singapore	Thailand
Population						
Total 1989 (million)	0.3	184.6	17.4	64.9	2.7	55.6
1989 density (person/ha)	517	948	526	2,163	43,200	1,082
% average annual growth 1981-1988	2.7	2	2.5	2.8	1.2	1.7
Projected year 2000 (million)	0.3	222	20.9	85.5	2.9	65.5
Urban population (%)	59	26	35	41	100	17
Infant mortality (per 1,000)	11	83	31	48	7.4	50
Life expectancy (year)	71	58	67	66	73	65
Workforce						
Total (million)	0.09	72.2	6.30	25.2	1.3	30.4
% Commerce/services	26.4	29.8	27.6	36.2	63.5	20.5
% Manufacturing	8.6	8.3	17.3	20.6	28.5	10
% Agriculture/fishing	5	56.1	30.8	10.0	0.4	57
% Construction	33[a]	-	6	7.6	6.7	2.7
% Government and public authorities	40	5.8	13.5	25.7	5.5	6.3
Social						
Person per hospital bed	260	1,550	668	628[b]	270	600
Person per doctor	1,690	7,440	2,700	6,667	837	5,000
Car (thousands)	89	1,320	1,600	377	239	1,150
Production and prices (1988)						
GDP at market prices (US$ billion)	2.9[a]	64.15	24.5	39.2	24.5	56.1
Per capita income (US$)	12,772[a]	403.7	1,875	667.4	8,162	1,038
GDP, real growth (%)	-	3.59[a]	8.7	6.4	11	11
Agriculture as GDP	1.46[a]	25.5	18.2	23.0	0.4	16.9
Manufacturing as GDP	52.4	13.93	25.6	25.1	30.1	24.4
Consumer prices (% rise)	-	5.47	2.5	8.8	1.6	3.8

[a] 1987.
[b] 1986.

4. LAND-BASED SOURCES OF POLLUTION IN THE EAS REGION

Degradation of the coastal and marine environment of the East Asian Seas region results from a wide range of sources both land-based and marine. Major land-based pollutants originate from municipal, agricultural and industrial activities. Other land-based activities like human settlements, land use, construction of coastal infrastructure, forestry, urban development and tourism are also the contributor of coastal and marine pollution (Jalal and Aziz 1986, Lee and Troxler 1991). Coastal erosion and siltation also are of particular concern. Various marine sources of pollution are maritime, oil development and production. In this report, only land-based pollution sources will be discussed.

Major land-based pollution sources are domestic sewage, solid waste, agricultural waste, industrial waste, toxic chemicals and hazardous waste. Land-based sources contribute 70 percent of marine pollution, while marine activities contribute 30 percent. The pollutants that pose the greatest threat to the marine environment are, in variable order of importance and depending on differing national situations: organics, nutrients, sediments, litter and plastics, metals, radionuclides, oil/hydrocarbons and polycyclic aromatic hydrocarbons (PAHs). Many of the polluting substances originating from land-based sources are of particular concern to the marine environment since they exhibit at the same time toxicity, persistence and bioaccumulation in the food chain (Jalal and Aziz 1986, Van-Veldhuizen and Aragones 1991).

4.1 Domestic Sewage

The major source of organic pollutants in the coastal waters of the region is domestic sewage from both rural and urban centres. The increasing population density in coastal and urban areas has further worsened the of quality marine waters, due to the lack of services, policies and plans for collection, treatment, disposal and the overall management of the domestic sewage. The level of domestic sewage pollution is high, particularly in the Upper Gulf of Thailand, Manila Bay, Strait of Malacca, West Coast of Peninsular Malaysia, North Coast of Java Island and Jakarta Bay (Lee and Troxler 1991). Sewage collection is a basic problem in countries of the region with few piped sewer systems. Sewage treatment plants (STPs) are generally lacking. The most common method of sewage disposal is direct discharge into rivers or the sea (Bell 1991, Chua et al 1991).

Typically, extensive sewage collection systems are few. Almost all major metropolies in the region, except in Singapore, lack sewage treatment systems. Most households have individual subsurface disposal systems which sometimes malfunction, sending sewage to surface drainage channels. The situation is aggravated during the rainy season.

The majority of the populations in Indonesia, Malaysia, the Philippines and Thailand use the individual septic tank system, which is also widely used in Brunei Darussalam (COBSEA 1990, De Silva et al 1991). The septic tank drain fields are often installed in inappropriate soil and groundwater conditions, and effluent is often discharged into street drains or the nearest streams. Household wastewater, other than excreta, is also often disposed of in drains leading to streams and coastal waters.

Most urban areas in Brunei Darussalam have sewers that lead to STPs, where sewage is given both primary and secondary treatment. An exception is the Pintu Mabim plant which gives only primary treatment (De Silva et al 1991). There are places which are not yet served by STPs (e.g. Kuala Belait). A particular problem area is Kampong Air, a water village on the Sungai Brunei Estuary. Its approximately 25,000 inhabitants throw their sewage and garbage into the surrounding waters contributing about 100 percent of the total biological oxygen demand (BOD) to the country's waterways (De Silva et al., 1991).

Around 5 percent of the population of Malaysia is served by sewers, and about 70 percent of households use either septic tanks or Imhoff tanks. Up to 40 percent of the inhabitants do not reside within a municipality and thus receive no organized sanitation services (Jafar 1991, Malaysia 1994).

Jakarta lacks sewer systems. Most household sewage that has not been in contact with excreta is discharged through open channels into rivers. This poses a health problem, since gray water can still have high fecal coliform levels. In about 60 percent of households, human waste is disposed of in septic tanks and septage is pumped for disposal. Other households do not have a septic tank system or an adequate sanitation facility (Indonesia 1994).

In the Philippines, only Metro Manila has a sewerage system. It serves only the more densely populated areas (12 percent of the population). Sewage is discharged untreated into Manila Bay (DENR 1990). Communal septic tanks are used in parts of Metro Manila (Philippines 1994).

In Singapore, almost 100 percent of the population is sewered, and sewage is treated before being discharged into the sea. Effluent is also used as a processed water supply by industries and factories (Tan 1991, Singapore 1994, Koe and Aziz 1994).

Many urban households in Thailand have modern pour-flush or cistern toilets, although fewer than 100,000 people are served by conventional sewerage or centralized STPs (UNDP-WB 1991). In Bangkok, for instance, there is a lack of conventional sewerage since groundwater supply is considered more important (Taranatham 1991).

Table 4.1 presents estimates of the daily pollution (BOD) load from sewage discharges from six countries in coastal areas of EAS region in 1989 and 2000 (Lee and Troxler 1991). In 1989, the estimated BOD load in the coastal areas from six countries was around 9,800 tonnes per day. It is expected that the BOD load will reach 12,000 tonnes per day in the year 2000.

Table 4.1 Estimated Pollution Load (BOD) from Sewage Discharges in Coastal Areas from Six Participating Countries

Year/Parameters	Brunei Darussalam	Indonesia	Malaysia	Philippines	Singapore	Thailand	Total
1989							
Population (million)	0.25	184.60	17.40	64.90	2.70	55.60	325.45
Total daily BOD load (tonne)	30	9,230	870	3,245	324	2,780	16,479
Population in coastal area (percent)	85	60	65	70	100	40	
Coastal population (million)	0.21	110.76	11.31	45.43	2.70	22.24	192.65
Daily BOD load in coastal areas (tonnes)	26	5,538	565	2,272	324	1,112	9,837
Primary treatment (percent)	40	60	70	60	10	70	
Secondary treatment (percent)	30	0	5	0	90	1	
Daily BOD removal by treatment (tonnes)	10	997	144	409	272	244	2,076
Residual daily BOD disposal (tonnes)	16	4,541	421	1,863	52	868	7,761

Table 4.1 (Cont'd)

Year/Parameters	Brunei Darussalam	Indonesia	Malaysia	Philippines	Singapore	Thailand	Total
2000							
Population (million)	0.29	222	20.90	85.50	2.90	65.50	397.09
Total daily BOD load (tonnes)	35	11,100	1,045	4,275	348	3,275	20,078
Coastal population (million)	0.25	133.20	13.58	59.85	2.90	26.20	235.98
Daily BOD loading in coastal areas (tonnes)	30	6,660	679	2,992	348	1,310	12,019
Daily BOD removal by treatment (tonnes)	12	1,199	173	539	292	287	2,502
Residual daily BOD disposal (tonnes)	18	5,461	506	2,454	56	1,023	9,518

4.2 Solid Waste

The dumping of municipal solid waste (MSW) has become a serious environmental problem in the region due to increasing population densities and the absence of adequate collection and disposal facilities (Lee and Troxler 1991). Some MSW are buried, some are open-burned and a lot are dumped directly or indirectly into the river systems or the sea. These also accumulate in some unauthorized dumping locations. They enter and clog surface drains and are flushed into coastal waters. Municipal refuse has also been used for land reclamation in some coastal areas of this region. This has resulted in leachate containing heavy metals and plastics dispersion in the marine environment and destruction of sensitive ecosystems.

The per capita solid waste generation estimates in the region range from 0.4 to 2.0 kg/day (Table 4.2). In 1989, roughly 94,000 tonnes/day were disposed of in designated disposal sites. This excludes uncollected garbage that was disposed of directly or indirectly into watercourses or coastal areas. Table 4.3 gives the average composition of solid waste of the participating countries. Estimated average daily quantities of the most common solid waste types received at authorized disposal sites in coastal areas in 1989 and 2000 are presented in Tables 4.4 and 4.5 respectively (Lee and Troxler 1991). It is seen that the solid waste composition is dominated by organic (putrescible) materials and paper.

4.3 Agricultural Waste

Agricultural waste is the second most important source of organic pollutants in the region. The three main components of agricultural pollution entering the rivers and coastal waters are: organic refuse from livestock farms; fertilizers and pesticides; and siltation from erosion. There is no evidence of agricultural pollution problems in Singapore and Brunei Darussalam. In Brunei Darussalam, however, stormwater runoff carries substantial amounts of silt due to the presence of highly erodible soils.

Livestock Farms: Although most livestock manure is merely recycled by spreading it on agricultural land, poultry and pig wastes are produced in large quantities constituting a significant source of pollution in the coastal envrionment, except in Singapore and Brunei Darussalam (Loh 1988; Tan, 1991). In Malaysia, an estimated 10-25 percent of the agricultural organic wasteload to the coastal waters is from livestock effluents, particularly from pig farms located beside rivers. Due to the government's current stringent environment regulations, livestock wastes have to undergo primary treatment in oxidation ponds prior to disposal (Lee and Troxler 1991). Singapore, on the other hand, has phased out pig farms entirely and placed controls on poultry farms (Loh 1988; Tan, 1991). In Thailand, 50 percent of the agricultural solid waste is sold as soil conditioner and approximately 10 percent is discharged into fish-ponds. Solid waste from other agro-industries is often recycled as fuel or composted (Taranatham 1991).

Table 4.2 Estimated Daily Solid Waste Generation in Participating Countries and the Amount Arriving at Authorized Disposal Sites in Coastal Areas

Year/quantity		Brunei Darussalam	Indonesia	Malaysia	Philippines	Singapore	Thailand	Total
Per capita daily rate (kg)		1.00	0.40	0.75	0.46	2.00	0.66	
Population (million)	1989	0.25	184.60	17.40	64.90	2.70	55.60	325.45
	2000	0.29	222.00	20.90	85.50	3.10	65.50	397.09
Daily quantity (tonnes)	1989	250	73,840	13,050	29,854	5,400	36,696	159,090
	2000	290	88,800	15,675	39,330	8,100	43,230	193,125
Daily quantity in coastal areas (tonnes)	1989	212	44,304	8,483	20,898	5,400	14,678	93,976
	2000	247	53,280	10,189	27,531	8,100	17,292	114,339

Table 4.3 Solid Waste Composition (%) of EAS-27 Participating Countries

Component	Brunei Darussalam	Indonesia	Malaysia	Philippines	Singapore	Thailand
Paper	26	2	25	10	28	19
Glass	6	1	3	2	4	6
Metals	11	4	6	3	5	4
Plastics	13	3	8	9	12	10
Organics	41	87	56	70	44	55
Others	3	3	2	6	7	6

Table 4.4 Estimated Average Daily Quantity (tonnes) of Most Common Solid Wastes Types Received at Authorized Disposal Sites in Coastal Areas of EAS-27 Participating Countries in 1989

Component	Brunei Darussalam	Indonesia	Malaysia	Philippines	Singapore	Thailand	Total
Paper	55	886	2,121	2,090	1,512	2,789	9,453
Glass	13	443	254	418	216	881	2,225
Metals	23	1,772	509	627	270	587	3,788
Plastics	28	1,329	679	1,881	648	1,468	68,458
Organics	87	38,544	4,750	14,628	2,376	8,073	68,458
Others	6	1,329	170	1,254	378	881	4,018
Total	212	44,303	8,483	20,898	5,400	14,679	93,975

Table 4.5 Estimated Average Daily Quantity (tonnes) of Most Common Solid Wastes Types Received at Authorized Disposal Sites in Coastal Areas of EAS-27 Participating Countries in 2000

Component	Brunei Darussalam	Indonesia	Malaysia	Philippines	Singapore	Thailand	Total
Paper	64	1,066	2,547	2,753	2,268	3,285	11,339
Glass	15	543	306	551	324	1,038	2,675
Metals	27	2,131	611	826	405	692	4,577
Plastics	32	1,598	815	2,478	972	1,729	7,348
Organics	101	46,354	5,706	19,272	3,564	9,511	83,496
Others	7	1,598	204	1,652	567	1,038	4,905
Total	246	53,290	10,189	27,532	8,100	17,293	114,340

Fertilizers and Pesticides: Synthetic fertilizers and pesticides are widely used in agriculture in the region. Fertilizers and pesticides are the two most popular groups of substances used in crop production and protection respectively particularly for rice, vegetable and cotton crops. Generally, insecticides are used in vegetable and rice production; herbicides, in rubber, palm oil and sugar cane production; and fungicides, on vegetables and fruit crops. Key pesticides used are: 2, 4-D, paraquat, dalapon, parathion-methyl, copper oxychloride, atrazine, monocrotophos, dimethoate, diuron and ametryne (ADB 1987). Fertilizers causes entrophication in coastal waters and pesticides have toxic effect on fish and other marine life.

Siltation from Erosion: Agricultural practices without proper erosion control and protection of watersheds have resulted in increased silt and sediment deposition in rivers and coastal waters in the region. The situation has been aggravated by deforestation and land clearing. This accelerated sedimentation is sometimes considered one of the most dangerous forms of pollution in the coastal waters of the EAS region. Sediment accumulation can smother coral reefs, change the characteristics of the surrounding waters and block navigation channels (Lee and Troxler 1991).

4.4 Industrial Waste

Most of the industrial wastes originate from food and beverage processing, palm oil and rubber manufacturing, pig and livestock farming, tapioca starch industries, commercial fertilizer production, textile manufacturing, pulp and paper industries, tanneries and sugar refineries. More than 50 percent of manufacturing industries in the region are located along river banks or in coastal regions. They are found mainly in the Manila Bay area, the inner Gulf of Thailand, along the Straits of Malacca and the west coastal of East Malaysia, and on the north coast of Java Island (particularly in Jakarta Bay and off Surabaya). The agro-industries, a significant fraction of the industrial base in the region are distributed in remote rural areas. Most industrial plants in the EAS region also lack waste treatment facilities (Koe and Aziz 1994).

Pollution load (BOD) contribution from various industrial wastes is quite significant. In 1989, the Malaysian government estimated national organic pollution load from various sources in terms of BOD as follows (Jafar 1991):

	BOD (tonnes/day)	Percent
Domestic sewage	366	80
Animal husbandry	60	13
Manufacturing industry	21	5
Agro-based industry	11	2
Total	458	100

A recent study in Thailand which estimated annual BOD load from various industries is shown in Table 4.6 (Lee and Troxler 1991).

Table 4.6 Estimated Industrial BOD Load in Thailand

Industry	Establishments	BOD load (tonnes)	
		1990	2000
Sugar	508	140,700	302,200
Pulp and paper	234	93,200	217,900
Rubber	44	89,700	169,600
Beverages	31	84,000	163,000
Tapioca	142	36,700	81,300
Slaughter	57	14,900	19,400
Canned fish and crustaceans	50	10,100	19,400
Tannery	143	9,600	35,400
Canned fruits and vegetables	131	3,500	5,200
Total	1,340	482,400	1,013,400

The study could not obtain necessary data on other high BOD-loading industrial facilities such as noodle and soy sauce factories; palm oil mills; and fruit processing, monosodium glutamate and textile industries. Thus, the actual industrial BOD load would be higher than the estimates. Nevertheless, the study projected that the BOD load in the year 2000 would be more than twice the estimated 1990 BOD load due to the expected industrial growth in Thailand. In addition, 60 percent of registered industries are located in coastal areas in Thailand (i.e., Bangkok Metropolitan Region and South Region). Thus, industrial BOD load in these areas, estimated at 793 tonnes/day in 1990, would be 1,665 tonnes/day in 2000. This means that it would exceed the domestic sewage BOD load in the year 2000 (Table 4.1). Similar rapid growth in industrial BOD load is expected in Brunei Darussalam, Indonesia, Malaysia and the Philippines, although the quantification is difficult without the existing and projected data on high BOD-load industrial activities. Industry is also the major source of hazardous wastes. Other sources include mining operation, energy production processes, oil refining, hospitals and health-care facilities and research laboratories. Some hazardous wastes and their sources include: heavy metal sludge from semi-conductor industries; high heavy metal concentrations from geothermal plants; oil residues/volatile organic carbons from petroleum industries; arsenic/sulphur oxides/other heavy metals from copper roasting or smelting processes; pesticide-loaded polyethylene bags from banana plantations; mercury from small-scale gold mining; chromium and other heavy metals from leather tanning and finishing industries; wastes from agrochemical industries; and radioisotopes, pathologic/infectious agents and other toxic chemicals from hospital/laboratory wastes. Heavy metals like lead, mercury, cadmium and silver are also discharged into rivers and coastal waters by mining and quarrying operations and also by some other industries.

The problem posed by hazardous wastes in the EAS region is not of the same magnitude as that in highly industrialized nations. Still, it is beginning to cause concern in concentrated industrial zones such as Jakarta, Bangkok, Surabaya, Metro Manila, Kuala Lumpur and Singapore. The production rate of hazardous waste in the region is expected to grow rapidly with the current economic growth and increased industrial sophistication.

Table 4.7 shows the results of a study completed in 1989 on hazardous waste quantities in Thailand which vary with the type of industry. Some findings of the study are (Lee and Troxler 1991):

Table 4.7 Estimated Hazardous Waste Quantity in Thailand (tonnes)

Industry	1986	2001
Basic metal	732,508	5,070,027
Fabricated products	132,868	393,896
Transport equipment	63,993	31,147
Electrical machinery	50,990	282,699
Chemical products	37,916	217,566
Machinery	30,158	166,627
Textiles	17,362	100,432
Printing/publishing	14,867	95,558
Rubber/rubber products	8,273	58,159
Paper/paper products	2,737	16,462
Petroleum products	1,978	12,431
Miscellaneous/necessities	1,092	11,381
Furniture/fixtures	1,092	11,381
Wood/cork	515	3,324
Total industrial waste	1,097,078	5,471,570
Hospital and laboratory waste	46,674	200,699
Household hazardous waste	11,787	31,093
Total hazardous waste	1,155,539	5,703,362

- Over 60 percent of the total national hazardous waste is generated by the basic metal industry.

- Over 95 percent of the total national hazardous waste is generated by manufacturing industries.

- Total quantity of hazardous waste production in the year 2000 would be about 5 times the 1980 quantity due to the projected rapid industrial growth.

- Infectious wastes from hospitals health-care facilities and laboratories would increase by about 4.3 times the 1989 level in 2000 due to the improved health care system.

- Hazardous waste generation rate of households would be greater than the projected population growth rate as the society becomes more affluent due to economic growth.

Due to the lack of available data, the hazardous waste generation in the region has been estimated under the following assumptions (Lee and Troxler 1991, Hernandez 1993):

- Industrial hazardous waste generation rate per industrial manufacturing GDP of other countries of the region be the same as that of Thailand.

- Infectious hazardous waste generation rate per doctor of other countries of the region would be the same as that of Thailand.

- Household hazardous waste generation rate per person would be proportional to per capita income.

- Other countries of the region would experience more or less the same economic growth as Thailand.

Table 4.8 presents the estimated hazardous waste quantities generated in the region under the above asumptions. Major marine pollutants from land-based sources, their origin and characteristics are presented in Table 4.9 (Lee and Troxler 1991). Table 4.10 provides organics (BOD) and nutrient levels, faecal coliforms and trace metals in some rivers of the region as reported by the GEMS/Water Programme, 1987-1991 (UNEP 1993).

Table 4.8 Reported and/or Estimated* Annual Production Rates of Hazardous Waste in the Participating Countries

Country	Reported and/or estimated hazardous waste production (1000 tonnes/yr)
Brunei Darussalam	1 - 2
Indonesia	5000
Malaysia	377
Philippines	80 - 150
Singapore	28
Thailand	882

*The data in this table are estimates derived from various sources, with some as current as 1992 and others pertaining to the late 1980s. As the same definition of "**hazardous waste**" has not been employed in all cases, the information is not comparable between countries and should be used only as a very crude estimate. For those countries where no information is available, the values were based on calculations using a coefficient for hazardous waste generation. This was varied between 4 and 20 kilograms per capita per year depending on the country.

Source: Harnandez, J. (1993). The Hazardous Waste Manager's Manual, Workbook and Database. Appeared in the NETTLAP Publication No. 1, UNEP, Bangkok

Table 4.9 Major Marine Pollutants from Land-based Sources: . Origin and Characteristics

Type	Origin	Characteristics
Domestic sewage	River discharges or direct outfall.	High bacterial count high bio-chemical oxygen demand high nutrient concentrations with potential eutrophication.
Municipal solid waste	Direct dumping or river discharge.	Interfere with fishing operation, causes damage to marine life. Unsightly. Causes beach pollution.
Industrial waste		
Organic industrial waste products (sulphite, petrochemicals, phenols, polycyclic aromatics, benzene, alpha-naphthylamine, oil products, etc)	River discharges, coastal pipelines, marine dumping by chemical factories, refineries, pulp and paper mills, and atmospheric fallout of airborne particles.	Many toxic to marine life, oxygen depleting, affects higher forms fo marine flora and fauna.
Inorganic industrial waste products (acids and alkalis, nitrates and phosphates, mercury, lead, copper, zinc, chromium, cadmiun, arsenic, bismuth, antimony, selenium, etc)	River discharges, coastal pipelines, marine dumping by chemical processing, and manufacturing industries, and atmospheric fallout of airborne particles.	Most metals are toxic to marine life, some (eg. nitrates and phosphates) are nutrients with eutrophication potentials, and a few (eg. mercury, lead, and arsenic) are toxic to humans.
Pesticides (herbicides, organochlorine compounds, carbornate compounds, insecticides, fungicides, germicides, rodenticides, etc). Most common forms are DDT, BHC, Dieldrin, Endrin, Aldrin, and Endosulfan.	Agriculture and forestry, reaches seas through marine absorption of atmospheric sprays, runoff from agricultural uses, floods, dumping, burning and drainage.	Some toxic to marine life, especially in upper levels of food chains. Chronic mammalian toxicity and adverse effects on sea birds. High concentrations may result in local damage to fish populations. Noticeably biodegradable.
Mining, dredging, and quarrying wastes	Dredging operations, disposal of mining and quarrying spoils in marine environment.	Heavy concentrations of suspended materials cause serious changes in marine life and dangers to fish population in spawning and nursery grounds. Can kill marine plant and animal life, often interfere with fishing operations.

Table 4.10 Organics (BOD), Nutrients Levels, Faecal Coliforms and Trace Metals in Some Rivers of the East Asian Seas Region as Reported to the GEMS/Water Programme, 1987-1991

Country	Station	1987	1988	1989	1990	1991
Organics, BOD (mg/L)						
Indonesia	Musi River at New Intake	1.40	1.60	1.10	NR	NR
	River Banjir Kanal	8.10	8.80	5.70	9.20	NR
	River Citarum	7.00	6.80	7.80	7.40	NR
	River Garang	1.40	2.65	NR	2.30	
	River Sunter	10.00	8.55	6.20	7.90	NR
	River Surabaya	11.70	15.00	10.00	5.90	
Malaysia	Kinta River	NR	0.80	NR		
	Klang River	7.00	7.00	4.80		
	Linggi River	NR	1.95	3.10		
	Sekudai River	2.20	1.35	2.20	NR	
Philippines	Cagayan River		0.70	0.30	1.00	0.44
Thailand	Chao Phrya R. D/S Nakhon Sawan		NR	1.20	0.50	
Suspended solids (mg/L)						
Indonesia	Musi River at New Intake	95.0	61.5	89.0	NR	NR
	River Banjir Kanal	44.0	45.6	45.2	48.0	NR
	River Citarum	192.0	77.0	169.0	70.0	NR
	River Garang	76.0	75.5	131.0	245.0	
	River Sunter	86.0	73.5	121.0	140.0	NR
	River Surabaya	48.0	82.0	370.0	90.0	
Malaysia	Kelantan River	63.5	106.5	156.0		
	Klang River	95.5	82.5	154.0		
	Linggi River	NR				
	Muda River	62.5	34.0	16.0	NR	
	Sekudai River	14.5				
Philippines	Cagayan River		29.0	52.0	36.0	6.0
Nutrients: Nitrogen, Nitrate + Nitrite (mg/L as N)						
Malaysia	Klang River	5.40	3.70			
	Linggi River	NR	1.65			
	Sekudai River	1.75	1.92	2.16	NR	
Nutrients: Total Orthophosphate (mg/L as P)						
Indonesia	Musi River at New Intake	0.02	0.01	0.04	NR	NR
	River Banjir Kanal	0.17	0.19	0.13	0.12	NR
	River Citarum	0.03	0.03	0.03	0.05	NR
	River Garang	0.07	0.06	0.10	0.08	
	River Sunter	0.11	0.16	0.08	0.07	NR
	River Surabaya	0.15	0.12	0.10	0.11	
Malaysia	Kelantan River	0.19				
	Muda River	0.04				

Table 4.10 (contd)

Country	Station	1987	1988	1989	1990	1991
Nutrients: Total Phosphorus (mg/L as P)						
Indonesia	Musi River at New Intake	0.08	0.08	0.09	NR	NR
	River Banjir Kanal	0.40	0.45	0.14	0.30	NR
	River Citarum	0.13	0.16	0.08	0.10	NR
	River Garang	0.12	0.11	0.16	0.09	
	River Sunter	0.33	0.35	0.14	0.18	NR
	River Surabaya	0.24	0.16	0.13	0.16	
Faecal coliforms (No. per 100 mL)						
Indonesia	Musi River at New Intake	5.164	5.674	5.284	NR	NR
	River Banjir Kanal	$>1x10^6$	$>1x10^6$	820,000	$>1x10^6$	NR
	River Citarum	460,000	460,000	$>1x10^6$	890,000	NR
	River Garang			NR	82,500	
	River Sunter	$>1x10^6$	$>1x10^6$	310,000	560,000	NR
Trace Metals: Total Cd (mg/L)						
Indonesia	River Banjir Kanal	0.001	NR	0.004	0.004	NR
	River Citarum	0.003	NR	0.020	0.011	NR
	River Garang	NR	0.002	NR	NR	
	River Sunter	0.001	NR	0.009	0.010	
	River Surabaya	0.016	NR	NR	NR	
Thailand	Chao Phrya R. D/S Nakhon Sawan	NR	NR	0.002	NR	
Trace Metals: Total Pb (mg/L)						
Indonesia	Musi River at New Intake	0.001	0.010	NR		
	River Banjir Kanal	0.010	NR	0.025	0.325	NR
	River Citarum	0.009	NR	0.030	0.155	
	River Sunter	0.007	NR	0.035	0.268	NR
	River Surabaya	0.080	0.90	0.050	NR	
Malaysia	Klang River		NR	0.020		
	Linggi River		NR	0.020		
	Sekudai River		0.100			
Thailand	Chao Phrya R. D/S Nakhon Sawan	NR	NR	NR	0.020	

5. ASSESSMENT OF POLLUTION LOADS IN THE EAS REGION

The lack of reliable statistics describing the generation of pollution loads from various land-based sources continues to impair the assessment of total pollution loads in the EAS region and the formulation of appropriate waste management strategies (COBSEA 1988 and 1989). Total pollution loads that are discharged into the East Asian Seas region from various land-based sources include organics (BOD and COD), nutrients (nitrogen and phosphorus), suspended solids (SS), oil and grease (O&G), heavy metals, highly persitent organics and hazardous substances. Due to non-availability of reliable quantitative information on pollution loads contribution due to heavy metals, highly persitent organics and hazardous substances, total inputs of pollution loads in the EAS region was assessed (UNEP 1989) based on BOD, COD, suspended solids (SS), nitrogen (N), phosphorus (P) and oil and grease (O&G). Organics (BOD) is the major pollution load in the EAS region. Most of the organic pollution loads (BOD) are discharged in Zones 2, 3, 4, 5, 6, 7 and 11 as shown in Fig. 2.2 (Koe and Aziz 1989). These zones are characterized by shallow seas of the EAS region (Gomez et al 1990).

In the absence of intensive monitoring programme, the pollution loads entering the coastal envrionment were evaluated under two conditions (UNEP 1992). The first condition excluded the pollution load reduction on the river system while the second condition considered only the pollution load generated within 60 km distance from the estuary.

Figure 5.1 shows the pollution loads from each country when only the regions close to the coastline are considered while Figure 5.2 shows the pollution load from each country when the pollution loads reduction in the river system is neglected. The sum of the pollution loads from the different countries discharged to the various zones (Fig. 2.2) had been shown in Fig. 5.3 considering only the pollution loads from the areas near the coast. Figure 5.4 presents the sum of the pollution loads neglecting the pollution loads reduction in the river system (UNEP 1989).

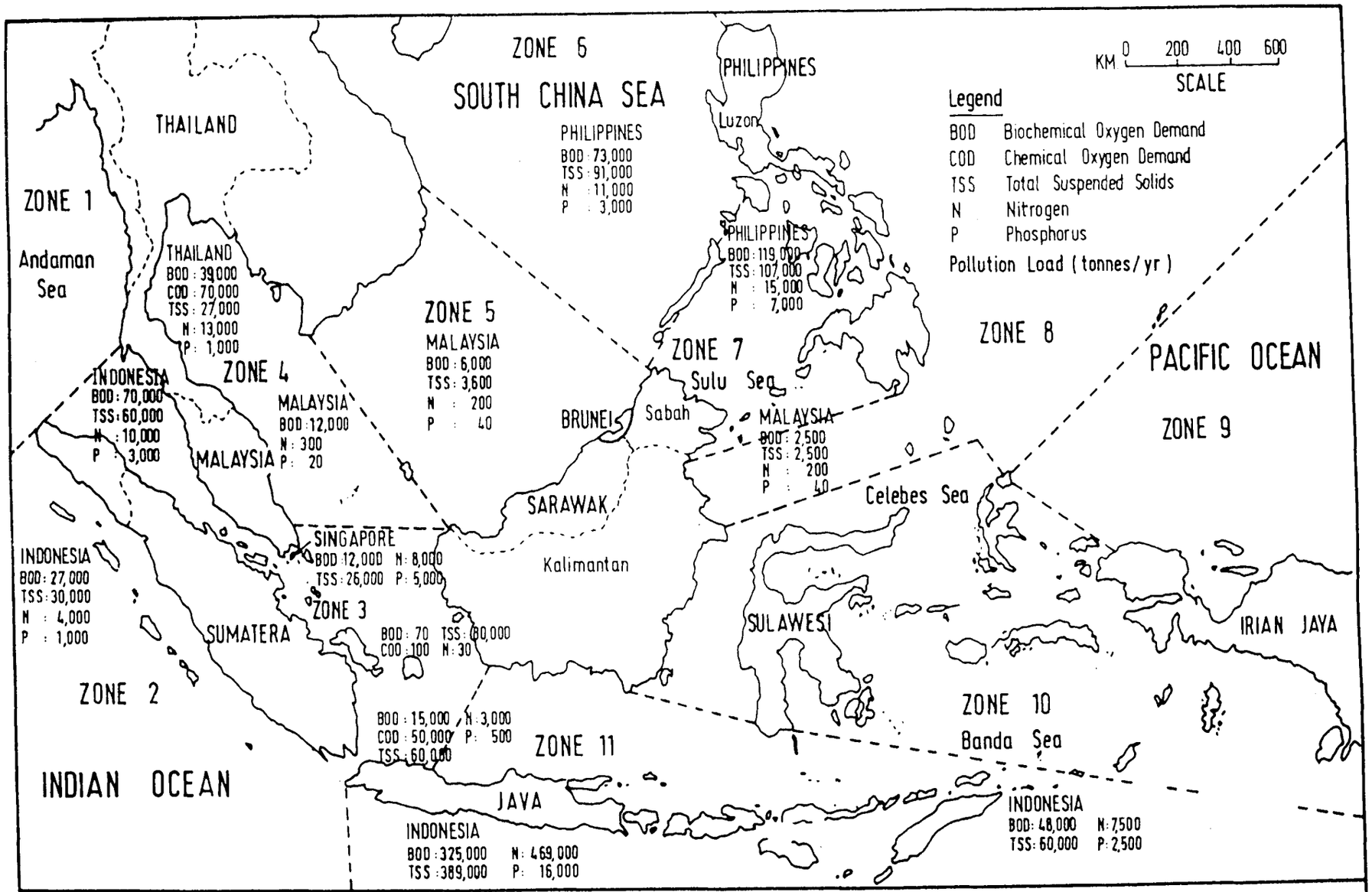

FIG. 5-1 POLLUTION LOADS FROM VARIOUS LAND-BASED SOURCES IN DIFFERENT ZONES OF THE EAST ASIAN SEAS REGION CONSIDERING ESTIMATED REDUCTION IN RIVERS

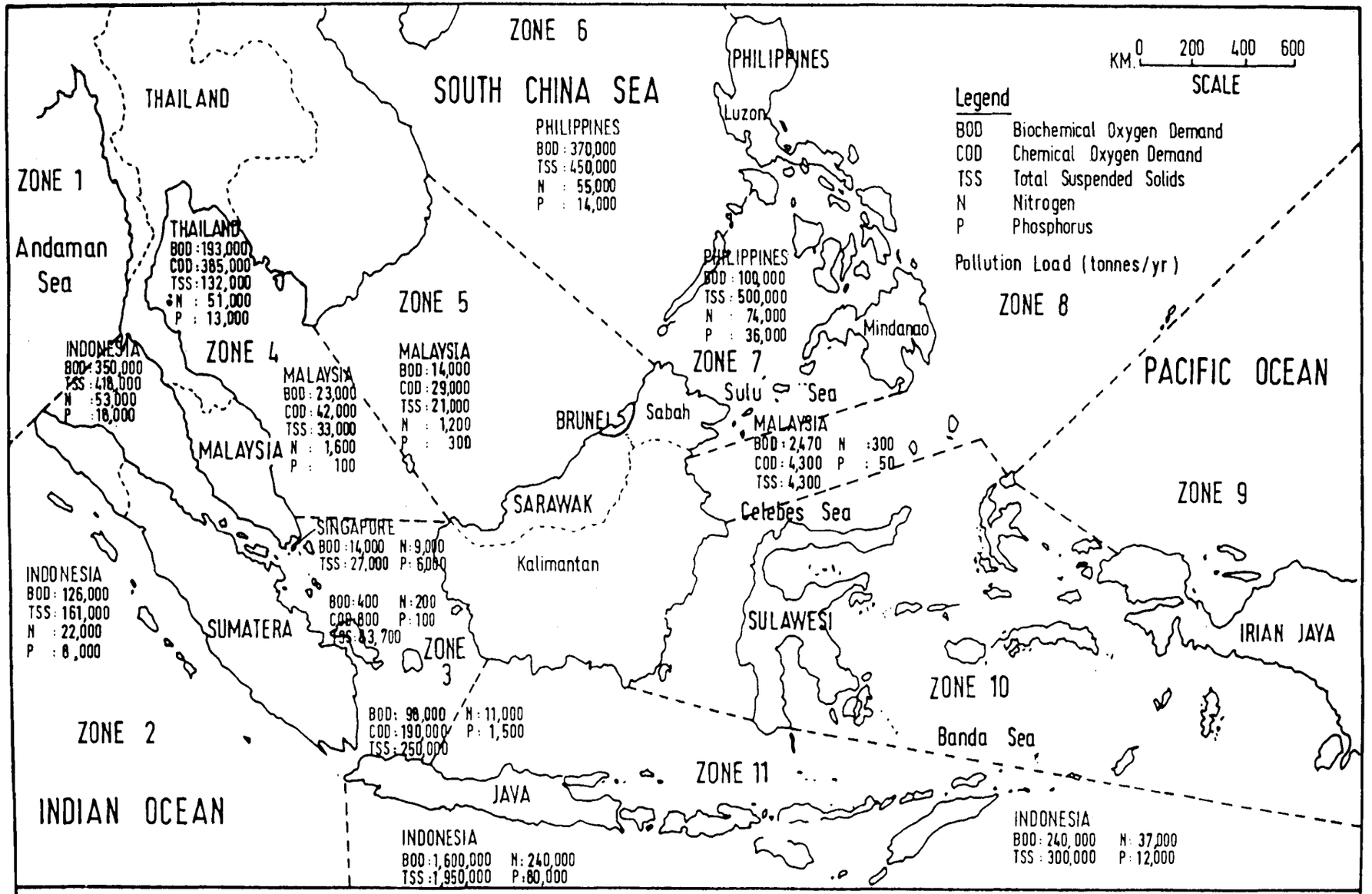

FIG. 5-2 POLLUTION LOADS FROM VARIOUS LAND-BASED SOURCES IN DIFFERENT ZONES OF THE EAST ASIAN SEAS REGION CONSIDERING TOTAL POPULATION IN WATER BASINS

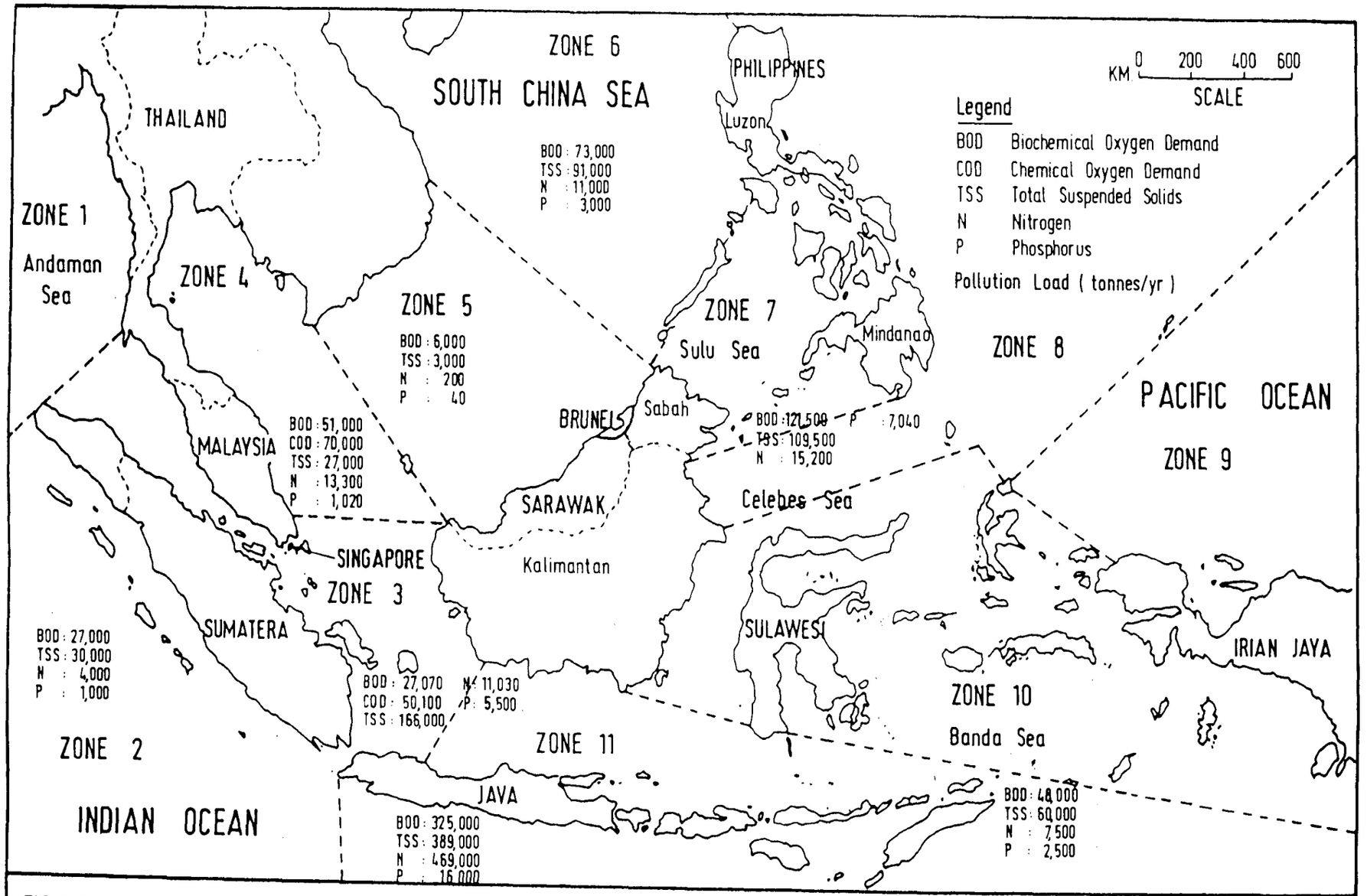

FIG. 5-3 SUM OF POLLUTION LOADS FROM VARIOUS LAND-BASED SOURCES IN DIFFERENT ZONES OF THE EAST ASIAN SEAS REGION CONSIDERING ESTIMATED REDUCTION IN RIVERS

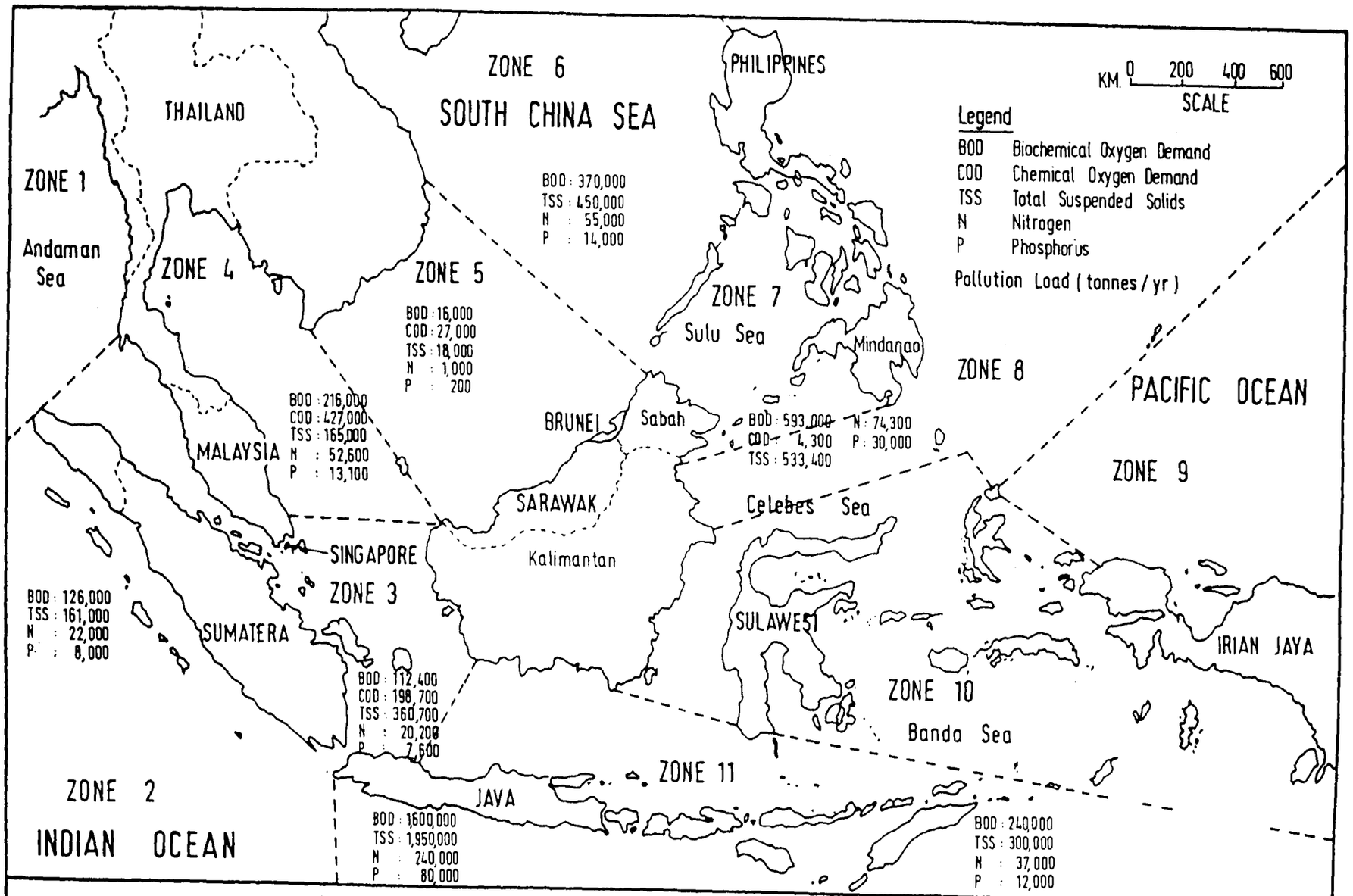

FIG. 5-4 SUM OF POLLUTION LOADS FROM VARIOUS LAND-BASED SOURCES IN DIFFERENT ZONES OF THE EAST ASIAN SEAS REGION CONSIDERING TOTAL POPULATION IN WATER BASINS

6. IMPACTS OF LAND-BASED SOURCES OF POLLUTION INTO THE EAS REGION

Major source of organic pollution in the region is sewage, much of which is discharged raw into coastal waters whether directly or through rivers and waterways. Sewage is in fact the most universal form of marine pollution. Their impact is usually in inshore waters which are used for growing and/or harvesting of shellfish as well as for recreation such as bathing and boating (Aziz and Ng 1989, Van-Veldhuizen and Aragones 1991, UNEP 1993). The effect of sewage on such filter-feeders as oysters, clams and mussels is well known. These shellfish concentrate bacteria and viruses from sewage in the process of feeding. The consumption of raw or partially cooked shellfish which have been exposed to untreated sewage can thus lead to the transmittal of viral diseases such as **hepatitis.**

Sewage pollution in coastal waters has affected water-related recreation and amenities. While cases of serious diseases, e.g. typhoid and cholera, due to sea bathing in sewage-polluted waters have never been conclusively proved, there is evidence of transmital of certain mild afflictions, such as respiratory infections and gastro-enteritis, through this mode. The more undesirable aspect of sewage-pollution has been its effect on amenity value of the water and beach. There have been visible turbidity, scum and other floatables on the water surface and beach, and an offensive odour, associated with the sewage discharge.

Sewage discharge had led to **eutrophication** of some coastal waters in the region. In recent years, more **red tides** (both toxic and nontoxic) have been reported in the region (Fig. 6.1). A number of incidents involving paralytic shellfish poisoning have been recorded in virtually all the countries in the region. **Eutrophication** has severely affected some coastal areas (Aziz and Ng 1989, Van-Veldhuizen and Aragones 1991, UNEP 1993).

High **faecal coliform** levels are detectable near population centres with the notable exception of Singapore which has waged a concerted effort to curb pollution at source. Organic inputs from industries are considerable near industrialized areas, although there is no evidence that toxic contaminants are being released in high concentrations.

An in-depth indication on the economic implications of marine evironmental impacts of land-based sources of pollution in the EAS region is not easily quantifiable. However, the following are some of potential economic consequences:

- **Sewage** contamination of shellfish beds results in loss of export earnings from shellfish; increase in cost to consumers of clean or depurated shellfish; loss of livelihood by shellfish farmers along with human health problems resulting from the consumption of contaminated shellfish.

- **Solid waste (litter)**, apart from being a nuisance, spoils the aesthetic value of the marine environment. Floating litter also reduces the amenity of swimming beaches and causes navigational hazards.

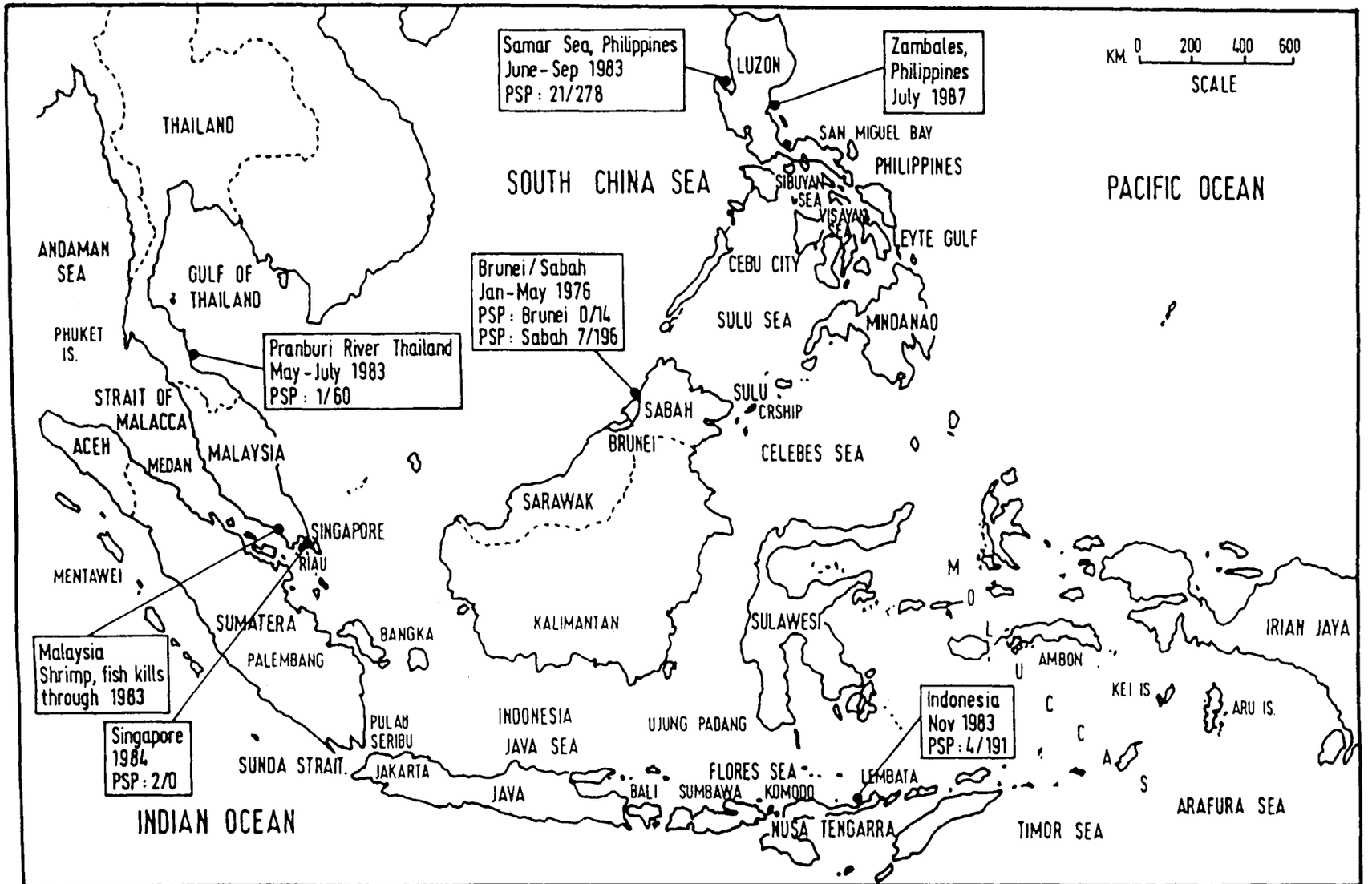

FIG. 6-1 LOCATIONS OF RED TIDES, INCLUDING THOSE RESPONSIBLE FOR FISH KILLS AND INCIDENTS OF SHELLFISH POISONINGS IN THE EAST ASIAN SEAS REGION (1980-1991)
(Numbers and dates in boxes refer to numbers of deaths/illnesses and the time of the first reported incident)

- **Industrial wastewater effluent** discharges damage marine and aquaculture resources leading to high cost of restoration of the marine environment along with fines and compensation.

- **Eutrophication** often implicates in **red tides** which lead to paralytic shellfish poisoning which invariably result in loss of export earnings from fish and shellfish, human health problems, and loss of livelihood for fishermen and shellfish farmers.

Pollution from land-based sources is a serious problem in the East Asian Seas region. Most pronounced impacts are those resulting from both organic and inorganic pollution.

Eutrophication in various coastal waters receiving high organic inputs from sewage is common in the region. Malaysia reported nutrient enrichment in some parts of the Straits of Malacca (around Penang Island and in Johor) and off the coast of Sabah that has given rise to eutrophication of waters and high BOD. However, in other offshore areas of the South China Sea, the phosphate levels were low. Organic load from sewage in the northern part of the Straits is believed to have given rise to considerable levels of microbial contamination in shellfish.

Both toxic and non-toxic red tides have been reported in the coastal waters of Brunei Darussalam, Indonesia, Malaysia, .Philippines and Thailand. Several others red tide phenomena have been reported from Brunei Bay, Manila Bay and Jakarta Bay (Fig. 6.1). The bloom normally occurs in September/October coinciding with the first period of the season's heavy rain. It has also been noted that the occurrences of red tides are more frequent in the region, although the link to eutrophication due to sewage discharge or agricultural runoff has yet to be established. There is more direct evidence that eutrophication adversely affects benthic communities. A number of incidents involving paralytic shellfish poisoning have been recorded in virtually all the countries of the region. Farmed fish which are confined in cages as well as juvenile fish are most seriously affected.

Most pronounced biological effects of eutrophication are probably those on benthic communities. Some studies conducted in the region clearly showed spatial changes in the epi-benthic community structure along the organic pollution gradient. The decrease in community diversity as well as abundance and dominance of predatory gastropods along the gradient also reflect changes in trophic structure brought about by organic pollution. In contrast to the situation in Manila Bay, however, no significant change in the percentage of deposit feeders was found. Likewise, the species composition and trophic structure of the fish community changed in relation to the pollution gradient. In the harbour where organic pollution is severe, summer mortality of fish and benthos due to oxygen depletion followed by winter recovery becomes a regular phenomenon, and it was postulated that such a phenomenon may be characteristic in subtropical benthic systems subject to high levels of organic pollution.

Concentrations of coliform in a number of coastal locations in the region exceed national standards, indicating the potential risk of exposure to human pathogens and consequent disease transmission. However, records of human disease associated with swimming in

polluted beach waters are lacking for the region. A drastic increase in coliform count was noted in Manila Bay from 1983 to 1985. Coliform counts in all beach resorts exceeded the maximum allowable total of 1000 MPN/100 mL for recreational waters. Coliform counts in other areas of the bay also exceeded the maximum of 5000 MPN/100 mL for waters for aquaculture. Recent surveys found that some swimming beaches of the region, the coliform count exceeded the standards for recreational waters (UNEP 1993). Coliform levels as high as 26,000 MPN/100 mL were obtained in some coastal water samples. In some coastal waters, pathogens have been reported in edible shellfish and fish. High numbers of faecal coliform were reported in shellfish beds contaminated by sewage pollution in the Straits of Malacca. High coliform levels in oysters and mussels in the Gulf of Thailand were reported particularly during the high flow season resulting in low salinity of coastal waters. Some pathogenic bacteria have been reported occassionally resulting in closure of some beaches.

In addition, the destruction of productive ecosystems like mangrove swamps, coral reefs, seagrasses and other marine resources due to heavy metals and other hazardous substances is not uncommon in the region (Aziz and Ng 1989).

The coastal areas of the EAS region have been adversely affected by inadequate waste management practices. The resource base of the coastal area inhabitants (e.g., fisheries) is deteriorating. Many of the coastal areas are unsafe for water contact recreation. These areas will deteriorate further due to uncontrolled waste discharges as a result of population growth, urbanization and industrialization (Koe and Aziz 1994).

7. CURRENT STATUS OF POLLUTION CONTROL STRAGEGIES OF PARTICIPATING COUNTRIES

7.1 BRUNEI DARUSSALAM

Introduction

In Brunei Darussalam, the National Committee on Environment was instituted in January 1993 and its role is to coordinate matters on various environmental issues. There exist legal infrastructure and institutional arrangement for coastal resources management (CRM) and environmental protection in Brunei Darussalam. Assessment of the coverage of existing laws focuses on those that affect: (a) landward portion of the coastal zone, (b) sand mining, (c) water quality and (d) pesticide use. These laws are adequate to meet acceptable levels of environmental quality. Administrative agencies, however, have yet to use the full authority that the laws provide through their proper translation into relevant rules and regulations. Currently, no single ministry or department has responsibility for overall CRM and environmental protection.

Prevention

Planning controls

Development control measures exist to control soil erosion and sedimentation resulting from private development works. Measures include the requirement for developers to turf areas of bare soil, construction of sedimentation ponds or silt traps and construction off diversions of troughs to intercept and divert runoff around exposed areas. In order for these control measures to be effective, monitoring and enforcement need to be strengthened.

New dwellings and buildings in areas without piped sewerage system are required to have a septic tank system. The Government exercises control over septic tank usage and design through the Town and Country Planning Act in development control areas. In municipal areas, the Public Works Depaprtment and the Medical and Health Department check septic tank designs, plumbing stack designs and proposed construction materials.

Infrastructure development

An efficient sewerage system is an integral factor in achieving a clean and healthy environment. With urbanisation and the increasing population, the need for more extensive sewerage system becomes more pressing. Currently, certain portions of major towns of Bandar Seri Begawan, Seria, Kuala Belait, Tutong and Muara are served with central sewerage systems. The objective of the current and sixth National Development Plan (1991-1995) is to extend the seervice to other areas (Sunny and Soraya 1994).

The Government is continually allocating financial resources for the construction of sewerage systems and STWs/STPs. In the sixth National Development Plan, a sum of B$82.3 million has been allocated (about 1.5 percent of the total amount allocated for development expenditure) for the implementation of sanitation projects. Amongst the major projects are Muara Town Sewerage Scheme Phase III, New Sewerage Treatment Works for Brunei/Muara, Improvement to Sewerage System Kuala Belait Phase I, Gadong Area Sewerage Scheme Stage I, Seria Sewerage Treatment Works and Extension of Seria Sewerage System.

A sewerage system for Kampung Buang Sakar in Kampong Ayer has recently been initiated. The system is a vacuum sewer system which consists of a gravity sewer between a house toilet and a vacuum chamber, collection chambers with vacuum valves servicing 2-5 houses; vacuum sewer mains laid along the alignment of walkways connected to collection chambers. An efficient sewerage system in Kampong Ayer will prevent discharge of untreated sewage into Sg Brunei and Sg Kedayan. This will greatly improve the water quality of the rivers concerned and reduce the potential health problems associated with water based activities in the area and have a positive impact on tourism and fishing in the area.

Legislation and enforcement

There are no specific laws which specifically addresses the protection of water quality. Existing laws are not effective legal instruments to protect water quality. Consequently, an appropriate legal framework needs to be established which are specific for water resource management.

Monitoring programmes

There is presently no systemmatic monitoring programme for water quality of rivers and coastal waters. In addition to the need to the establish a harmonised legal framework, it is also necessary to establish environmental quality objectives, corresponding standards and monitoring requirements for the water resources of Brunei Darussalam.

Education and training

The Ministry of Development conducts environmental awareness courses and training on specific environmental topics on a regular basis for both government and private sector officials. A proposal for a national environmental education plan is currently being considered. The aim is to enhance environmental awareness and training programmes to a wider audience including schools and colleges, youth organisations and the general public.

Institutional framework

Although there is no single agency responsible for environmental matters in Brunei Darussalam, a National Committee on Environment was set up in 1993 to coordinate and review environmental matters as well as provide policy guidance. The Environment Unit of the Minsitry of Development serves as a Secretariat to the Committee.

Currently, no single department in Brunei Darussalam is responsible for effective implementation of water quality management measures. Ideally, it would be necessary to create a single authority with water quality monitoring and enforcement capabilities. However, with limitations in manpower resources, a Working Group on Water Resource Management has been established. Members comprise representatives from the relevant departments involved in water qaulity management, for example, Department of Drainage and Sewerage Services, Health, Municipal Boards, and Environment Unit, Ministry of Development.

Implementation of Proposed Action Plan on Water Resources Management

Policy

To promote sustainable management of water resources, in particular:

- to safeguard the freshwater supply from rivers and groundwater for drinking water at WHO drinking water standards for the foreseeable need of future generations

- to safeguard the use of water resources (freshwater, river, intertidal and coastal waters) for development purposes. In particular for fishing, aquaculture, agriculture, industrial and recreational purposes.

Objective

Establishment of environmental quality objectives and corresponding standards and monitoring requirements for the water resources of Brunei Darussalam.

Establishment of a plan of action to mitigate adverse effects on Brunei Darussalam's water resources (present and future) with particular emphasis on the following critical activities:

- raw sewage discharge from settlements
- solid waste management
- silt from land clearance
- oily waste from workshops
- live stock wastes from agricultural development
- discharges from industrial development
- establishment of harmonised legal framework for water resource management

Activities

Proposed activities are as follows:

- Assessment of existing water quality (rivers, estuaries, coastal waters and ground water) and potential trends
- Establishment of water quality objectives based on present and potential use
- Establishment of corresponding standard for each objective
- Establishment of water quality monitoring plan
- Implementation including allocation of resources and monitoring plan
- Communication of the environmental quality objectives and corresponding standards and monitoring requirements to all relevant parties, including government departments, industry and general public.

Mitigation Projects

To mitigate adverse effects on the environment taking into consideration the following recognised priority areas for action (Sunny and Soraya 1994):

Sewage discharge: to ensure that all of the sewage is collected, treated and discharged into the environment at a quality compatible with the quality objective of the receiving environment by 2000.

Oily waste from workshops: to ensure that no oily waste from workshops is discharged into the marine aquatic environment by 1996.

Siltation: to upgrade the soil erosion control measures in public and private developments in order to reduce the sediment load of the marine environment by 1/6/1995.

Livestock Wastes and Agriculture Runoff: to reduce the pollution load (organic and inorganic) by segregation and appropriate treatment of livestock wastes and proper use of agricultural chemicals.

Industrial discharges: Establishment of Environment Impact Assessment and verification procedures for all new industrial projects.

Mitigation projects include amongst others the following:

- Development of systematic framework for setting objectives and targets (e.g. agriculture, aquaculture, construction, industry, sewerage) affecting the specific water quality objectives.

- Review and ranking of sewerage projects, in particular the construction of sewage treatment plants, sewerage scheme at Kampong Ayer, septic tanks and rural sanitation projects.

- Feasibility study of collection and treatment facility for oily waste from workshops.

- Establishment of soil erosion control guidelines and verification procedure for public and private development.

- Development of EIA procedure for new industrial projects through a workshop.

Organisations and Resources

Establishment of a Water Resources Management Working Group of the National Committee on Environment (NCE). The Working Group is proposed to comprise the following:

Chairman	Director of Drainage and Sewerage Services, PWD
Members	Environment Unit
	Department of Water Seervices, PWD
	Health
	Fisheries
	Agriculture
	Forestry
	Brunei Shell Co.

The Working Group shall be responsible for the execution of the plan and report periodically to the NCE on progress against plan.

7.2 INDONESIA

Introduction

Apart from being a source of primary power and drinking water, rivers are also used as waste disposal sites. As population pressures increase, the amount of waste disposed into rivers increases as well.

To address this problem, water pollution control activities were initiated in 1988 on the Kali Surabaya. The following year, a major river cleanup programme, **PROKASIH**, was incorporated into the national budget for 1989/1990.

PROKASIH (the River Cleanup Programme) activities were focused at improving river water quality to a recognized minimum level. Efforts in attaining this level included the reduction of rubbish directly being disposed of into rivers.

Project goals of **PROKASIH** were limited to implementing several practical principles which included simple focused and deliverable solutions as well as "**accountable**" law adherence together with enforcement.

The successful implementation of **PROKASIH** depended on the following parameters (Uktolseya and Rachmawati 1994):

- lowering pollution levels by reducing refuse levels entering the river
- improving water quality of the river
- providing institutional strengthening through the development of regulations, enhanced human resources development and improved budget resources.

To achieve these goals, regulation enforcement is a primary concern. This is presently being accomplished through the issuance of a **Declaration Letter** to various plant and company management ordering them to reduce the levels of refuse they are disposing into the river.

During the first year of the **PROKASIH** programme, implementation efforts have been introduced in eight provinces and expanded in the second year to a further eleven provinces. It is planned that by the fifth year of the programme, implementation will occur in a total of thirteen provinces.

Table 7.2.1 presents a list of regional and provincial rivers that are participating in the **PROKASIH** programme (Uktolseya and Rachmawati 1994).

Table 7.2.1 Participating Regions in the PROKASIH Programmme

	Region	River
1.	DKI Jakarta	• Ciliwung • Cipinang • Mookervart
2.	West Java	• Ciliwung • Citarum • Cisadane • Cileungsi
3.	Central Java	• Kaligarang • Bengawan Solo
4.	East Java	• Brantas: - Kali Lesti - Kali Porong - Kali Brantas - Kali Surabaya - Kali Mangetan • Bengawan Solo Hilir
5.	Lampung	• Way Pengabuan • Way Seputih • Way Tulang Bawang • Way Terusan • Way Pegadungan • Way Sekampung
6.	South Sumatera	• Musi: - Keramasan - Ogan - Komering
7.	North Sumatera	• Deli • Semayang • Asahan • Merbau
8.	East Kalimantan	• Mahakam
9.	DI Aceh	• DPS Krueng • DPS Langsa
10.	Riau	• Siak
11.	West Kalimantan	• Kapuas
12.	DI Yogyakarta	•
13.	South Kalimantan	•

In order for a river to be considered for involvement in the **PROKASIH** programme, it must serve as a primary source of drinking water (Basic Water Quality Group B) or receive high levels of industrial effluents.

If waste effluents exceed certain quantities, industrial plants are obliged to participate in the programme upon receipt of a "**letter of declaration**" issued by the PROKASIH management. Four years after the implementation of the programme, the number of participating industrial plants has risen to a total of 1,405. The focus of the monitoring component of the programme has been on the following parameters:

- pH
- Total Suspended Solids (TSS)
- Chemical Oxygen Demand (COD)
- Biochemical Oxygen Demand (BOD)

There are, however several problems being experienced in the execution of the **PROKASIH** monitoring programme. There appears to be between province variation in the distribution of sampling locations as well as the sampling frequency and the number of parameters being measured.

In spite of these inconsistencies, 1,038 water quality samples have been collected and analyzed in addition to 3, 851 industrial effluent samples. These figures represent total samples from all participating provinces.

Although 1,405 industrial plants are participating in the programme, the previously referred to samples have come from only 549 of them. The results thus far do indicate that the amounts of organic industrial effluent being introduced to the various rivers is being reduced.

Industrial effluent disposal into the rivers is decreasing. Nonetheless, the impact this reduction is having on water quality is unclear. The absence of a clear improvement trend may be a result of water level f luctuations in the rivers and the impacts of numerous other pollution sources.

With respect to measures of water quality, the results may be summarized as follows:

a. Rivers which appear to show an improvement in water quality:

- Kali Garang (Central Java)
- Musi (South Sumatera)
- Mahakam (East Kalimantan)
- Siak (Riau)

b. Rivers which demonstrate no change in water quality:

- Brantas (East Java)
- Ciliwung (DKI Jakarta)
- Mookervart (DKI Jakarta)

c. Rivers which show a decrease in water quality:

- Bengawan Solo River (Central & East Java)
- Cipinang (DKI Jakarta)
- Deli (North Sumatera)
- Asahan (North Sumatera)
- Kapuas (West Kalimantan)

The success of the **PROKASIH** programme was acknowledged by the American Society of Environmental Engineers. The management award, presented in April 1992, had previously never been presented to a programme outside the United States.

Prevention

Planning Controls

The issues related to industrial effluents and riverine water pollution control in Indonesia constitute an immense problem. In addressing these problems, the **PROKASIH** management strategy have guided their operational activities by the following four principles:

- to focus on limited but achievable goals due to institutional constraints, keep it simple
- to demonstrate perseverance
- to support institutional strengthening activities at every opportunity

As previously mentioned, the initial **PROKASIH** programme limited its activities to eight provincial rivers but the programme is now fully represented in 13 provinces. As implementation capabilities improve, the project expects to have a full national presence.

The **PROKASIH** project realizes that while implementing pollution control measures, it will evolve through a feed-back process, whereby reporting and information systems are improved, and through the development of its human resources and management skills at both the national and regional levels.

In addition to industrial effluent discharge, the programme has also taken action on the discharge of domestic waste from hotel, restaurant and apartment/condominium operations.

Provision of Sewage Infrastructure

In Indonesia, there is at present no formal regulation directly addressing sewerage infrastructure. However, in 1993 the Government issued Regulation No. 51, the Environmental Impact Assessment act known as **AMDAL**. This act states that any new development which will have consequences for the environment is obliged to conduct an impact assessment prior to project implementation.

In the **AMDAL** process, there is an environmental management planning (RKL) component. The RKL component requires that the technical process for disposing of the industrial wastes generated by the proposed venture be precisely outlined. If this part of the AMDAL process is successfully evaluated, a license will be issued giving permission for the venture to begin construction. Furthermore, if the disposal process is not followed, the operating license may be revoked.

Legislation and Enforcement

The **PROKASIH** programme will be successful if the regulations are uniformly and consistently enforced. If an industry under the cleanup programme continues to violate effluent standards and demonstrates no concerted effort to decrease its waste production, the **PROKASIH** programme has the power to issue a letter of notice. This letter may indicate that a temporary closing of the facility could take place if changes are not made or that municipal site services such as access to sewer mains will be stopped.

Prior to the implementation of the **PROKASIH** programme, a number of legislative acts addressing environmental concerns were already in existence. These include:

- Law No. 4 (1982) Basic Provisions for Management of the Environment
- Law No. 5 (1984) relates to Industrial Activities
- Law No. 9 (1985) relates to Fisheries
- Law No. 11 (1974) relates to Irrigation
- Government Regulation No. 20 (1990) Water Pollution Control
- Government Regulation No. 51 (1993) Environmental Impact Analysis
- Ministerial Decree Population & Environment No. Kep-03/MENKLH/II/1991 on Liquid Waste Standards for Activities Already in Operation
- Circular of the State Minister for Population and Environment No. Kep-03/SE/MENKLH/6/1987 on Procedures for Addressing Population and Environmental Damage
- Other Laws and Regulations of the Clean River Programme (**PROKASIH**) at central, regional and local levels

Monitoring Programme

The monitoring programme at the provincial level is a top priority of the programme. It is operationally carried out by a Regional **PROKASIH** Working Team under the coordination of the Deputy Governor who in turn receives technical guidance from the Environmental Impact Management Agency (**BAPEDAL**). Results are periodically reported to the provincial Governor (Regional Level 1) . Following a national format, the Governor in turn submits reports to **BAPEDAL**.

Operational implementation of the water quality field monitoring programme consists of:

a. selecting permanent monitoring locations on the river and its tributaries; these locations are to be sampled three times each year

b. selecting key parameters which are to be monitored and analyzed: parameters include Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), pH, Dissolved Oxygen (DO), NH_3, Sulphides, Phenols, Iron (Fe) and Zinc (Zn)

c. summaring results in a graphed form that illustrates changes in water quality from one year to the next

Education and Training

Success of any water pollution control programme is enhanced by achieving a heightened awareness, an increased level of participation among the general public and the development of human resources in conjunction with an effective programme management.

In order to achieve these goals, **BAPEDAL** has been working together with regional governments, institutions of higher learning, non-governmental organizations (NGOs) as well as with the private sector. Together these groups have organized training sessions, courses, seminars and workshops.

These educational programmes have been aimed at increasing environmental awareness and participation among the general public. Efforts have been directed at getting the public to think of environmental concerns such as waste disposal procedures, emission standards, and selecting environmentally friendly materials when conducting business.

The training components of the education programme have been directed to improve the technical skills of the regional executive staff. Overseas training has been provided for the treatment and control of industrial wastes, wastewater treatment and legal studies.

Institutional Framework

PROKASIH activities operate at central and regional levels. Provincial activities are carried out by a **Regional Team** under the coordination of the Deputy Governor. Furthermore, this group cooperates with other regional agencies such as Public Works, Cipta Karya Source, Health Services, Industrial Affairs Service and the Life and Environment Research Centre (PPLH). This provincial level determines the scope of the unit as well as the working goals. The goals are largely determined by the work volume and the capabilities of the human resources available.

BAPEDAL manages and coordinates programme activities at the federal level. This organization cooperates with the Department of Internal Affairs and Technical Institutions

such as the Department of Public Works and the Department of Industrial Affairs. Together these units are involved in the following activities:

- developing framework and goals of the programme
- adjusting regional level planning and implementation
- general programme guidance
- data analysis and preparing the national programme report
- publication and publicity
- overseas cooperation
- human resources development

Financial Arrangements

At the regional level, funding for the **PROKASIH** programme comes from several sources. These sources are:

- Level 1 Region Cost Income Budget (APBD)
- State Cost Income Budget (APBN) which is made up of the Reward Fund (INPRES) of Dati 1
- Project funds from Environment Impact Management Agency (BAPEDAL)

At the national level, funding is received from:

- State Cost Income Budget (APBN)
- Donor agencies such as CIDA-Canada, JICA-Japan and GTZ - Gemany

From 1989 to 1993, the total budget for the **PROKASIH** programme at the regional level can be summarized in the Table 7.2.2.

Table 7.2.2 Budget Summary for PROKASIH programme

Year	Number of Provinces	Budget (Rp in billions)		
		APBD	APBN	TOTAL
1989/1990	8	455	0	455
1990/1991	11	696	0	696
1991/1992	11	1,091	35*	1,126
1992/1993	11	1,469	443**	1,912
TOTALS		3,711	478	4,189

* Funding source - Donation Fund of Dati I
** Funding source - Donation Fund of Dati I, INPRES Fund of Dati I and BAPEDAL Project Fund

From 1989 to 1993, APBN funds dispersed by BAPEDAL for PROKASIH activities totalled Rp. 595 million (see Table 7.2.3).

Table 7.2.3 Dispersal of APBN Funds

Year	APBN (Rp. in millions)
1989/1990	19.5
1990/1991	31.6
1991/1992	34.5
1992/1993	509.0
Total	595.0

Implementation of Action Plans

PROKASIH implementation action plan is drawn up on three schedules, namely short-term, interim and long-term periods and these intervals consist of several components (Uktolseya and Rachmawati 1994).

Stage one consisted of systematic pollution control planning and took place during 1988-1989. Activities included:

- policy determination
- legislative activities resulting in a valid act
- enforcement of legislation

It was during this first stage that efforts were also directed at increasing public awareness of the programme and its objectives and to develop basic management infrastructure and settle basic programme issues.

Stage two involved institutional mobilization and human resources management and was completed during 1989-1991. Additional activities included:

- development of Environment Impact Control Agency (BAPEDAL)
- implementation of the first stage of PROKASIH
- announcement of PROKASIH activity components that included:
  - defining who would be participating provincially
  - establishment of provincial project team
  - identification of rivers to be included in the project
  - developing legislation for PROKASIH implementation
  - implementation of technical guidelines
  - identification of polluters
  - notifying polluters of their inappropriate activities

- submission of declaration letter indicating permissible effluent levels and expected time frame for compliance
- maintenance of quality control
- study by regional project officers of law enforcement as achieved in other countries
- human resources development stressing technical skills

Stage three focused on improving the quality of senior **PROKASIH** management particularly in respect to institutional strengthening. Activities during this phase were carried out during 1991-1993 and included:

- re-evaluation of work schedule
- composing the data terminal system
- refining the reporting system
- refining the implementation of technical guidelines
- directing action to offenders which fail to take appropriate measures to reduce their pollution production
- training of equipment technicians
- definition of water pollution legislation especially Government Regulation No. 20 (1990) and Decision of the State Minister for Population and Environment No. 3/1991
- identifying waste production within a plant and incorporating these levels into the plant's operating license
- activities related to hospital waste and domestic waste disposal procedures especially for hotels, apartment complexes and restaurants

Stage four (1993-1995) featured a broadening and deepening of activities related to an increase in quality and capacity. Steps involved were:

- re-evaluation of the total programme in conjunction with PJPT II and REPELITA VI
- supervision of licensing procedures for waste disposal and control
- increasing quality control of data gathering, processing, reporting and publishing results
- dissemination of information to the public

Stage five will be directed towards the reduction of water pollution by the year 2000 and beyond. Planned activities include:

- development of an environmental awareness among the private commercial sector
- identification of commercial activities which have a minimal environmental impact
- identifying appropriate technology to reduce pollution production
- spatial planning with respect to environmental carrying capacity
- identifying potential impacts of commercial operations
- achieving minimal emission and effluent standards
- appropriate and safe disposal of hazardous wastes
- preparation of emergency response protocols

- conducting self-monitoring exercises
- availability of information for consultation to take responsibility for protection of the public interest

To encourage the private commercial sector to comply with programme legislation and to participate in the activities cited above, the project will-develop the following activities:

- offering information and consultation services to the private sector
- developing environmental monitoring mechanisms which identifies incentives and disincentives for the market
- enforcing the licensing system and adherence to the law
- developing a mediation mechanism for societal/business conflicts
- following appropriate AMDAL protocols
- offering recognition to businesses which follow good environmental practices
- developing an import ban which "**blacklists**" hazardous wastes and poisons
- offering support to small-scale business in addressing negative environmental impacts

7.3 MALAYSIA

Introduction

Since independence, Malaysia has forged ahead with rapid economic growth in order to provide for the material condition of an acceptable standard of living. The implementation of various development plans have resulted in setting up of manufacturing industries and intensification of agricultural activities to provide employment and export earnings. However, Malaysia's rapid economic development has drawn heavily on its resource base ranging from forestry, land and water to fossil fuels and minerals. Air, noise and water pollution and industrial waste generation and degradation of the environment are of serious concern arising from such development.

Fully aware of. the environmental problems and the consequences that would follow, if no actions were taken, an inter-government committee was set up by the Government of Malaysia in 1970 to study and recommend plan of actions to counter the emerging pollution problems throughout the country. One of the recommendations of the committee was the need to strengthen the existing legal provisions for the control of pollution and preservation of the environment. A technical committee was formed in 1972 to draft a Bill to deal with environmental matters. The final Act, the Environmental Quality Act 1974 (EQA) was enacted by Parliment in March 1974 and subsequently came into force on 15 April 1975. One of the three strategies embodied in the EQA is to regulate pollution. The other two strategies are to prevent and abate any form of pollution.

The Department of Environment (DOE), the agency responsible for the implementation of the EQA has formulated and adopted a three-pronged strategy based on (Ramlah and Madhi 1994):

a. pollution control and prevention

b. integration of environmental factors in project planning and implementation

c. environmental inputs into resource and regional development planning

Prevention

In the promotion of environmentally sound and sustainable development, the Government of Malaysia has established the necessary legal and institutional arrangements to ensure that environmental factors are considered at the early stages of project planning. Environmental assessment is an important technique for ensuring that the likely impact of the proposed development on the environment are fully understood and taken into account before such development is allowed to go ahead. In Malaysia, Environmental Impact Assessment (EIA) is required for activities prescribed under the Environmental Quality (Prescribed Activities Environmental Impact Assessment) order 1987. Those industrial activities that are not subject to the mandatory EIA requirements are also subject to various regulations under the Environmental Quality Act of 1974. The standing regulations call for project siting

evaluation, pollution prevention and control, monitoring and self-regulation.

Planning Control

The objective of environmental planning is to ensure that environmental factors are taken into account in various development planning activities such as the preparation of master plans, structure plans and local plans and in planning of development projects. The success of the environmental planning programme depends much on the availability of adequate data, the awareness and commitment of the planners as well as adequate research and development support.

The Environmental Quality Act 1974 requires industrial activities to obtain several approvals from the Director General of Environmental Quality prior to the project implementation. The approvals required are as follows:

i. Environmental Impact Assessment reports (for prescribed activities only)

ii. Site suitability evaluation (for non-prescribed activities)

iii. Written permission to construct

iv. Written approval for installation of incinerator, fuel burning equipment and chimney

v. Licence to use and occupy (for prescribed premises).

Environmental impact assessment (EIA) requirement for prescribed activities

Environmental impact assessment (EIA) was made a mandatory requirement in January 1985 with the amendment of the Environmental Quality Act 1974. Further to this amendment, the Environmental Quality (Prescribed Activities Environmental Impact Assessment) Order 1987 was gazetted. This order requires those intending to carry out any of the prescribed activities to carry out an environmental impact assessment study and the EIA report should be submitted to the Director General of Environmental Quality before the project is implemented. The project is not allowed to proceed unless approval of the EIA has been granted. For an industrial project, the EIA generally would assist in determining site suitability as well as the necessary environmental control and mitigation measures.

Site suitability evaluation for non-prescribed activities

Most of the industrial activities (manufacturing activities) in Malaysia are sited in industrial estates. These industrial estates are managed by respective State Economic Development Corporations or are privately-owned. However, there are also ventures such as aquaculture activity and agro-based industry which are not sited within industrial estates. Irrespective of whether the proposed industrial activity is going to be sited within an industrial estate or

otherwise , it is the policy of the Government that it should be developed and managed with environmentally sound control measures. Therefore, all potential industrial sites for the establishment of new industrial activities which are NOT subject to EIA, particularly the Small and Medium Scale Industries (SMIs), should be referred to the DOE for consideration and advice on site suitability.

In considering the suitability, the site is evaluated in terms of its compatibility with respect to surrounding landuse patterns, provision of set backs or buffer zones, the capacity of the area to receive additional pollution load and waste disposal requirements.

For potentially hazardous type of industries, the project proponent may be required to submit a **Risk Assessment Analysis** to the DOE as part of the site consideration.

Written permission

Any person intending to carry out activities as listed below should obtain prior written permission from the Director General of Environmental Quality :

i. New installation near dwelling area as detailed out in Regulation 4 and First Schedule of the Environmental Quality (Clean Air) Regulations 1978.

ii. Construction of any building or carrying out any work that may result in a new source of effluent or discharge as stipulated under Regulation 4 - Environmental Quality (Sewage and Industrial Effluents) Regulations 1979.

iii. A factory which is categorised as prescribed premises i.e.

- Crude palm oil mill
- Raw natural rubber processing mill
- Treatment and disposal facilities of scheduled wastes

Written approval

For any installation of fuel burning equipment that is rated to consume

- Pulverised fuel or solid fuel at 30 kg or more per hour,

- Liquid or gaseous fuel at 15 kg or more per hour.

An applicant should obtain prior **'written approval'** from the Director General as stipulated in Regulations 36 and 38 of the Environmental Quality (Clean Air) Regulations 1978. Written approval is also required for any erection of incinerator and chimney/exhaust.

Licence to occupy

A licence is required to occupy and operate prescribed premises. Application shall be made after obtaining written permission and written approval. Licensing fee will be charged for every licence issued for premises of palm oil mill and raw natural rubber processing mill.

Provision of Sewerage Infrastructure

The implementation of a comprehensive sewerage system in Malaysia has been very slow due to lack of financial support. Being a highly capital intensive investment, commitment to sewerage projects have been extremely low. In the past, efforts have been made to improve sanitation in the country through a number of approaches. In the rural areas, a rural environmental sanitation programme in which pour flush latrines are constructed through community participation had been very successful and had taken care of sanitation needs in the rural areas. In the urban areas, all new developments in the past decade were required to be installed with waterborne sewerage systems following guidelines issued by the Ministry of Health and the Ministry of Housing and Local Government with a view to connecting to city wide sewerage systems in the future. Treatment methods that had been used include waste stabilisation ponds, imhoff tanks, aerated lagoons, oxidation ditch, rotating biological contractors and other extended aeration systems. As such, there exists a large variation in sewage treatment systems in Malaysia.

However, realising that the only practical and cost effective means of collecting, treating and disposing sewage from the densely-built up areas of towns is by means of waterborne sewerage systems, efforts had been made to plan and implement sewerage systems in the major towns of the country. So far, 19 Sewerage Master Plans were completed and only parts of 7 of these Master Plans have been implemented with the others being held up due to lack of funds.

Previously, the management of sewerage systems was the responsibility of the various Local Authorities throughout the country. However, little attention had been given to the operation and maintenance of these facilities with the result many systems that had been constructed do not perform adequately to meet the health and environmental standards.

In order to address the problem of poor and indequate sewerage facilities in the urban areas and the increasing environmental damage to rivers and beaches and to fulfil the urgent need to provide for an integrated accelerated development programme to upgrade and extend sewerage services to all urban areas, the Government of Malaysia has given a concession to a private consortium to undertake a nation-wide sewerage programme for the next 18 years on the privatisation basis for 145 population centres in both East and West Malaysia.

Sewerage facilities will thus continue to be upgraded and expanded to progressively control pollution of ground and surface water. Aside from expanding sewerage projects for major cities, sewerage schemes are also being implemented in designated tourist resorts in order to sustain these resorts as principal tourist destinations.

Legislation and Enforcement

The Environmental Quality Act 1974 (EQA) is the most comprehensive legislation relating to the prevention, abatement and control of pollution and enhancement of the quality of the environment in Malaysia. The EQA was approved in March 1974 by Parliament and brought into force in April 1975 and at the same time, the Division of Environment (Department of Environment since September 1983) now within the Ministry of Science, Technology and the Environment was established to administer the Act.

The provisions of the EQA are wide and provide for the control of pollution of the atmosphere, noise, soil, inland waters and the sea. Pursuant to the Act, 13 sets of Regulations have been introduced and enforced to deal with specific pollution problems. The Director General of Environmental Quality has been appointed by the Minister to administer this Act and any regulations and orders made thereunder.

To bring the law and other environment-related laws into effect, the following regulations and orders have been introduced and enforced to control land-based sources of pollution:

Control of Agro-Based Water Pollution

i. Environmental Quality (Licensing) Regulations 1977

ii. Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulations 1977

iii. Environmental Quality (Prescribed Premises) (Raw Natural Rubber) Regulations 1978

Control of Municipal and Industrial Wastewater Pollution

iv. Environmental Quality (Sewage and Industrial Effluents) Regulations 1979

Integration of Environment and Development

v. Environmental Quality (Prescribed Activities - Environmental Impact Assessment) Order 1987

Control of Toxic and Hazardous Waste

vi. Environmental Quality (Scheduled Wastes) Regulations 1989

vii. Environmental Quality (Prescribed Premises) Scheduled Waste Treatment and Disposal Facilities Order 1989

viii. Environmental Quality (Prescribed Premises - Scheduled Waste Treatment and Disposal Facilities) Regulations 1989

While environmental planning helps to integrate environmental dimension into development planning, the control of pollution through preventive and curative measures continues to be a major instrument in our environmental programmes. To enforce compliance of all significant sources of pollution with various standards of discharge either directly into watercourses or onto land, the DOE had adopted a number of enforcement mechanisms as its strategy, largely through the application of licensing instruments. The main purpose of licensing is to provide "**incentives**" for polluters to comply with the imposed standards as rapidly as possible, as well as to allow polluters to "**buy**" the necessary time for further R&D studies or for proper design and installation of the necessary wastewater treatment or disposal facilities. Thus, polluters are not "**licensed to pollute!**"

The DOE issues several types of licences, the first being the annual licence for prescribed premises provided for under Section 18(l) of the EQA. Both palm oil and rubber processing mills are required to comply with the standards of discharges specified under the Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulations 1977 (Amended 1982) and the Environmental Quality (Prescribed Premises - Raw Natural Rubber) Regulations 1978 (Amended 1980), respectively.

The second type of licences being the contravention licences issued under Section 25(l) of the EQA for manufacturing industries other than the crude palm oil and raw natural rubber processing industries. These licences are issued for the purpose of contrvening discharge standards specified in the Environmental Quality (Sewage and Industrial Effluents) Regulations 1979.

Monitoring Programmes

Environmental quality monitoring is one of the main activities carried out by the DOE to implement the pollution control strategy. Programmes for environmental quality monitoring have been established since 1978. In order to enhance and protect the national water quality uses, the Department had initiated a National Water Quality Monitoring Programme. Under the river water quality monitoring programme, a total of 116 river water quality regions and tributaries involving 892 sampling stations were established throughout the country. The water quality regions cover a catchment area of 654,708 km2 for the whole country.

Assessment of water quality is carried out in terms of physical, biological and chemical characteristics of the water body. In-situ water quality measurements include parameters such as turbidity, dissolved oxygen, salinity, temperature, pH and electrical conductivity while laboratory analyses are performed for as many as 30 other chemical and biological parameters. These also include bacteriological indicators, pesticides and detergent. Appraisal of the water quality are based on the Water Quality Index (WQI) for 5 parameters, namely Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Ammoniacal Nitrogen (NH_3N) , Suspended Solids (SS) and pH. The water quality data is also compared to the Interim National Water Quality Standards of Malaysia.

The DOE also established coastal water quality monitoring since 1985. Coastal water quality is monitored at approximately 153 locations selected with respect to fishery or recreational importance. Marine water samples were collected for chemical and bacteriological analyses.

Education and Training Programmes

In Malaysia, post-independence and current economic policies have prompted the rapid growth of the agricultural and industrial sectors whose activities, more often than not, are accompanied by the generation of large volumes of wastes which has the potential for polluting the environment if not properly controlled. In this respect, environmental education and information are of fundamental importance as they provide the necessary knowledge, values and skills needed by the general public and decision-makers to understand the complexities of the environment.

Environmental education and information, as a tool for creating environmental awareness and as a preventive strategy in environmental management has been given priority by the DOE. The Environmental Education and Information Unit was established in 1981 with the following objectives:

a. To disseminate environmental information as input to the decision-making process to protect and preserve the environment as well as to upgrade the quality of human life

b. To promote greater awareness and understanding of the environment among the general public and to inculcate responsible attitudes to control and prevent pollution through education.

In the **formal area** of environmental education, the new primary and secondary school curicula have environment as one of the subject to be taught in schools. At the tertiary level, a degree in environmental science is offered in one of the local universities while others have environment as one of the papers in the engineering or science courses.

In the **non-formal area**, the Department has implemented a number of activities to increase public awareness on the environment and these include the **Malaysian Environment Week** and **World Environment Day** celebrations held every year,talks to the general public and school children, seminars, workshops, inter-varsity debate's and various campaigns to increase the environmental awareness of specific target groups.

Apart from environmental education, information to the public in the form of press releases, policy statements made the Minister in charge of the environment when officiating seminars and workshops, easy access to the Department's library for research and other purposes, pamphlets and brochures on the activities and functions of the Department and publications such as the environmental quality reports also kept the public informed on environmental affairs.

The Department also implements various training activities such as sending officers for post-graduate courses, for short term courses both locally and abroad as well as in-house training.

Institutional Framework

In functional terms, water pollution control activities are many and varied and must therefore involve, whether directly or indirectly, numerous institutions and agencies at the Federal and State Government levels. Three broad groups of agencies or authorities are identified; namely, those having authority over water as a resource, secondly, those involved or concerned with the protection and conservation of water, and thirdly, those having authority over land use and related matters having an impact on water. However, not all the agencies and authorities identified have legislative or legal powers in relation to water pollution control. A large number of them are either involved in the planning processes of government administration or play an advisory role. Only a limited number of these agencies and institutions have legislative or legal powers for the exercise of control over water polluting activities and the management of water quality, and with the wide-ranging and enabling provisions of the EQA, the DOE has now become the lead agency for environmental protection and enhancement.

In view of the **State rights** as contained in the **Constitution** and the existence of **State laws** which indirectly affect pollution control, the DOE has adopted a two-pronged legal approach fot the control of pollution sources; namely, statutory control and non-statutory approach. The statutory means of control involving the regulatory process is adopted in areas expressly within the ambit of the EQA and other Federal environmental legislations. The non-statutory approach on the other hand, is used in areas not amenable to direct regulation under Federal legislation, but within the jurisdiction of the State Governments. These include the control of discharges arising from mining activities, forestry and agriculture, disposal of solid wastes and soil erosion and siltation. In this second approach, the DOE has formulated a number of environmental control guidelines for implementation by the relevant State Government authorities having the necessary powers of statutory control.

Financial Arrangement

The Federal development allocation for programmes to ensure the maintenance of sustainable development and the effective management of the environment is reflected in components of sectoral allocation placed under the control of the respective agencies. The DOE has been allocated RM 40.35 million in the period 1991-1995 to carry out research as well as to implement projects for the betterment of the environment. Among major projects to be implemented include EIA guidelines, control of water and marine pollution. In addition, the DOE also embarked on programmes such as environmental information and education, and the formulation of guidelines and regulations pertaining to environmental control. Apart from the DOE, other relevant ministries and their agencies are also given allocations to incorporate the environmental apsects into their programmes and projects wherever relevant, in order to help sustain a clean and healthy environment.

Implementation of Action Plans

It is recognised that regulatory control has its limitations in water quality protection and enhancement. Despite compliance with discharge standards, the pollution cumulative loads may eventually exceed the assimilative capacity of rivers and other waterbodies.

The deteriorating state of water quality of rivers and coastal waters of Malaysia necessitates changes to the present approach to water pollution control and the control of landbased sources of pollution. A fundamental need is the adoption of a holistic approach to water management. This aspect has in fact been recognised in the National Water Resources Study undertaken in the mid 1980's. The study recognised that a non-integrated approach makes water resource management ineffective. Hence, the study recommended the adoption of an integrated water resource management strategy based on a river basin management approach. It was further recommended that a national water policy and council be formed to guide and oversee water resources development and use in the country.

Pollution control is an integral factor in water management and should form part and parcel of the approach to be adopted to achieve optimum management of resources. In this context, some of the following proposals are recommended towards achieving the objective of integration. These include (Ramlah and Madhi 1994):

a. Pollution control to be managed on river basin approach. The adoption of water quality standards which have already been established for rivers is a long-term solution to address the deteriorating state of water quality of rivers. River water quality criteria and standards need to be developed. Rivers and other waterbodies should be classified for the review of existing effluent discharge standards. Appropriate effluent discharge standards can then be established for sources that discharge effluents into classified rivers.

b. Land use control to be managed on a river basin approach taking into consideration of set objectives for use of water and protection of river catchments. Ad-hoc decisions on land conversion should be avoided or restricted to decisions which will not adversely affect the set objectives.

c. Integration of control of water supply and sewerage for optimal management of resources and control of pollution. Cross subsidy of the two components would effectively allow the generation of funds for sewerage development and make the latter more attractive to local authorities or investors.

d. Additional financial resources to be allocated to local authorities to improve sewerage, drainage and waste collection services and provide other related services. This is reasonable given the bulk of population are found in the urban sectors and where the need for such services is most critical. Further, these areas are where the high yield taxes are paid to the government.

e. Responsibility of pollution control to be spread to states and local authorities rather than DOE alone. The latter should focus on the setting of policies and strategies to achieve environmental targets while the former should have responsibility to monitor and control pollution.

The implementation of the EQA and its regulations alone, even to its fullest extent, will not ensure the environment sufficiently protected from all sources of pollution. Other environment-related laws have to be fully implemented by the relevant agencies although their functions are not solely to prevent environmental problems arising from their respective sphere of competence. Most of these agencies could be characterized as agencies with dual missions: not only to protect or conserve natural resources but also to exploit such resources as water, land, forest, fisheries and minerals. The expected check-and-balance within their respective systems of internal administration should have ensured that resource exploitation is controlled for its renewal and sustainability such that the protected resources remain permanently available for further development and for future options.

Equally critical is the need of a common plan or joint programme of enforcement agencies. The individual action taken by different enforcement agencies is often too independent from one another, but also the action in toto has to concentrate in problematic areas of common concerns. Only through coordinated measures, the question of equitable distribution for pollution control among major sectors of the economy could be fully addressed.

7.4 PHILIPPINES

Introduction

The underlying basis of any government action towards the prevention and control of land based sources of pollution is on the policy adopted either by constitutional mandate or by congressional or parliamentary mandate. The Philippines has many appropriate laws enacted and thus the national policy is explicitly manifested. Essentially, the constitutional mandated policy is that people have the right to a clean and healthy environment and that any person or firm that creates a pollution situation must abate the same. In actual implementation of this policy, however, there are many difficulties encountered. Among these are lack of funds for industry to put up pollution control systems, and for government to closely monitor and enforce existing laws and regulations; lack of local technology and expertise; lack of technical capability needed for enforcement at the local level; deficiencies in laboratory equipment and analytical capability of the regulatory agency; the unique abatement problems of small scale or backyard industries; and the lack of adequate trained human resources (Rivera and Panaligan 1994).

Planning Control

Efforts at pollution control in the Philippines include monitoring of effluents; periodic inspections to determine compliance with effluent and discharge regulations and conformance with water quality standards; and hearing of pollution cases which could result in imposition of fines or cessation of operations that cause water pollution.

New or proposed projects which are actual or potential sources of pollution, such as industries and factories, are now required to prepare and submit an Environmental Impact Statement (EIS) prior to construction and operation to allow the government to look into possible and probable pollution implications of the said projects, and how this pollution could be minimized or mitigated.

The Environmental Management Bureau (EMB) has also encouraged the designation of Pollution Control Officers (PCO) in all the industrial and manufacturing establishments to be in charge of the water and air pollution control efforts of the company and serve as contact person with EMB/DENR. Such officers are regular employees of the company and their educational background, qualifications and experiences are considered prior to their designation. To improve the level of competence of such officers they are required to attend seminars, conferences and workshops on pollution control conducted by both governmental and non-governmental groups concerned with environmental pollution.

Industrial dispersal and industry location policy

The encouragement of industry dispersal into the countryside through rural infrastructure development and the provision of incentives is also a key measure towards an effective pollution control scheme. To a certain extent, the government has already moved in this

direction, particularly with the establishment of the Regional Industrial Centers and other decentralization efforts. Likewise, tax incentives and other privileges are granted to firms locating outside Metro Manila in accordance with the Investments Priorities Plan.

In general, anti-pollution devices are now required, and there are incentives provided. Examples of incentives are full tax and duty exemptions on imported pollution control equipment and tax credits for locally fabricated ones.

Provision of Sewerage Infrastructure

As experienced in Asian megacities and urban centers, a highly significant amount of water pollution is due to the inadequacy of sewer coverage of polluted areas. As a result, liquid discharges from septic tanks used in unsewered sections of the city eventually find their way into rivers and other waterbodies, causing pollution in terms of BOD, organic matter and total solids (TS).

At present, barely 13 percent of the population in Metro Manila is served by a sewerage system, 60 percent have septic tanks and 25 percent discharge their untreated wastewaters directly into the storm drains, river systems or coastal waters.

Outside Metro Manila where sewerage is the responsibility of the local government units, the condition is much worse. Baguio (summer capital city) is partly sewered. Some cities belonging to the top ten urbanized centers such as Cebu and Zamboanga only have plans while the rest do not have anything except septic tanks. Septic tanks have been the most prevalent form of on-site sanitation. Because of the small lot sizes in typical urban areas, septic tank effluent overflow into roadside drains. The government is studying a strategy to solve the problem on urban sewerage on a national scale.

A sewerage and sanitation plan was developed in Metro Manila in 1979 and the recommendation at the time was to construct a sewage collection system (separate system) for most of the MMR and in the case of low income high density areas, to install a low cost combined sewer system. The first stage was to be implemented in 1980-1985, the second stage in 1986-1990. The third stage was to be implemented in 1991-1995. To date, only the first stage (METROSS 1) has been built and the second stage is presently under review by the World Bank for possible funding.

The suggested strategy for further development of the sewerage system is to continue the staged construction of the collection system and corresponding pump stations and outfalls so as to remove the BOD loads from the rivers and coastal waters. Once all of the area is sewered, construction of treatment facilities should follow. It does not make sense to construct treatment facilities during the early stages of development of sewerage system as this would not be cost effective.

An interim approach that is much more cost effective is to implement an accelerated septic tank desludging programme. Although MWSS has previously attempted to implement a septic tank desludging programme, it has not been successful thus far, because of the lack

of septage disposal sites acceptable to the Environmental Management Bureau (EMB).

Legislation and Enforcement

Pollution control laws

PD 1151: **Philippine Environmental Policy (1977)**: Under this Decree, it was declared a continuing policy of the State: (a) to create, develop, maintain and improve conditions under which man and nature can thrive in productive and enjoyable harmony with each other; (b) to fulfill the social, economic and other requirements of present and future generations and (c) to insure the attainment of an environmental quality that is conducive to a life of dignity and well being.

PD 1152: **Philippine Environment Code (1977)**: The Philippine Environment Code prescribes management guidelines aimed to protect and improve the quality of the environment particularly the Water Resources through: (a) classification of Philippine Waters; (b) establishment of water quality standards; (c) protection and improvement of the quality of Philippine water resources; and (d) responsibilities for surveillance and mitigation of pollution incidents.

RA 3931: **Pollution of Inland Waters**: This act established the National Water and Air Pollution Control or NWAPCC, whose task was to combat industrial pollution. In 1976, this was revised by PD 984 which resulted in a stronger National Pollution Control Commission (NPCC). The NPCC was also the sole agency responsible for the prevention, control and abatement of air, land and water-based pollution. In 1987, however, the NPCC was abolished, together with the National Environmental Protection Council (NEPC). The functions of these agencies were absorbed by the then newly organized Environmental Management Bureau under the Department of Environment and Natural Resources (DENR/EMB) by virtue of EO 192.

PD 600: **Marine Pollution, PD 979 Revised, PD 600:** Marine Pollution Decree of 1976. It vested the NPCC with the primary responsibility of promulgating national rules and policies governing marine pollution while vesting the Philippine Coast Guard, an arm of the Philippine Navy with the primary responsibility of enforcing laws,rules and regulations pertaining to marine pollution. Within the PCG, there was set up an operation center for combatting oil spills, the National Operation Center for Oil Pollution or NOCOP as noted above. The PCG and DENR have a standing agreement that "**vessel-based pollution**" is the responsibility of PCG while "**land-based pollution**" is that of DENR.

RA 6969: **Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990**: This act regulates, prohibits the importation, manufacture, processing, sale, distribution, use and disposal of chemical substances and mixtures that present unreasonable risks and/or injury to health or the environment. It also prohibits the entry, even in transit, of hazardous and nuclear wastes and their disposal into the Philippine territorial limits.

PD 1586: **Establishment of the Philippine EIS System**: This decree established an Environmental Impact Statement System based on the requirement under Section 4 of PD 1151. Under this decree, no person, partnership or corporation has to undertake or operate any such declared environmentally critical project or area without first securing an Environmental Compliance Certificate. Violators shall be punished by the suspension or cancellation of ECC and/or fine.

DENR Administrative Order 29: Implementing Rules and Regulations of RA 6969 or Toxic Substances and Hazardous and Nuclear Wastes Control of 1990: These rules and regulations cover the importation, manufacturing processing, handling, strategies, transportation, sale, distribution, uses and disposal of all unregulated chemicals and mixtures in the country, including the entry, as well as the keeping or storage and disposal of hazardous and nuclear wastes into the country for whatever purposes.

Executive Order No. 927 (which amended RA 4850 & PD 813): Vested the Laguna Lake Development Authority (LLDA) with major environmental functions in the Laguna de Bay region (that includes Metro Manila).

Water quality standards

The first set of water quality standards were promulgated by the National Water and Air Pollution Control Commission (NWAPCC) in 1967. This was revised in 1978 by the NPCC and in 1982, NPCC came up with effluent standards for different classification of water bodies. In 1990, these standards were further revised.

The Philippines has both ambient and effluent standards. It defines five classes of fresh and inland waters, i.e. Class AA, A, B, C, and D and four classes of marine and coastal waters i.e. Class SA, SB, SC and SD.

Ambient water quality criteria: This is embodied in DENR AO 34 (s 1990) and it sets the values with which water must meet in order that its intended usage will not be jeopardized or so that it can still be used for the purpose that is classified for. The ambient water quality criteria is, however, not being enforced unlike the effluent standards.

National standards for drinking water: This specifies the quality with which drinking water (e.g. in water taps, springwater, groundwater, and bottled water) supply must meet before it can be considered safe for drinking. The NSDW is currently undergoing a revision process (by DOH).

Effluent regulations: These regulations practically set the maximum limit of pollutant concentration in the effluent of point sources prior to discharge to a body of water. A specific set of effluent standards is set for every classification of the receiving body of water i.e. 9 sets for Class AA, A, B, C, D and SA, SB, SC and SD.

Penalty Sanctions

Fines and Cease and Desist Order (CDO): Violators under the Pollution Control Law are to be penalized by a fine or by closure or both. Administrative violations, such as failure to secure permits, is punishable by a fine. Violation of standards is punishable by a Cease and Desist Order (CDO), which means stoppage of discharge of pollutants into the environment, plus a fine. The task of resolving pollution cases now rests with the Pollution Adjudication Board (PAB). And before any firm would be allowed to operate again,it must have to satisfy three requirements namely (a) to submit a plan of rehabilitation or construction of a wastewater treatment facility; (b) it must limit its wastewater generation or scale down operations; and (c) posting of a performance bond to ensure that the respondent firm would put up a wastewater treatment facility as needed.

The current P5,000 per day maximum fine is already considered very small. There is a pending bill in Congress increasing this maximum fine to P50,000 per day. However, violations under PD 1586, the EIA system law, maybe fined up to P50,000 per violation of conditions set forth in the Environmental Compliance Certificate (ECC).

Monitoring Programme

River and coastal areas

During the period 1972 to 1982, the NPCC established a monitoring programme for some selected rivers and lakes. The design called for yearly and semestral sampling of major rivers and monthly sampling of Metro Manila rivers. After the reorganization of the DENR, increasingly constricted budget have constrained sampling to less frequent intervals on a few selected rivers nationwide. However, some water quality management projects have built-in monitoring activities such as the Ilog KoIrog Ko Project, Pasig Rehabilitation Project, Manila Bay Monitoring Project, etc. There is also that commitment under the UNEP/WHO Global Environment Monitoring System (GEMS) to monitor the Pampanga River and the Cagayan de Oro River. Laguna de Bay has a regular monitoring activity being pursued by the Laguna Lake Development Authority (LLDA).

Some 80 percent of the 421 principal river systems are not sampled or monitored. The same is also true in the coastal areas except for some selected beaches where beach resorts proliferate. In 1991, there were only about 80 waterbodies monitored/sampled throughout the country.

Parameters monitored

The parameters commonly monitored in the rivers at the moment are DO, BOD, pH, temperature, solids, colour, heavy metals, etc. The bacterial count is monitored at the beach resorts. In Manila Bay, parameters monitored include plankton and benthic fauna, trace metals and pesticide residues in fishes and trace metals in sediments.

Frequency of sampling:

For the water quality monitoring data in 1991 coming from DENR monitoring activity, samples were taken about once in a quarter while some are taken on a monthly basis. Those at the Metro Manila were monitored every two weeks. Monitoring in the Manila Bay is done bi-weekly for the bacteriological survey. Once a quarter monitoring is done at the offshore sampling stations. Laguna de Bay is monitored by LLDA on a monthly basis.

Industrial waste monitoring:

The Regulatory Agency in the Philippines, the DENR through its Regional Offices, monitors the operation of industrial and manufacturing firms to ensure that the effluent released into the environment comply with the quality standards set forth in the Department Administrative Order No. 35. Where manpower and equipment for such monitoring by the government are available and sufficient, as in the case of economically advanced Japan, Singapore and South Korea, the implementation of the regulations is not difficult to carry out. But this condition is seldom met in the developing countries, especially in the Philippines. Instead, individual establishments are themselves encouraged to carry out the monitoring. The government agency then merely checks, on a periodic basis, the data of the monitoring programme together with the performance of the instruments and equipment used in the measurements of the parameters indicated in the water quality standards in force. Non-governmental organizations or industry groupings can assist and have assisted by organizing seminars, conferences and symposia where results of such monitoring programmes are discussed and improvements therein suggested and recommended.

The Pollution Control Officer (PCO) system was initiated by the then NPCC as part of the government's efforts to encourage individual establishments and manufacturing plants with environmental emissions and/or discharges in the proper operation and monitoring of their respective pollution control works. As embodied in the latest amended Department Order, three types of PCO's were defined, namely Pollution Control Officer I, II, and III with increasing duties and responsibilities and, it was hoped higher pay scales.

The Philippines also innovated with the "**Dirty Dozen Programme**" in which the DENR Regional Offices were tasked to identify or ascertain the top 12 most controversial pollution cases in each of the 12 regions of the country. A multi-partite monitoring team composed of DENR officials at the local level, the industrial firm itself, the NGO's and members of the academe, was then formed in order to undertake the monitoring programme.

Education and Training

Department/Bureau level

There is an on-going manpower strengthening on environmental management and pollution control activities at the DENR. This comes in the form of local as well as foreign study grants, training, short courses, seminars, etc. Invitations come from various institutions, both local and foreign. Training slots could also be found in the on-going environmental

management projects. A number of trainings/workshops have already been done under joint sponsorships with other bilateral funding agencies.

Pollution Control Officers

As a requirement before a Pollution Control Officer (PCO) could be recognized by the DENR, under the revised PCO guidelines, one has to participate in some training courses. The Pollution Control Association of the Philippines (PCAPI) is conducting such training courses. EMB is also having similar courses, but on less frequent basis that would cater to small and medium industrial PCO's and to local government units' PCO's.

PCAPI has come up with three levels of PCO training courses, namely; (a) Basic Course; (b) Advanced Course; and (c) Management of Environmental Department. Each course runs for one week and covers such topics as duties/responsibilities of the PCO, functions of government agencies involved with air and water quality standards, treatment technologies, sampling techniques, crisis management, etc. There are about fifty participants in each class and since 1992, ten courses were already completed.

Training Programmes

Training ranges from strengthening of manpower capabilities of government officials in policy analysis and formulation, enforcement, implementation and monitoring, operation of monitoring and laboratory equipment to training of industrial technical personnel. The latter involves training of wastewater plant operators, conduct of waste audit/sampling, ways of minimizing waste generation, environmental impact assessment and risk assessment, etc.

An example of a training programme to build up the capability of the DENR staff as well as other local technical capabilities is that within the activities of the USAID funded project called Industrial Environmental Management Project (IEMP). This programme consists of one week seminar/training course for each of the following topics:

a. Pollution Management Appraisal (PMA)
b. Environmental Impact Assessment (EIA)
c. Environmental Risk Assessment (ERA)
d. Data Collection and Sampling.

For example, the Pollution Management Appraisal seminar teaches the participants ways, means, methods of waste minimization, clean technologies, low and non-waste technologies, waste audit, source reduction, recycling, etc.

Institutional Framework

The following institutional strengthening components are recommended as a part of the action programme:

a. To develop a strong and active constituency for the environment in order to generate sufficient political will for environmental management

   i. To intensify the IEC campaign already started by the DENR in cooperation with NGO's and the private sector to focus on the costs of environmental degradation and the benefit of environmental management

   ii. To encourage the organization on more NGO's which expose the cause of the brown environment and provides them access to resources for the implementation of activities which will raise the environmental consciousness of the general public

   iii. To include industrial pollution education in the curriculum of all academic levels

b. To institute the structural reforms within and among the government agencies concerned with the environment to optimize the utilization of limited resources.

   i. To place LLDA under DENR or transfer all environment-related functions of LLDA to DENR

   ii. To transfer the monitoring functions of EMB to the DENR Regional Offices

   iii. To re-schedule the devolution of the environment-related functions and responsibilities from DENR to the LGUs to synchronize the same with the development of sufficient technical competence within the LGUs to effectively discharge these environmental duties.

   iv. To conduct a series of multipartite consultations and dialogues

   v. To organize EIA divisions in EMB and in each of the DENR Regional Offices

c. To upgrade the capabilities of government agencies in terms of personnel, facilities and equipment

   i. To increase the number of appropriately trained personnel working in the environment sector

   ii. To provide additional equipment and upgrade the facilities for industrial pollution control and monitoring, as well as for enforcement

d. To provide training programmes to upgrade the expertise of technical personnel (DENR, LLDA, LGUs, MMA) in the environment sector.

Financial Arrangements

The government finances its normal operations through budgetary allocation to support programmes and projects prioritized in each budget year. It follows a regular process starting with preparation of operating budgets by line departments and agencies. These are then presented to the Department of Budget and Management (DBM) and the Legislative Committees of Finance in a budgetary hearing for their approval. Once approved by both the Congress and the President of the Republic, the DBM Schedules allocated fund disbursements. These are released by the DBM based on an approved work and financial plan submitted by the line department or the appropriate agency. In practice, the fund disbursement process is time consuming and often tedious, let alone bureaucratic.

Requests for new additional operating budgets for new programmes and projects have continued to put a strain on government's limited resources. New programmes seeking financial assistance through budgetary allocations generally experience long delays if not outright denial. This is a result of the stringent fiscal measures undertaken by monetary authorities to narrow down budgetary deficits to manageable levels and in keeping with Philippine Government commitments to the IMF. Unless key taxation issues are resolved which at the moment seems unlikely, the option of utilizing budgetary allocation for pollution control appears remote.

It has been suggested that the DENR and other regulatory agencies examine the possibility of sourcing additional revenues to support environmental enforcement functions from the collection of "**service fees**" or other "**special fees**" (inspection fees, etc) from these entities that are regularly monitored and periodically inspected as well as from new firms that are being established. Since the revenues generated from these are directly related and specifically connected to the enforcement and regulatory responsibilities of these government institutions, the idea is for them to earmark for the exclusive or specific use in meeting their mandated environmental enforcement functions.

Since this suggestion clearly points to the creation of a special fund to be specified in the national budget, a practice which is contrary to the existing general fund system followed by the Government, the legal implications have to be duly examined and properly sorted out in order to avoid any legal issues that may arise. A legislation will be required as the budgetary system will be affected.

If the above described proposal merits the Government's positive action, then DENR and its related environmental agencies could augment their existing budgetary allocations to ensure the effective implementation of their renumerated enforcement and regulatory responsibilities.

Draft Action Plan

Draft action plan for the control of various land-based sources of pollution in the Philippines is presented in Table 7.4.1 (Rivera and Panaligan 1994).

Table 7.4.1

Draft Action Plan for the Control of Land Based Sources of Pollution in the Philippines

Key Issues/Concern	Proposed Strategies/Intervention
Domestic Solid Waste and Domestic Sewage	Adoption of environmentally sound garbage disposal system Including recycling, sanitary landfill, etc; closure of all open dumps Systematization of collection, handling, transfer and disposal of solid waste, complimented by a livelihood program for scavengers Integration of specifications for pollution control (e.g. hospitals) and sanitary landfill structures In the National Building Code Massive information campaign on the effects of pollution aimed at educating coast dwellers on the proper waste management Conduct of localized environmental actions on cost effective/community self-help basis to Improve the existing sanitary conditions Improvement of MWSS services Construction of sewage treatment facilities and outfalls Strict implementation of anti-squatting law, EIA system
Industrial Agro-industrial	Strict Implementation of Pollution Control Law, devolution of pollution related functions to local government units, upgrading of pollution-related equipment Strengthened monitoring network for water pollutive industries Classification of waterbodies Support in terms of policy, research and economic instruments/market-based mechanisms for: Promotion or recyling or reuse of Industrial residuals and by-products Waste minimization through modification of manufacturing process, use of raw materials, equipment Institution of incentive system and effluent charges for industries

Table 7.4.1 (contd)

Key Issues/Concern	Proposed Strategies/Intervention
Industrial Agro-industrial (cont'd)	Research works on carrying or assimilative capacity of the coastal environment Research work on cost effective pollution control facilities/ disposal of wastes Imposition of payment of pollution fines high enough to make Investement In pollution control devices more attractive than payment of such fines Provision of technical assistance on pollution control to small and medium scale activities Upgrading of monitoring and laboratory capabilities
Agricultural	Implementation of a national pesticide and fertilizer control programme Prescription Ban(non-biodegradable chemicals) Environmental awareness building Promotion of indigenous farming systems and organic farming techniques

Major Constraints in Water Pollution Control

Financial constraints

Without funds, needed personnel are in short supply and equipment for monitoring water pollution resources are simply not on hand. Lack of funds also leads to the curtailment of personnel training programmes intended to improve their performance. Finally, it handicaps the government in the design, construction and operation of municipal and city sewerage systems and wastewater treatment plants. In general, availability of funds are inextricably linked to the economic conditions of the country and until the economy improves, no immediate solution to this problem will be forthcoming.

Limited extent of sewer coverage

A second major problem is the limited coverage of sewer systems. As cities grow in population, the priority of fund expenditures is given to provision of infrastructure and basic services such as water supply provision. In Metro Manila, for example, sewerage is given lower priority. A possible explanation could be that sewerage is buried under ground and thus not appreciated by the general public so that policy makers, politicians and other government functionaries at decision-making levels are less inclined to favour implementing projects that have no immediate impact nor visibility. However, there are plans and projects already prepared and are awaiting only the funds to enable the government to carry out such projects.

Inadequacy of solid waste collection and disposal

A major public service that calls for large expenditures is the collection, transport and treatment/disposal of solid wastes from urban centers. Experience in Metro Manila, for example, shows that the city budget allocated as much as 45 to 50 percent to this service so that it is a big drain on the city coffers. If such funds are lacking, then the service deteriorates and the result is that only a small fraction of these wastes are collected. It is estimated that in Metro Manila, only about 85 percent is collected so that the rest are left on the sidewalks. When the rain comes, these wastes are flushed down the drains or canal eventually reaching the rivers bays.

Rapid urbanization and industrialization

In its efforts to attain the New Industrialized Country (NIC) status, the country is moving from an agricultural economy to an industrialized one. In the process, factories and manufacturing plants are established and in turn, the excess agricultural labour move into the urban centers for better job opportunities. Unfortunately, only small fraction of such labour force could be absorbed by industry with the end result that squatters proliferate in urban centers. In such squatter areas, there are obviously no regular public services in place so that the residents dispose of their liquid and solid wastes in a most unsanitary, unaesthetic

and deplorable manner. In due time, this can lead to the formation of huge mountains of uncollected garbage and severe pollution of nearby waterways.

Inadequacy of industrial pollution control

Finally, the industries and manufacturing establishments that are set up, more often than not, do not have the proper pollution control equipment. In many cases also, the pollution control equipment, if in place, are not utilized fully in the effort to minimize operational costs, since operation of such pollution control devices consumes power, chemicals and manhours of labour. Instances have been found where such pollution control systems are installed only for show purposes (particularly to the authorities) but not operated fully in accordance with the original design. The final result is that industrial wastewaters are only partially treated and this leads to pollution of the receiving waters. This situation is further exacerbated if the regulatory agency lacks manpower and/or equipment to monitor such effluent.

7.5 SINGAPORE

Introduction

The key strategies adopted by Singapore since the early seventies to control land-based sources of pollution can be categorised as that of **prevention, enforcement, monitoring and education**. Prevention of pollution requires proper land use planning, and provision of environmental infrastructure. Once preventive measures are established, controls are stringently enforced to ensure that pollution control equipment and processes are properly maintained and operated. Monitoring of the water courses ensures that these pollution control measures are adequate. Public education provides for a high level of environmental awareness among the general public such that positive values and attitudes may emerge to prompt action to reduce pollution of the environment.

The responsibilities of implementing the above key strategies rest with various government departments principally within the Ministry of the Environment which was established in 1972 with the task of protecting and improving the environment. The Urban Redevelopment Authority (URA) under the Ministry of National Development is responsible for preparing the Concept Plan which provides the long-term plan for the physical development of Singapore (Singapore 1994).

Pollution Prevention

Land Use Planning: Land for various uses is safeguarded under the Land Use Concept Plan to achieve social and economic development and to maintain a quality environment. Environment controls have been factored into this land use planning to help ensure that developments are properly sited and are compatible with surrounding land uses to achieve a quality environment (Koe and Aziz 1994).

About 5 percent of the main island of Singapore has been set aside as protected water catchments. These comprise the central water catchments of Seletar, Upper Pierce, Lower Pierce and MacRitchie. In these protected water catchments, development is not allowed. A large portion of the catchment areas has been gazetted as nature reserves for conservation.

In addition, about 36 percent of land comprising the catchments of Kranji, Pandan, Sarimbun, Murai, Tengah, Poyan, Sungei Seletar and Jurong Lake are also developed as unprotected water catchment areas. The level and type of urbanisation in these unprotected water catchment areas are controlled. Only clean industries are sited within these catchments and all residential and industrial premises are served by public sewers.

Planning Controls of Developments: The Pollution Control Depaprtment (PCD) of the Environment Ministry is consulted by the planning control authorities on proposed new developments. In this context, PCD works very closely with other authorities such as Minsitry of National Development, Urban Renewal Authority, Housing and Development Board, Jurong Town Corporation and Economic Development Board. At an early planning stage, PCD checks the proposals and ensures that new developments can be served by existing public sewerage system or adequate sites would be set aside for the provision of on-

site sewage treatment plants. For new industrial developments, PCD assesses and ensures that measures would be incorporated into the manufacturing processes to minimise the generation of industrial effluent and the effluent could be treated to comply with the prescribed standards. For those industries which generate large quantity of industrial effluent, PCD will check with Sewerage Department whether the existing sewers serving the proposed sites have the capacity to handle the flow of industrial effluent. After a proposed development has been granted planning approval, PCD checks the building plans of the development for compliance with sewerage requirements to ensure that all wastewater would be discharged into a public sewer or a sewage treatment plant. After the completion of a building, Sewerage Department and PCD inspect the building to ensure compliance with technical requirements before granting clearance for the building to be occupied.

Legislative Control: The main legislations on water pollution control and waste management are as follows:

a. Prevention of Pollution of the Sea Act 1971.

b. Water Pollution Control and Drainage Act 1975, Chapter 348 and its subsidiary legislations

c. Trade Effluent Regulations 1976

d. Sewage Treatment Plants Regulation 1976

e. Sanitary Plumbing and Drainage System Regulations 1976

f. Sanitary Appliances and Water Charges Regulations 1975.

g. Singapore Port Regulations 1977

h. Environmental Public Health Act 1978

i. Poisons (Hazardous Substances) Rules 1986

j. Environmental Public Health (Toxic Industrial Wastes) Regulations 1988.

Prevention of pollution of the Sea Act 1971 controls oil pollution and other contaminants. The Water Pollution Control and Drainage Act 1975, Chapter 348 and its Regulations control the discharge of wastewater from domestic, industrial, agricultural and other premises and stipulate the standards for the quality of trade effluent to be discharged into the public sewers and watercourses. Under the Act, the Director of Water Pollution Control and Drainage may require all wastewater generated to be discharged into public sewer if the sewer is available. The Director may also serve wayleave notice to enable the Government to construct any sewerage system through or under a privately owned land. The Act also provides for severe penalty and punishment for offences that result in serious water pollution.

The standards stipulated in the Trade Effluent Regulations (TER), 1976 (amended 1977) are generally strictly followed. Industries that discharge their wastewater into the public sewers are required to ensure that the quality of the industrial wastewater would comply with the stipulated limits. Industries are charged a fee if their trade effluents exceed the biochemical oxygen demand (BOD) and total suspended solids (TSS) levels stipulated in the TER. The tariff, computed based on the concentration of the BOD and TSS and the volume of effluent discharge, is levied to recover the higher cost incurred in treating the excess pollution loads at the sewage treatment works. The schedule of tariff is revised regularly to reflect the market cost in treating the wastewater. Apart from the two parameters, BOD and TSS, all industries must comply with the discharge standards of the TER for all other parameters and where necessary, install on-site treatment plants to treat their effluent to the stipulated standards. Existing factories that generate large quantities of acidic effluent have been required to install continuous pH-monitoring and recording instruments to monitor the pH of the effluent discharged. New factories that generate such acidic wastes will in addition to the above, be required to install pH-activated control valves which will prevent the discharge of acidic effluent into the sewers. The Sewage Treatment Plants Regulations 1976 allow the Director to maintain such privately owned sewage treatment plants as he thinks fit, and charge appropriate monthly fee to the owner of the premises on which the plant stands or for the use of which the plant is maintained. When a public sewer becomes available, the Director is empowered to require the owner of a sewage treatment plant to divert the drain-line from of the said plant and connect it to the public sewer, and thereafter demolish the plant.

The Sanitary Plumbing and Drainage System regulations 1976 stipulate that a permit from the Director is required before any sanitary works is carried out, and that all works are to be carried out by qualified registered plumbers in accordance with the Code of Practice. The Sanitary Appliances and Water Charges Regulations 1975 allow the Government to collect the Sanitary Appliance Fee and the Waterborne Sewage Removal fee.

Singapore Port Regulations 1977 protects the harbour environment. The Environmental Public Health Act 1978 controls solid waste dumping whereas hazardous substances are controlled by the Poisons (Hazardous Substances) Rules 1986. The Environmental Public Health (Toxic Industrial Waste) Regulations 1988 controls storage, collection, transport, treatment and disposal of toxic chemicals and hazardous wastes.

Provision of Sewerage Infrastructure

Since 1972, the Ministry of the Environment has launched a programme to provide a comprehensive sewerage system to keep pace with new industrial, housing and commercial developments in Singapore (Koe and Aziz 1994). A Sewerage Master Plan which was formulated in the early 70s carved the island of Singapore into six Sewerage Catchments, viz Kim Chuan, Ulu Pandan, Bedok, Kranji, Seletar and Jurong. Sewage from each catchment is collected through a network of sewers and pumping stations and conveyed to a central sewage treatment works for treatment and disposal. This comprehensive sewerage infrastructure was developed in phases and costs a total of about S$2 billion. The system ensures that wastewaters generated from all land-based sources of pollution in Singapore are

adequately collected and treated to at least a secondary standard of treatment prior to their discharge to the sea.

Government is now adopting the compact and covered design for sewage treatment works as this would eliminate odour nuisance and allow the odour buffer zone around sewage treatment works to be reduced, thus releasing valuable land for higher value development. Planning and design work for compact and covered treatment works have commenced in 1992 and some S$950 million has been set aside for such development at four of the six treatment works. The targetted date for completion of this initial group of compact and covered sewage treatment works is 1997/98.

Strategies of Solid Waste Disposal

An important consideration in the planning of a solid waste disposal method is having accurate data on the amount and the composition of wastes that are generated (Loh 1988). A computerised system was developed in the mid-1970s to provide the data on the amount and type of wastes generated in Singapore. The Waste Management System (WMS) is a central computerised system with linkage to the operational sites such as the Environment Health Office (EHO), the sanitary landfill sites and the incineration plants. One of the functions of the WMS system was to facilitate the EHOs in their deployment of refuse collection vehicles and in the planning of the collection routes for their vehicles (Cheong 1993).

The data on the amount of waste that are generated are obtained from the computerised operation of the weighbridges at the sanitary landfill sites and the incineration plants as the operational data at these disposal sites are transmitted to the central computer. The availability of data on the waste generated in Singapore had facilitated the planning of strategies for waste disposal as the system was able to provide the information on the amount of waste collected and its geographical distribution. The centralised waste management system was an important strategy as it provided the easily available data on the refuse collected in Singapore which enabled the projected growth of refuse to be accurately and quickly forecast. The WMS was also operationally advantageous as it provided the following:

a. Centralised data on the amount of waste collected
b. Waste disposal patterns such as the arrival rates
c. Efficient site operations as magnetic cards are used to identify the vehicle
d. Automatic computation of fees which enables changes in the fees structure to be quickly implemented
e. Credit facilities and monthly billing to regular waste collectors

With the available data on the daily waste collected, the waste generation was projected for the 1980s and 1990s. There was a need to build a second incineration plant so as to prolong the life of the dumping ground.

The second plant was designed in the early 1980s and was located at Tuas which is the extreme west end of Singapore. The disposal need was, however, generated by the higher density population living in the east. It was not economical for every disposal vehicle to travel from the east to the west of Singapore as it would mean that more refuse collection vehicles would have to be purchased. The concept of a **Transfer Station** in the eastern part of Singapore was conceived. The strategy was to minimise the cost of transporting the refuse collected from the eastern part of Singapore to the Tuas Incineration Plant. The Kim Chuan Transfer Station was commissioned in 1986 and has a capacity of 1,500 tonnes of refuse per day. It was built at a cost of $30 million (Cheong 1993).

Refuse collected from the eastern part of Singapore is transported from the transfer station to the Tuas Incineration Plant by large container trucks. Each container truck capable of carrying 20 tonnes of refuse would travel a single journey instead of having 3 to 5 refuse collection vehicles having to go through the same journey. This reduces the overall number of vehicle trips and hence the manpower and the number of refuse collection vehicles required.

The Tuas Incineration Plant was commissioned in October 1986 at a cost of $200 million. With a growing rate of refuse generated in 1980s, there was a need to build a third incineration plant. The third plant is situated at Senoko which is at the northern tip of Singapore. The third incineration plant was commissioned in 1992 at a cost of $560 million.

With the third incineration plant, the routing of refuse collection trucks had to be re-planned and a decision rule was established to determine whether a refuse collection truck should dispose its refuse directly at Senoko Incineration Plant or via Kim Chuan Transfer Station.The criteria was based on economics and compared on a parameter known as the **km-tonne indicator**. The decision was based on the lowest operational cost.

With the three incineration plants fully in operation, there was sufficient incineration capacity for all incinerable waste. One strategy that was adopted in 1993 to prolong the life of Lorong Halus Dumping Ground was to enforce that all incinerable waste must be disposed of at either one of the three incineration plants.

The three incineration plants are currently able to incinerate all waste suitable for incineration. The amount of refuse generation is expected to exceed 8000 tonnes by the year 2000. The fourth incineration plant is at its planning stage and will start operating by the end of the decade to meet the ever-increasing amount of waste generated in Singapore. In addition to planning the fourth incineration plant, other major complementary disposal facilities are also in their planning stages. They are (Cheong 1993):

a. The Kim Chuan Transfer Station will be extended to handle the higher volume of waste generated in the eastern part of Singapore.

b. The only sanitary landfill site left, Lorong Halus Dumping Ground is nearing capacity and will be closed towards the end of this decade. Singapore faces an acute problem of siting additional solid waste disposal facilities on the main island proper.

A new refuse disposal site is being planned in the Singapore's southern island. The proposal calls for a perimeter bund to be constructed to enclose a space between Pulau Semakau and Pulau Sakeng. When the space is fully filled up with non-incinerable waste and incineration ash, an island of about 350 hectares will be created.

c. A marine transfer station is also planned to be built at Tuas. At the transfer station, waste will be loaded into containers. Quay cranes will be installed to load the containers onto barges.

   Each barge will be capable of carrying up to 200 containers. The barge will be moved by pusher tugboats over a 23 km course to the offshore disposal site at Pulau Semakau.

   The landfill site will have a capacity of about 63 million cubic metres and will be able to meet Singapore's disposal needs for non-incinerable waste for at least 40 years.

Enforcement

An important pillar of pollution control is the of **enforcement of legislations**. The current legislations embody the policies and strategies for the control of the sources of pollution. The provisions in the legislations are generally adequate and are reviewed regularly to maintain or to improve their effectiveness. Stringent and effective enforcement are necessary for Singapore to be committed to the implementation of these policies and strategies.

Regular inspections are conducted to ensure that all wastewater is discharged into the sewerage system and that the wastewater treatment plants installed by industries are properly and efficiently operated and maintained. Strict enforcement action against offenders who fail to comply with the pollution control legislations are carried out. In 1992, there were 97 prosecution cases for causing pollution or for failure to comply with sewer discharge limits.

Monitoring

Water quality monitoring is an integral part of a water pollution control programme. The Ministry of the Environment monitors the water quality of various water bodies in rivers, streams, reservoirs and coastal waters in and around Singapore (Singapore 1994).

Regular monitoring of the inland and coastal waters is carried out to assess the adequacy and effectiveness of the various pollution control programmes. A total of 47 streams in water catchments and 17 rivers and streams in non-water catchments are monitored monthly. The PUB also monitors the water quality of 13 reservoirs on the main island. The coastal waters around Singapore are also monitored monthly at 9 sampling points in the Straits of Johor and at 10 sampling points in the Straits of Singapore. Checks are made to ensure that standards for recreational use of the coastal waters are met.

Physical, chemical and bateriological examinations are carried out on the samples collected. The results are evaluated and checked for changes in trends and are used to decide future programmes. The parameters selected for laboratory analysis depend on the nature of the water flowing into the rivers or streams. As both domestic and industrial wastewaters are discharged into the sewers, the flow in the rivers and streams during dry weather is very low. The analytical methods specified in the latest edition (1989) of the "**Standard Methods for the Examination of Water and Wastewater**" published by the American Public Health Association, American Water Works Association and the Water Environment Federation are adopted in carrying out the analysis.

Beside the water quality monitoring programme for rivers and coastal waters, close surveillance of sources of pollution is also being carried out. This is to check that wastewaters are discharged into the sewers and not into the open drains. Samples of industrial discharges are also taken for analysis to check that sewer discharge limits are complied with.

Public Education

The Ministry of the Environment has long recognised the importance of public education in the implementation of environmental policies and control strategies. National campaigns are regularly conducted via schools and media, to educate school children and the community on various aspects of environmental controls such as on the use of sewerage facilities and the disposal of wastewater to protect inland and coastal waters. The long term strategy is to achieve a high level of environmental awareness in Singapore.

The major contributing factors for Singapore's success in controlling land-based sources of pollution are sound planning, advanced technology, well-trained work-force, effective legislation, monitoring and enforcement and public education.

The past decades of responsible environment management have made Singapore well-known as a nation with high environment standards, modern environmental infrastructure and effective environmental-management systems. As a result, Singapore has accumulated considerable experience in identifying and implementing appropriate environmental-management and -control technologies. This expertise is relevant to the East Asian Seas region as Singapore has built up its environmental-management and -control systems from similar economic, social and physical circumstances.

Some of the salient features of the Singapore's action plans presented herein have traced the development of key stragtegies that Singapore has adopted over the years. The planning and legislative controls that has been strictly enforced have been supported by the construction of a comprehensive sewerage system to enable proper collection and treatment of land-based sources of pollution. Monitoring programmes are in place to ensure that pollution control processes are operating adequately and public education provides for a high level of public awareness to reduce pollution of the environment.

7.6 THAILAND

Introduction

Thailand covers an area of about 513,115 km^2. Total length of coastline and marine area of Thailand are 2,614 km and 95,000 km^2 respectively. About 23 of 76 pronvinces (Chang-wat) are located along the coastline of Gulf of Thailand. Out of Thailand's 2,614 km coastline, about 1,660 km is bordering with the Gulf of Thailand and the rest facing the Andaman Sea.

Major land-based sources of pollution are identfied as: (a) communities, (b) Industries, (c) agriculture, and (d) mining . Some pollution sources are located along the coastline and some sources are located along the river banks.

In the year 1992, about 46.6 tonnes/year of BOD loads from communities (greater than 100,000 people) and 40.4 tonnes/year of BOD loads from coastal area were discharged into the Gulf of Thailand. About 5.9 and 3 tonnes of BOD loads per year from coastal area and Phuket respectively are discharged into Andaman Sea.

Prevention

Pollution control planning

At present, there are no clear policies and programmes specifically on overall wastewater management in municipal areas in Thailand. There are, however, existing policies reflecting the need for wastewater treatment and also proposals for construction of wastewater treatment systems in many areas. In the Seventh National Economic and Social Development Plan (1992-1996), there are three principal objectives, namely: (a) to sustain the country's economic growth at an appropriate level with stability; (b) to promote more equitable income distribution and rural development; and (c) to develop human resources, improve quality of life, and enhance the quality of the environment and natural resources.

Thailand is in a position to respond to the environmental challenges facing the country because of its recent economic strength-financial resources generated by a growing economy can be used to invest in the evironmental rehabilitation. The framework of environment policy is already established in the Seventh National Economic and Social Developmnt Plan. There is a high level of public consciouness of environmental issues and a willingness on the part of Government to take actions (Kositratana and Ittaharatana 1994).

The planning control stategies are as follow:

i. Establishing and/or strengthening legal and institutional frameworks and/or mechanisms to facilitate effective protection of water quality and control of water pollution sources at all levels (national, regional, provincial, and local). Under the National Environmental Quality Act of 1992, the following strategies have been set:

- To set water quality standards: surface water, groundwater, coastal water. Existing standards should be reviewed as appropriate

- To set effluent standards for pollution sources

- To set type of sources to be controlled (comply with the effluent standards) and the owners are responsible for construction of wastewater treatment plants, sending waste for proper treatment, and/or following other measures specified by the pollution control officers.

- In pollution control zone or other areas being served by Royal Thai Government common treatment facilities (or private), the owners shall send their wastes for proper treatment and pay the service charge. The private shall be licenced by the local officer following the criteria, procedures, and conditions to be established by a ministerial order. The private operator shall not collect the service charge higher than that established by a ministerial order.

- In pollution control zone or other areas which are not served by the common treatment facilities (or private), the owners shall follow the temporary procedure for treatment/disposal which is specified by the local Government under the recommendation of the pollution control officers.

- The owners of treatment facilities are responsible for operation and maintenance of the treatment facilities, including monitoring and reporting, and the final effluent shall comply with the effluent standards. Ministerial orders shall establish to set criteria and procedure for collection and transportation of wastes from sources, including prohibition and conditions for industries for monitoring and reporting, and to set service charge.

ii. Legal/institutional requirement at regional, provincial, and/or local levels.

iii. To strengthen the effective use of EIA process in control of water pollution sources by strengthenning monitoring and enforcement and expanding type of activities to be subject to EIA.

iv. To establish water quality management plan for each major water basins as soon as possible to facilitate effective protection of water quality suitable for its uses as specified by water quality standards

v. To continuously monitor/evaluate water quality of receiving waters with close coordination and cooperation wiht other agencies (Department of Industrial Work, Department of Public Health, etc.) and to report the results to the Pollution Control Commitee

vi. Water quality management plan shall comprise a plant to control pollution sources; including monitoring and enforcement, and a plan to manage water quality in the receiving waters

vii. To strengthen coordination and cooperation with the key agencies and provide assistance (technical and financial) to the implementing acencies, especially the provincial and local government

viii. To strenthen institutional capacity to facilitate effectively management of pollution sources and water quality

ix. To promote research and development as well as participation of the private in pollution control

x. To promote public awareness, education and campaign.

Provision of Sewerage Infrastructure

Of the 135 municipalities, there are only six wastewater treatment facilities in five municipalities and one sanitary district, namely Nakornrachasima, Khon-Kaen, Uthai-Thani, Hua-Hin, Panusnikom and Pa-Tong. The first two systems constructed in 1988-1989 are stabilization ponds with treatment capacity of 32,000 and 25,000 m^3/day. The system for Panusnikom is oxidation ditch with a capacity of 2,000 m^3/day. The systems for Hua-Hin, Uthai-Thani and Pa-Tong are rotating biological contractors with capacity of 4,000 m^3/day, oxidation pond, and activated sludge with capacity of 7,200 m^3/day , respectively. The collection systems for these facilities are the combined sewer type. However, six wastewater treatment plants for Bangkok with capacity of 842,200 m^3/day are under construction. The construction of one of them is completed with a capacity of 30,000 m^3/day and started operating from Mach 1994. These treatment facilities are planned to complete construction by the year 2000 and expected to remove about 30 percent of the waste loads from Bangkok. In the city of Pattaya, new wastewater treatment facilities are also in the process of construction. Most of the large hotels located along Pattaya beach have their own wastewater treatment systems consisting mainly of septic tanks with leaching pits.

Legislations and Enforcements

Water polluton is a leading environmental issue which always attach wide public attention in Thailand. Although the need to find a proper solution to the problem has been formally recognized in the National Constitution for nearly a decade, it is generally felt that very little has been achieved with regard to legislative development in Thailand. The existing Thai laws on water pollution control are, in the views of many experts inadequate when measured by the severity of their criminal sanctions.

In addition, there are a number of laws under which municipalities, sanitary districts and other forms of local governments and standards necessary for the management of municipal wastes, (both liquid and solids). For instance, these laws are the Bangkok Metropolitan Act of 1975, the Tamblo Administration Act of 1956, the Municipal Act of 1953, the Local

Health Administration Act of 1952, and so on. One of their important functions is the maintenance of clean waters under their jurisdictions. The main reason why most of the local governments have not been able to develop municipal wastewater treatment systems and regulatory standardss for management and control thereof seems to be the lack of technical and management capacities rather than the inadequacy of their legal powers to carry out the tasks.

At present, there are new laws and regulations that can be directly used to mandate provision of wastewater management in municipal area or to control water pollution, However, many existing laws and regulations relating to the public health, safety of the people, and the environment have been applied. The most important environmental laws are as follows (Kositratana and Ittaharatana 1994):

a. Sanitary District Act of 1952
b. Municipal Government Act of 1953
c. Provincial Authority Act of 1955
d. Navigation in Thai Waters Act of 1972 (NTWA)
e. Bangkok Metropolitan Act of 1975
f. City of Pattaya Act of 1978
g. Building Code of 1979
h. Law of Sea of 1982 (LOS)
i. Public Health Act of 1992 (PHA)
j. Factory Act of 1992 (FAC)
k. Enhancement and Conservation of the National Environmental Quality Act of 1992 (ECNEQA)

Public Health Act: This law, enacted by the Ministry of Public Health, aims to protect the health of the Thai people. The act authorized local governments to issue ordinances to ensure proper collection and disposal of human, solid and other unsanitary wastes. However, the act deals only with collection and transportation of wastes, it does not require adequate treatment of sewage and wastewater generated by communities.

Enhancement and Conservation of the National Environmental Quality Act This act aims to protect and conserve the quality of the nation's environment.

Factory Act: This act, enacted by the Ministry of Industry, aims to control the discharge of wastes from industrial activities. However, application of this act to small and/or household industries located in many urban areas is still ineffective due to limited monitoring and enforcement. This act does not control the discharge from gas stations which are also mojor contributors to water pollution in urban areas.

Building Code: The building code, enacted by the Ministry of Interior, is used to control construction of buildings in urban areas. The code requires the installation of a proper system to collect and treat human wastes. The presence of a leaching pit with soakaway is considered sufficient for a house and a septic tank connected with a cesspool is considered adequate for large buildings. The lack of monitoring to ensure proper construction of these systems reduced the effectiveness of this code.

Navigation in Thai Waters Act: This law aims to control construction along public water courses, to prevent sedimentation obstructing navigation, and to prevent pollution effects on living resources. It forbids any dumping of rocks, gravels, soils, mud, detritus, solid wastes, sewage, oil, and chemicals into public water courses such as rivers, canals, swamps, reservoirs, and lakes that are used for navigation or other purposes, This act lacks enforcement due to the shortage of personnel and budget.

Provincial Authority Act, Municipal Government Act, Sanitary District Act, City of Pattaya Act, and Bangkok Metropolitan Act: Under these acts, local governments are assigned compulsory functions such as providing water supply and drainage. Specific authority or control over sewage and wastewater collection or treatment is lacking.

In summary, any objectives appraisal of the legislative development in the area of water pollution control in Thailand during the past decade would reveal the following achievements: (i) Adoption of the environmental impact assessment (EIA) approach in the environmental planning and management process as a legal requirement for the initiation of certain development projects. As far as water pollution control is concerned, EIA will of course play an increasingly significant role in checking adverse effects of development activities that cause water pollution. For now, EIA is being used to fill the gap where no where no laws exist to deal with the problems. (ii) First amendment to the Factory Act brought about almost simultaneously with the promulgation of improvement and conservation of National Environmental Quality Act of 1975, the manifestation of environmental awareness of industrial waste hazards, has ultimately led to the development of a regulatory basis for establishing the present effluent standards for industrial waste management. (3) Regulatory development in the context of the Petroleum Act has provided for preventive measures against accidental blowouts, exploration and exploitation of the seabed, and subsoil of the continental shelf.

Concerning the municipal wastes issues, it may be unfair to put the blame on the lack of laws for the seriousness of the problem of water pollution from this source. The public Health Act has in fact one of the best legal mechanisms for both administrative and judicial sanctions.

Monitoring and Training

The government agencies that are responsible to survey and monitor for water quality such as Pollution Control Department, will set up water quality monitoring programmes to collect water samples and base data of water environment. Water quality programmes are considered to monitor in inland waters (rivers) and sea waters (coastal sea water). Monitoring activities are: about 4 times/year for four major rivers (Chao-Praya, Tha-Chin, Mae-Klong, and Bangpakong), Songkla lake, and eastern sea board.

Inland water quality monitoring

Northern basin: Monitoring programme is conducted in four rivers in the north region such as Ping, Wang, Yom and Nan. The number of sampling stations are 13 in Pin river, 6 in Wang river, 12 in Yom river and 12 in Nan river.

Central basin: Ten rivers are located in the central basin of Thailand. Three of them are main river, namely Chao-Praya, Tha-Chin and Mae-Klong. About 103 sampling stations are monitored in the rivers: 33 in Chao-Praya river, 27 in Tha-Chin river, 10 in Mae-Klong river, 12 in Pa-Sak river (tributary of Chao-Praya river), 6 in Phetchaburi river, 4 in Khwae-Yai river (tributary of Mae-Klong river), 4 in Khwae-Noi river (tribuutary of Mae-Klong river) and 5 in Noi river.

Eastern basin: Nine rivers are located in the eastern basin. There is only one river in this basin, namely Bangpakong. A total of 42 sampling stations are monitored in these inland waters: 15 in Bangpakong river and 11 stations in its tribuutaries (6 in Prachinburi river and 5 in Nakom-Nayok river), 3 each in Rayong and Prasae river, 1 each in Plang-Rat river and Welu river, and 4 each in Chantaburi river and Trat river.

Northeastern basin: About 43 sampling stations are monitored in the rivers of the northeastern basin: 11 in Chi river and 9 in its tributaries (5 in Lum Chi and 4 in Lum Nam Sieo), 16 in Mun river and 7 in its tributary (Phong river).

Southern basin: About 26 sampling stations are designated to monitor in the rivers of the southern basin: 6 in Pranburi, 2 in Kuiburi, 4 in Lang-Suan, 9 in Tapee-Pumduang, and 5 in Pak-Panang.

ii. Coastal water quality monitoring

The programme of water quality monitoring is also considered for coastal sea water of the Gulf of Thailand. About 96 sampling points are monitored along the coastline.

Education and Training

Thailand has established two institutions which are specifically aimed at strengthening the country's human resources and research capacity in the area of environment and development. These are the Chulabhorn Research Institute (CRS) and The Environmental Research and Training Center (ERTC). The CRS and the ERCT serve national needs for the development of human resources in environmental and health protection as well as encourage joint projects with other developing countries.

Institutional Framework

The lack of an authorized agency responsible for wastewater mangement, inadequate coordination and cooperation among agencies, and inadequate capacities of the key institutions are the main institutional issues. In many countries, implementation of wastewater management is the responsibility of the local governments with close coordination with the national agencies. Roles and responsibilities of the concerned agencies as well as ways and means for coordination must be clearly assigned. Effective water pollution control needs the roles and responsibilities of the national, regional or provincial, and local agencies to be clearly established.

Strengthening the capabilities of the key institutions is very important for effective invesment and implementation of the water pollution control activities.

i. **Specific legislation**

To enact specific new legislation at the national level, either in the form of a major revision of the existing National Environmental Quality Act (NEQA) or a new Water Polltuion Control Act. Penalties and enforcement procedures should be clearly established.

ii. **Strengthening existing laws**

To amend existing laws (such as Factory Act, Public Health Act) to strengthen environmental concern and foster appropriate developmental measures.

iii. **Strengthening local governments**

Local governments must be given the clear authority to establish sewerage units, to develop sewerage systems, to require connection to be made, to set tariffs and collect revenues, and to provide treatment plants. Local government's capability must also be strengthenned in terms of financial resources, technical skills, and administrative structure needed to achieve the desired results.

iv. **Strengthening key agencies**

It is very important that the key agencies such as Pollution Control Department (PCD), Office of National Economic and Social Department Board (NESDB), Ministry of Industry (MOI), Ministry of Interior (MOI), Ministry of Finance (MOF) and local Government, have adequate qualified personnel and financial resources to carry out the tasks.

Under the Public Health Act, nuisance abatement is the primary responsibility of the local authorites (municipality or provincial government depending upon the administrative status of the locality) whose officials are charged with the duty to remove, prohibit and abate

nuisances occurring in both public and private places. In particular, it is their legal duty to look after and keep "**all watercourses, gutters, trenches, and canals**" within their district free from nuisances.

Financial Arrangement

Thailand has a highly centralized system of government. The central government determines policy, allocates budget, and generally maintains tight conntrol over local governmennt affairs. Local governments have authority to collect properties and certain other taxes, license fees, fines, and to raise income from municipal property. However, most of the revenues collected are sent to the central governmental treasury which then allocates part of the money back in the form of grants. This makes it difficult for local governments to better manage their own financial resources and to provide adequate services to their communities.

In Thailand, the decision to provide wastewater treatment facilities is made at the national level. The decision is often imposed upon the local government without adequate consideration of its capabilities. At the local level, decision making is influenced by priorities which often differ from those established by the central government. Local authorities have to satisfy a wide variety of community needs (roads, schools, health care etc.) with limited financial resources and to compete with these and other local priorities. "**Ability and willingness to pay**" are, therefore, crucial questions wich must be answered at the local level.

A thorough financial analysis needs to be conducted before technical solutions to water pollution are selected. The analysis should address the issues like (a) costs/benefit ratios of alternative solutions, (b) methods and sources of funding, (c) level of the central government's contribution, (d) ability and willingness of a community and its residents to pay, (e) allocation of costs on an equitable basis among the polluters and other beneficiaries of a project. In most studies conducted in Thailand, financial analysis has been limited to only some part of the first four issues.

Financing Strategies

Financing strategies should be:

i **Central government support**

The central government should be prepared to continue providing 70-75 percent of investment needs for wastewater management projects.

ii. **Local government support**

The local government should accept the obligation of providing the remaining 25-30 percent of capital investment.

iii. **Revolving loan fund**

Establishment of a new Revolving Loan Fund or allocation of a major share of the Environmental Fund specifically for the wastewater management facilities.

iv. **Operation and maintenance cost**

Local governments must prepare to move towards acceptance of full operation and maintenance costs of the wastewater management facilities.

Implementation of Action Plan

The implementation schedule of the action plan for water pollution control mentioned earlier shall be considered as shown in Table 7.6.1 (Kositratana and Ittaharatana 1994).

Table 7.6.1

Implementation of Action Plan for Water Pollution Control

Activities/Year	1992-1996	1997-2002	2003-2008
1. To set WQ standards	done		
2. To set effluent standards for:			
2.1 Building	done		
2.2 Wastewater treatment plant	done		
2.3 Industries	done		
2.4 Agriculture	done		
3. To set type of pollution sources to be controlled	done		
4. To set fee			
5. To set criteria for licensing of the private sector for treatment			
6. To set criteria and procedure for discharge into common WWTP			
7. To set criteria for self monitoring of polluters			
8. Annual report to PCC/NEB			
9. To prepare WQ master plan for river basins			
9.1 Central basin	1994-1995		
9.2 Northeastern basin	1994-1995		
9.3 Eastern basin	1994-1995		
9.4 Northern basin	1995-1996		
9.5 Southern basin	1995-1996		
10. To implement WQ master plan for rivers basins			
10.1 Central basins			
10.2 Northeastern basin			
10.3 Eastern basin			
10.4 Northern basin			
10.5 Southern basin			
11. WQ monitoring in major rivers			
12. To implement master plan for ESB			
13. WQ monitoring for ESB			

Table 7.6.1 (contd)

Implementation of Action Plan for Water Pollution Control

Activities/Year	1992-1996	1997-2002	2003-2008
14. Coordination of activities			
15. To strengthen PCD capacity			
16. To strengthen provincial/local governments and other agencies			
17. To promote research and development (R & D) activities			
18. Publication and campaign			
19. To set specific laws/regulations and mechanisms			

8. RECOMMENDED COUNTRY - SPECIFIC PROGRAMME OF ACTION TO CONTROL LAND-BASED SOURCES OF POLLUTION

8.1 Introduction

In the preceding chapters, the on-going strategies and national programmes of action adopted by each of the participating countries to control land-based sources of pollution, have been presented and discussed. These on-going action programmes can be seen to be adopted by each individual country to address specific areas of concern. To provide an improved strategy for the control of land-based sources of pollution into the EAS, the following country-specific programmes of action are now recommended for each of the participating countries of this EAS-27 Project. The recommended list of activities under each **National Programme of Action** takes into consideration on-going actions currently implemented in each of the participating country. Brief description of each proposed activity is provided and possible time-frames have been suggested where appropriate.

8.2 BRUNEI DARUSSALAM

The priority areas of concern for Brunei have been identified to be in the following:

- establishment of water quality objectives, standards, and monitoring programmes
- raw sewage discharge from settlements
- management of solid wastes
- silt from land clearance
- oily waste from workshops
- live-stock wastes from agricultural development
- discharges from industrial development
- harmonised legal framework for water resources management

To address these areas of concern, the following **National Programme of Action** is proposed:

Water Quality Assessment & Monitoring

Activity 1: Assessment of existing water quality (rivers, estuaries, coastal waters and ground water) and continued monitoring to observe potential trends. Institutions are to be identified and equipped with appropriate water quality instruments and laboratory staffs. A monitoring programme shall be developed to ensure that critical water quality parameters, analytical methods and sampling sites are appropriately selected.

Time: 1997-2002

Activity 2: Establishment of water quality objectives and corresponding standards based on present and potential use of water resources. A consultancy study shall be initiated to identify and recommend appropriate water quality objectives and standards.

Time: by 1996

Activity 3: Communication of information established under Activities 1 and 2, shall be regularly transmitted to appropriate government departments, industry and the general public. This can be carried out via forums, workshops & the media.

Time: 1997-2002

Control of Sewage Discharge

Activity 1: Development/updating of the Master Plan for Sewerage Infrastructure. The Master Plan should ensure that existing and future developments have provision for sewerage systems. All sewage shall be planned to be collected, treated and discharged into the environment at a quality compatible to the quality objective of the receiving environment.

Time: on-going

Activity 2: Review and prioritization of sewerage projects, in particular the construction of sewage treatment plants, sewerage scheme for Kampong Ayer, septic tank management and expansion of sewerage systems to less urbanised and rural areas.

Time: by 1996/7

Activity 3: Review and prioritization of rural sanitation projects. A study is to be carried out to review the status of sanitation projects for the rural areas and to recommend appropriate prioritization of the projects.

Time: by 1996/7

Solid Waste Management

Activity 1: Review and implementation of solid waste management Master Plan.

Time: by 1996

Siltation

Activity 1: Upgrading of soil erosion control measures in public and private development. The activity would also require the enhancement of monitoring and enforcement of development control measures currently in-place.

Time: by 1996

Activity 2: Establishment of soil erosion control guidelines and verification procedures for public and private development.

Time: by 1996/7

Oily Waste from Workshops

Activity 1: Oil and grease traps and appropriate technological measures are to be implemented to ensure that no oily wastes are discharged into the coastal waters. Continued operation of workshops shall require adherence to this requirement. A feasibility study of the collection and treatment of oily wastes from workshops is to be carried out.

Time: by 1996

Live-stock Wastes and Agricultural Runoff

Activity 1: Development of waste treatment systems for live-stock & other agricultural wastes.

Time: by 1996

Activity 2: Development of guidelines for the proper use of agricultural chemicals.

Time: by 1996

Industrial Discharge

Activity 1: Development of EIA procedure for new industrial projects. A workshop shall be convened to review, discuss and finalise appropriate EIA guidelines and procedural framework.

Time: by 1996

Organisational & Legal Structure

Activity 1: Establishment of a legal framework specific for water resource management.

Time: by 1996/7

Capacity Building & Public Awareness

Activity 1: Conduct training seminars & workshops on water resources management and waste management.

Time: by 1995/6

Activity 2: Undertake public awareness and education activities to promote environmentally sound management of water resources & solid wastes.

Time: by 1995/6

8.3 INDONESIA

The priority areas of concern for Indonesia have been identified to be in the following:

- establishment of water quality objectives, standards, management and monitoring programmes
- waste discharges from settlements, industries & agriculture
- silt from land clearance & other development activities
- capacity building
- national/provincial jurisdiction on pollution control

To address these areas of concern, the following **National Programme of Action** is proposed:

Water Quality Assessment & Monitoring

Activity 1: Establishment/Assessment of existing water quality (rivers, estuaries, coastal waters and ground water) and continued monitoring to observe potential trends. Institutions are to be identified and equipped with appropriate water quality instruments and laboratory staffs. A monitoring programme shall be devloped to ensure that critical water quality parameters, analytical methods and sampling sites are appropriately selected according to existing legislations.

Time: 1995-1998

Activity 2: Establishment of water quality objectives and corresponding standards based on present and potential use of water resources. A consultancy study can be initiated to identify and recommend appropriate water quality objectives and standards.

Time: by 1996

Activity 3: Communication of information established under Activities 1 and 2, shall be regularly transmitted to appropriate government agencies, private sectors and the general public. This can be carried out via forums, workshops & the media.

Time: 1995-1998

Control of Waste Discharge

Activity 1: Development/updating of the Master Plan for Sewerage Infrastructure. The Master Plan should ensure that existing and future developments have provision for sewerage systems. All sewage and industrial discharges shall be planned to be collected, treated and discharged into the environment at a quality compatible to the quality objective of the receiving environment.

Time: by 1996/7

Activity 2: Prioritization of waste management plan with emphasis on major urban centres. The phased implementation of the waste management plan should be considered.

Time: by 1996/7

Activity 3: Implementation of waste treatment systems for agricultural wastes. Reduction of pollution by segregation and appropriate treatment of live-stock wastes and the proper use of agricultural chemicals.

Time: by 1997

Siltation

Activity 1: Upgrading of soil erosion control measures in public and private development. The activity would also require the enhancement of monitoring and enforcement of development control measures currently in-place.

Time: by 1996

Activity 2: Establishment of soil erosion control guidelines and verification procedures for public and private development.

Time: by 1996/7

Capacity Building

Activity 1: Education & training attachments at selected institutions on waste management. Training workshops to develop skilled manpower on environmental planning, design, operation and management of waste treatment facilities can be convened for relevant environmental officials.

Time: 1995-2000

Activity 2: Supporting attachments for regional and provincial level officials to the related activities including training in information networking.

Time: 1995-2000

Public Education and Community Participation

Activity 1: Continuing with public awareness campaigns, newletters and public forums. These activities should involve community participation. Focused public talks to illustrate the positive contributions of community participation with audio-visual aids should be organised on a regular basis.

Time: 1995-2000

8.4 MALAYSIA

The priority areas of concern for Malaysia have been identified to be in the following:

- waste discharges from industries & agriculture
- silt from land clearance and other development sites
- capacity building
- Federal/State jurisdiction on pollution control

To address these areas of concern, the following **National Programme of Action** is proposed:

Water Quality Assessment & Monitoring

Activity 1: Expansion of water quality assessment and monitoring programmes, and the incorporation of water quality criteria and standards according to classification of rivers in accordance with beneficial uses for river basin management.

Time: 1997-2002

Activity 2: Improvement of communication of information established under Activity 1. Information shall be regularly transmitted to appropriate government departments, industry and the general public. This can be carried out via forums, workshops & the media.

Time: on-going

Activity 3: Improvement of enforcement/implementation of EIA procedures particularly to coastal development to ensure appropriate adoption of pollution control technologies in planned development.

Time: on-going

Control of Waste Discharge

Activity 1: Extension & updating of the Sewerage Master Plan to cover all urban centres in the country. The Master Plan should ensure that existing and future developments have provision for sewerage systems. All sewage and industrial discharges shall be planned to be collected, treated and discharged into the environment at a quality compatible to the quality objective of the receiving environment.

Time: on-going

Activity 2: Early implementation of national solid waste management plan.

Time: on-going

Activity 3: Development of co-ordinated approach to address water pollution. Workshops involving various state/federal environmental agencies to discuss and develop guidelines for an integrated approach to waste management.

Time: by 1997

Control of Soil Erosion & Siltation

Activity 1: Review of soil erosion and siltation guidelines.

Time: by 1995

Activity 2: Development of guidelines for the control of soil erosion and siltation by specific development projects.

Time: by 1996/7

Capacity Building

Activity 1: Training attachments at selected institutions on waste management. Training workshops to develop skilled manpower on environmental planning, design, operation and management of waste treatment facilities can be convened for relevant environmental officers.

Time: 1996-2001

Activity 2: Establishment of environment training institute to train Department of Environment officers.

Time: by 2000

Legal Strengthening

Activity 1: Review and amendment of the Environment Quality Act, 1974.

Time: by 1996/7

Activity 2: Review and amendment of the Environment Quality (Sewage and Industrial Effluents) Regulations, 1978 with respect to discharge limits and addition of more quality parameters.

Time: by 1996/7

Activity 3: Review of the Environment Quality (Prescribed Activities) (Environment Impact Assessment) Order, 1987.

Time: by 1996/7

Activity 4: Formulation of Marine Pollution Control Regulations.

Time: by 1997

Activity 5: Formulation of regulations to control tanker cleaning activities.

Time: by 1997/8

Activity 6: Formulation of regulations to control electroplating industry.

Time: by 1997/8

8.5 PHILIPPINES

The priority areas of concern for The Philippines have been identified to be in the following:

- review/update of water quality objectives, standards and monitoring programmes
- waste discharges from settlements, industries, agro-industries & agriculture
- solid waste collection and disposal system
- toxic and hazardous waste
- silt from land clearance, mining and other development sites
- capacity building
- public education & awareness

To address these areas of concern, the following **National Programme of Action** is proposed:

Water Quality Assessment & Monitoring

Activity 1: Assessment of existing water quality (rivers, estuaries, coastal waters and ground water) and continued monitoring to observe potential trends. Institutions are to be identified and equipped with appropriate water quality instruments and laboratory staffs. A monitoring programme for new sites shall be devloped to ensure that critical water quality parameters, analytical methods and sampling sites are appropriately selected.

Time: 1997-2002

Activity 2: Review/update of water quality objectives and corresponding standards based on present and potential use of water resources. A consultancy study can be initiated to identify and recommend appropriate water quality objectives and standards.

Time: by 1996

Activity 3: Communication of information established under Activities 1 and 2, shall be regularly transmitted to appropriate government departments, industry and the general public. This can be carried out via forums, workshops & the media.

Time: 1997-2002

Activity 4: Improvement & simplification of EIA procedures particularly to coastal development to ensure appropriate adoption of pollution control technologies in planned development.

Time: on-going

Control of Waste Discharge

Activity 1: Development/updating of the Master Plan for Sewerage Infrastructure. The Master Plan should ensure that existing and future developments have provision for sewerage systems. All sewage and industrial discharges shall be planned to be collected, treated and discharged into the environment at a quality compatible to the quality objective of the receiving environment.

Time: by 1996/7

Activity 2: Adoption of sound garbage disposal systems and improvement of solid waste management services. A systematic collection, handling, transfer and disposal of solid waste is to be complemented by a livelihood programme for scavengers.

Time: by 1996/7

Activity 3: Stricter implementation of pollution control legislations, devolution of pollution control functions to local government units.

Time: on-going

Activity 4: Provision of pollution control facilities and equipment for small & medium scale industries.

Time: 1996 - 2001

Activity 5: Extension of sewerage infrastructure

Time: 1996 - 2001

Siltation

Activity 1: Upgrading of soil erosion control measures in public and private development. The activity would also require the enhancement of monitoring and enforcement of development control measures currently in-place.

Time: by 1996

Activity 2: Establishment of soil erosion control guidelines and verification procedures for public and private development.

Time: by 1996/7

Capacity Building

Activity 1: Training attachments at selected institutions on waste management. Training workshops to develop skilled manpower on environmental planning, design, operation and management of waste treatment facilities can be convened for relevant environmental officers.

Time: 1996-2001

Activity 2: Provision of technical assistance on pollution control to small and medium scale industries.

Time: 1996-2001

Public Education & Awareness

Activity 1: Improve & intensify the conduct of information campaign on the effects of pollution aimed at educating coast dwellers on proper waste management.

Time: on-going

Activity 2: Conduct localized environmental actions on cost effective/community self-help basis to improve existing sanitary conditions

Time: by 1997

8.6 SINGAPORE

The priority areas of concern for Singapore have been identified to be in the following:

- building environmental consciousness
- upgrading environmental management and infrastructure
- adoption of clean technologies by industries

To address these areas of concern, the following **National Programme of Action** is proposed:

Building Environmental Consciousness

Activity 1: Introduction of environmental education in schools and tertiary institutions. Public forums, talks and campaigns on environmental issues are to be held regularly.

Time: on-going

Upgrading Environmental Management and Infrastructure

Activity 1: Encourage waste minimisation/recycling and in-house treatment of waste by industries.

Time: on-going

Activity 2: Upgrading of sewage treatment and sewerage systems.

Time: on-going

Clean Technologies

Activity 1: Draw up qualifying criteria for wastewater discharges from industries and consider fiscal incentives for industries which can meet these criteria using clean processes or highly efficient pollution control equipment

Time: by 1995

Activity 2: Upgrade trade effluent standards

Time: by 1996

Activity 3: Upgrading of solid waste management infrastructure.

Time: on-going

8.7 THAILAND

The priority areas of concern for Thailand have been identified to be in the following:

- water quality assessment and monitoring
- waste discharges from domestic sources,industries, agro-industries & agriculture
- capacity building
- public education & awareness

To address these areas of concern, the following **National Programme of Action** is proposed:

Water Quality Assessment & Monitoring

Activity 1: Assessment of existing water quality (rivers, estuaries, coastal waters and ground water) and automatic water quality monitoring.

Time: on-going

Activity 2: Upgrading of post-evaluation and monitoring of effluent discharges from point sources to meet the compliance of effluent standards and the mitigation measures that were requested during pre-evaluation during EIA.

Time: on-going

Control of Waste Discharge

Activity 1: Setting of pollution sources effluent criteria and standards. These criteria and standards shall cover industries, commercial activities, livestocks & farming activities.

Time: by 1995

Activity 2: Evaluation of specific projects for Initial Environmental Evaluation / Environmental Impact Assessment requirements.

Time: on-going

Activity 3: Water pollution sources inventories in river basins and coastal zones for prioritization of waste minimization and management programmes for investment.

Time: by 1997

Activity 4: Sewage and solid waste management and investment in Bangkok Metropolitan Region.

Time: by 1997

Activity 5: Investment for wastewater treatment facilities in pollution control zones (Pattaya, Phuket, Phi-phi Island, Hat-yai and Songkla).

Time: by 1996

Activity 6: Establishment/Improvement of municipal, industrial, livestocks waste management systems.

Time: by 2000

Activity 7: Privatization project for hazardous waste & management control.

Time: by 2000

Capacity Building for Enforcements

Activity 1: Strengthening of local authorities to be capable of point source pollution control. This may involve training attachments at selected institutions on waste management and training workshops to develop skilled manpower on environmental planning, design, operation and management of waste treatment facilities.

Time: by 1995

Activity 2: Formulation of Government, private sectors and NGOs networks in pollution control and the encouragement of private firms to cooperate with the Government as third party in pollution control systems.

Time: by 1995

Public Education & Awareness

Activity 1: Training and workshops on waste minimization, waste management & control for different levels of officers.

Time: on-going

Activity 2: Introduction of pollution studies (courses) in schools, universities and initiating appropriate arrangements for public education in this area. The courses should be designed to suit different levels.

Time: on-going

Activity 3: Development of programmes for public awareness using mass media, NGOs and local government bodies to provide information on waste minimization, management and control of pollution.

Time: on-going

Activity 4: Promotion of research and the development of appropriate technologies for waste minimization, management and control.

Time: on-going

9. REGIONAL PROGRAMME OF ACTION TO CONTROL LAND-BASED SOURCES OF POLLUTION INTO THE EAS REGION

9.1 Introduction

The preceding chapter has suggested a range of project activities that each of the participating countries in the EAS-27 Project can undertake to control land-based sources of pollution into the EAS region. Generally, all participating countries are required:

a. To take appropriate measures to provide for the effective assessment & monitoring of water quality in coastal waters and other river systems;

b. To undertake practical steps to implement planning control measures and the development of pollution control infrastructure;

c. To implement capacity training programmes in the management & control of pollution; and

d. To encourage the participation and the creation of public awareness and education of community and nongovernmental organisations (NGOs) in the development and implementation of integrated waste management programes.

In order to provide for a regional approach to the control of land-based sources of pollution into the EAS region, a **Regional Programme of Action** is now recommended for the region.

9.2 Objectives

The principal objective of the **Regional Programme of Action** is to provide for the protection of the marine environment and the coastal areas of the EAS region from various land-based sources of pollution. The **Regional Programme of Action** should therefore provide a framework for an environmentally sound, technologically feasible and comprehensive approach, particularly appropriate to the needs of the region to control land-based pollution sources. **The Regional Programme of Action** seeks :

a. To provide Governments in the EAS region with specific plans for the control of land-based sources of pollution into the East Asian Seas.

b. To build or augment national and regional capabilities to plan and implement strategies for the control of land-based sources of pollution.

c. To provide for the implementation of regional assessment and monitoring of water quality in the EAS region.

d. To identify the institutional structure for the coordination of the Regional Programme of Action.

e. To enable the development of technical and financial arrangements for the implementation of the Regional Programme of Action.

f. To provide for the co-operation of countries in the EAS region to control land-based sources of pollution.

Figure 9.1 presents a schematic diagram showing the development and implementation of the the proposed **Programme of Action**. The **Programme of Action** in essence comprises the following four major project components:

- **Planning Control & Environmental Management:** This is to improve environmental management and provide appropriate planning controls in the EAS region;

- **Capacity Training:** This is to augment national and regional capabilities in pollution control technologies;

- **Regional Assessment & Monitoring of Coastal Waters:** This is to enable appropriate regional assessment and effective monitoring of water characteristics and potential trends for the EAS region;

- **Public Education & Comunity Participation:** This is to create public awareness and to encourage community participation on pollution control programmes.

The key to the success of the proposed **Regional Programme of Action** is in the agreement of Governments concerned and the execution of the **Programme** primarily by national and appropriate institutions from the region in close cooperation with UNEP EAS/RCU and other organisations within the existing structures. No new organisational structure has been recommended as it is felt that existing COBSEA organisations and national institutions are capable of implementing the proposed activities within the **Programme of Action**. To a large extent, the successful implementation of the **Regional Programme of Action** depends not only on the preparatory phase which should take into account the specific socio-economic and political situation in a particular country, but also the existing national action programmes being implemented in the country. Figure 9.1 shows the relationship of various preparatory activities that can lead to the adoption and implementation of the proposed **Regional Programme of Action** for the EAS region.

Specific project activities under the recommended **Regional Programme of Action** are given in the following sections. The estimated budget costs associated with each activity that is recommended for immediate implementation are provided together with suggested time-frames for each activity. Coordination and implemention of the proposed activities would require inputs both financially and in terms of expert consultants from relevant UNEP agencies and other institutions. It is imperative that the **Regional Programme of Action** obtain appropriate financial and manpower support to enable its implementation.

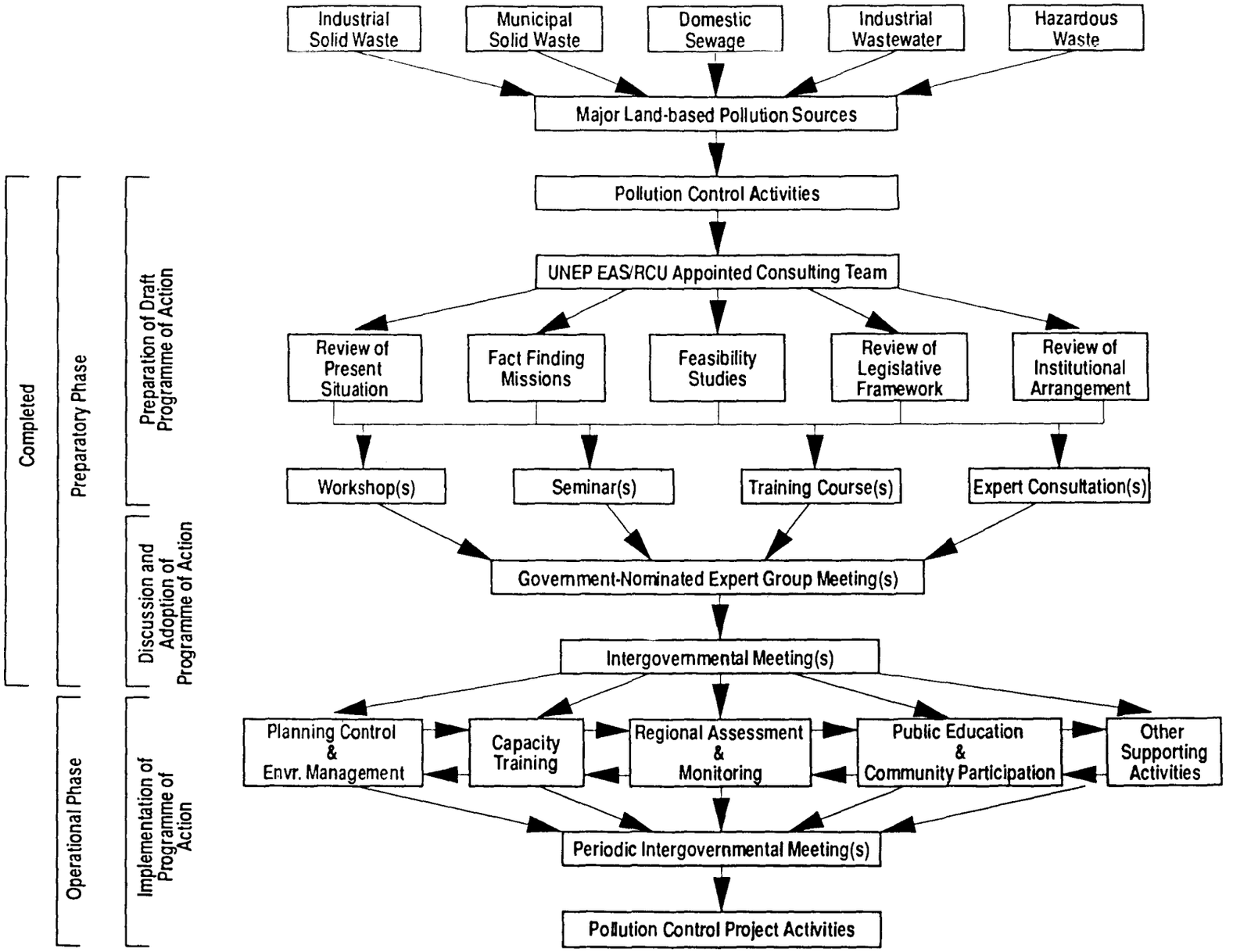

FIG. 9.1 SCHEMATIC DIAGRAM SHOWING DEVELOPMENT AND IMPLEMENTATION OF PROGRAMME OF ACTION TO CONTROL LAND-BASED SOURCES OF POLLUTION INTO EAS REGION

The implementation of the proposed **Programme of Action** would adopt a dynamic programming approach whereby various project activities are to be reviewed and modified as and when necessary to ensure that they remain regional in character, relevant to the overall objectives of the regional programme and that there is appropriate coordination of the regional activities.

9.3 Project and Activities

Project 1: Planning Control & Environmental Management

To improve environmental management and provide appropriate planning controls in all countries in the EAS region.

Activity 1: Master plans for infrastructural development of sewerage systems are to be drawn up or updated for each and every country in the EAS region. Environmental office in each country can be the focal point for this activity and a team of environmental consultants can be engaged to carry out this task. Estimated at 6 man-months per country with regional coordination provided by UNEP/RCU. The proposed activity duration is estimated to be about 12 months.

Cost: $400,000
Time: by 1996/7

Activity 2: Master plans for solid waste collection, handling and disposal in each of the EAS countries to be developed or updated. Engagement of consultants to carry out task and coordinated by UNEP/RCU. Project duration: 12 months.

Cost: $400,000
Time: by 1996/7

Activity 3: Review/development/updating of land-use concept plans for each of the participating countries in the EAS region. A team of consultants is proposed to be engaged for this activity which shall be completed over a period of 12 months.

Cost: $400,000
Time: by 1996/7

Activity 4: Development/upgrading of planning control guidelines to control pollution discharges and other adverse coastal impacts for development projects. Two workshops are proposed to be convened to review, discuss and formulate appropriate development guidelines. Experts within and without the EAS region shall be called upon to provide inputs to the workshops. Each workshop shall involve about 20 participants from the region and travel and per diems plus costs for materials pertaining to the workshops is estimated at $50,000 per workshop.

Cost: $100,000
Time: by 1995/6

Project 2: Capacity Training

To augment national and regional capabilities in pollution control technologies.

Activity 1: Training attachments at relevant sewage, industrial and solid waste treatment sites and environmental offices in and outside the region. Selection of appropriate training sites is to be carried out for the attachments. Training manuals and programmes are to be drawn up with assistance from experts within and without the region. Each training programmes may be for a duration of 1-2 months. (Total of 18 participants/country x 6 countries x 2 months x $2000/month plus incidentals)

Cost: $500,000
Time: 1996 - 98

Activity 2: Training workshop to discuss and exchange information on enforcement of pollution control legislations. The Workshop shall develop appropriate strategies for improved enforcement of existing legislations and formulation of more enforceable legislations. 18 participants from the region for 5 days.

Cost: $50,000
Time: by 1996

Activity 3. Training workshop is to be organised to discuss and develop/upgrade legislations for the protection of the marine environment. A register of institutions and legislations is to be prepared for the EAS region and priority areas for regional cooperation is to be identified and pursued. 18 participants from the region over a duration of 5 days.

Cost: $50,000
Time: by 1996

Activity 4: Training course on Environmental Impact Assessment particularly focusing on water quality impacts in the coastal regions. 18 participants from the region over 2 weeks.

Cost: $100,000
Time: by 1996

Project 3: Regional Assessment & Monitoring of Coastal Waters

To assess and monitor water quality characteristics and trends.

Activity 1: Workshop to discuss and set up effluent discharge standards, water quality criteria, sampling procedure, analytical methods and monitoring programmes. 18 participants from the region (each $1000 for travel and 5 days @ $150 for per diem) and 5 experts from within/outside the region (each $3000 for travel and 5 days @ $150 for per diem) plus incidental expenses .

Cost: $60,000
Time: by 1996

Activity 2: Establishment/augmentation programmes for continuous monitoring of coastal waters to evaluate status and changes of quality in the marine environment. Selection of sites, sampling methods, parameters, quality assurance, data management etc. would be needed. Sites should be established at existing stations and standardisation of procedures, instrumentation and data management carried out. UNEP/RCU can provide regional coordination and national laboratories/institutions can be the country focal points for this activity. Duration should be for at least 5 years. ($300,000/country x 6 countries)

Cost: 1,800,000
Time: 1997-2002

Project 4: Public Education & Community Participation

To create public awareness and encourage community participation on pollution control.

Activity 1: Publication of a newsletter, production of audio-visual aids, hosting of public talks, public competitions, etc. on pollution control and effects of pollution on marine environment. These activities is to be mounted on a national and regional basis. Duration of activity is about 5 years.

Cost: $200,000
Time: 1996-2001

10. CONCLUSIONS

Major land-based sources of pollution into the East Asian Seas (EAS) region are domestic sewage, solid waste, agricultural waste, industrial waste, toxic chemicals and hazardous waste. Various land-based activites like human settlement, land use, construction of coastal infrastructure, forestry, urban development and tourism are also the contributor of pollution into the EAS region. Coastal erosion and siltation also are of particular concern. But the domestic sewage is the major source of pollution to coastal waters of the region.

Land-based sources contribute more than 70 percent of the coastal pollution. The pollutants that pose the greatest threat to the coastal and marine environment are (in variable order of importance and depending on different national situations) organics, nutrients, sediments, litter and plastics, metals, radionuclides, oil/hydrocarbons, and polycyclic aromatic hydrocarbons. Many of the pollutants orginating from land-based sources are of particular concern to the coastal and marine environment since they exhibit at the same time toxicity, persistence and bioaccumulation in the food chain. Destruction of productive ecosystems like mangroves, corals, seagrass, fish and other coastal and marine resources due to land-based sources of pollutants is well documented in the region. Many of the coastal areas are currently unsafe for water contact recreation. These areas are expected to deteriorate further due to uncontrolled waste discharges as a result of population growth, urbanization and industrialization.

A concrete **Programme of Action** to control various land-based sources of pollution for the protection of the coastal and marine environment of the region is a must. Appropriate measures should be taken to implement various activities recommended in Chapters 8 and 9 of this report both for **country-specific and regional programmes of action** to control land-based sources of pollution into the East Asian Seas region in order to preserve the quality of the coastal and marine environment and thereby protecting its valuable resources.

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