

**MALAYSIAN COASTAL  
ENVIRONMENT – PLANNING  
DEVELOPMENT  
AND MANAGEMENT OF THE  
ENVIRONMENT IN  
PREPARATION  
FOR THE NEXT MILLENNIUM**

# **MALAYSIAN COASTAL ENVIRONMENT - PLANNING, DEVELOPMENT AND MANAGEMENT OF THE ENVIRONMENT IN PREPARATION FOR THE NEXT MILLENNIUM**

**By**

**Ir Hj. Keizrul Bin Abdullah  
Director General, Department Of Irrigation and Drainage Malaysia  
Jalan Sultan Salahuddin, 50626 Kuala Lumpur, Malaysia**

## ***Abstract***

*Malaysia covers a land area of about 329,293 km<sup>2</sup>. The total coastline length is about 4,809 km. The coastal zone of Malaysia has special socio-economic significance. A majority of the population lives in this zone and it is the center of economic activities.*

*Development planning in Malaysia has been largely sector-based. A large number of Federal, State and local agencies are involved in planning, development and management of various sectors having an impact on the coastal zone. The system has worked relatively effectively so far. However, in the past three decades, the country has experienced very rapid development and as a result, the coastal zone has come under greater stress. Many issues and problems have appeared. They include cross-sectoral and intra-sectoral conflicts in resource utilisation and management.*

*As the country moves towards the new millennium and in line with the vision of achieving a developed country status by the year 2020, it is working towards the implementation of integral coastal zone management. It is expected that the ICZM framework will include: -*

- *Development of National Coastal Zone Resource Management Policy;*
- *Enactment of Coastal Resources Management Act;*
- *Setting up of coastal zone resource management agency at the federal and state levels;*
- *Preparation and implementation of integrated regional coastal resources management plans;*
- *Capacity building in coastal resources management for government agencies;*
- *Development of mechanism for public participation in decision-making related to coastal zone development.*

## **1. INTRODUCTION**

The global concern and commitment to environmental management was clearly captured under Agenda 21 of the United Nations Conference on Environment and Development held on 3-14 June 1992 in Rio de Janeiro. The Rio Declaration on Environment has outlined 27 principles related to and explaining the concept of sustainable development. In particular, Principle 3 says, "The right to development must be fulfilled so as to equitably meet development and environmental needs of present and future generations".

The Rio Declaration reaffirmed an earlier declaration of the United Nations Conference on Human Environment in Stockholm on 16 June 1972. There is an increasing

realisation that many of the present day pursuit of economic progress are at the expense of the environment and hence are inherently non-sustainable. Sustainable development, in simple language is defined as that which meets the needs of the present without compromising the ability of future generations to meet their own needs. Simple as it sounds, the concept is in fact a demanding one in the light of expanding world population and diminishing non-renewable resources such as minerals, oil and gas.

The present day world is abounding with examples of non-sustainable developments, both in the developed and developing countries. In many developing countries, there is a tendency to accord greater emphasis to employment generation and income improvement, to the extent that environmental concerns are often ignored or suppressed as a result of socio-economic pressures. This has resulted in many cases where the environment has deteriorated to such an adverse level that the remedial repair costs are exorbitantly high, if at all still possible. Hence responsible planners and decision-makers are those who will balance economic gains against environmental degradation, often with greater weightage to the latter as the country becomes more developed.

Malaysia, being a developing country has the advantage that it is still in time to incorporate sound environmental concepts in most of its economic development activities. The country has an abundance of resources to support its population. At present, more than 50% of the country is still covered with forests. Malaysia has maintained a high growth rate of 7.8% during the last decade and is determined to achieve the status of a Developed Nation by the year 2020 (Vision 2020). A high-income level and quality living environment is amongst some of the desired targets under the Vision 2020 objectives.

## **2. THE COASTAL ZONE OF MALAYSIA**

Malaysia is located in South East Asia and comprises two regions, Peninsular Malaysia and the States of Sabah and Sarawak (collectively referred to as East Malaysia) on the northern part of Borneo Island, which are separated by 640 km of South China Sea. The total land area is 329,293 km<sup>2</sup> while the shoreline totals approximately 4,809 km. In addition, there are about 1,000 islands and coral reefs belonging to the country.

At present, there is no official geographical demarcation of the coastal zone, it can be broadly interpreted as areas where terrestrial and marine environments and processes interact. These include the coastal plains, coastal wetlands, estuaries and lagoons. There are differing views on the geographical definition of coastal zone and a consensus has not yet been reached. However, the width is likely to be set between 1 to 5 kilometers. Using the higher limit of 5 kilometers, the coastal zone would capture a total land area of 4.4 million hectares representing 13% of the total land area. Approximately 1.2 million hectares of the coastal zone are found in Peninsular Malaysia, 1 million hectares in Sabah and 2.2 million hectares in Sarawak. In addition, the territorial water totals about 150,000 km<sup>2</sup> while the EEZ extends another 450,000 km<sup>2</sup>. The coastal zone is the center of economic activities encompassing urbanisation, agriculture, fisheries, aquaculture and oil and gas exploitation.

### **3. HISTORICAL DEVELOPMENT OF THE COASTAL ZONE**

During the early days, man settled in the Malaysian coastal areas, especially in the river mouths where they could have easy access to the bountiful fisheries supported by the coastal wetland. Some of these early settlements developed into commercial centers serving both the local and international market such as the case of Melaka.. With the increase in trade, the population started to develop the hinterland for agricultural and tin mining activities. With the coming of the British, vast areas of virgin forests were converted into rubber plantations. Many of the coastal settlements in the coastal zone, especially at estuaries such as Kota Bharu, Kuala Terengganu, Kuantan, Johor Bahru, Melaka, and also George Town then developed further as state capitals and major urban centers. Other towns which were originally small fisherman's settlements have also developed in importance such as Dungun, Chukai, Pekan, Mersing, Batu Pahat, Muar, Port Dickson, Kelang, Lumut, Perai and Kuala Perlis.

### **4. DEVELOPMENT PLANNING PROCESS IN MALAYSIA**

Planning of development in Malaysia is largely sector-based. The government machinery is divided into three levels, namely Federal, State and local levels. At the Federal level, the Economic Planning Unit (EPU) under the Prime Minister's Department is the central economic planning agency charged with formulating medium and long-term policies and strategies for economic development. There are a number of Ministries, which carry out planning, coordination and implementation of government policies relating to its designated portfolio. Reporting to them are departments and statutory bodies acting as implementing agencies. Many of these agencies are involved in various aspects of planning and development in the coastal zone as summarised in Table 1 and the planning process is outlined in Fig. 1.

At the State level, planning is the responsibility of the State Economic Planning Unit (SEPU) but approval of development plans is by the State Executive Council. SEPU's play a major role in formulating the state's development strategy, coordinate the preparation of state development programs and submit its plans to the Federal Government for funding consideration. Each state is divided into a number of administrative districts within which the area is further divided into local authority areas and non-local authority areas. The local authorities are established under the Local Government Act, 1976 and are given considerable authority to administer its area. In Sabah, state administration is divided into state, district and village levels whereas in Sarawak, there are five levels of administration, i.e. state, division, district, sub-district and village.

### **5. LANDUSE PLANNING PROCESS IN MALAYSIA**

Systematic development of the 4,809 km of coastline in Malaysia obviously requires a comprehensive system of coastal zone planning and management. Landuse, both within the coastal area and the upstream hinterlands, have great influence on the health of the

coastal zone. In Malaysia, landuse planning follows a complex process set by the state, local authorities and a host of other relevant government agencies as shown in Fig. 2.

Malaysia is a federated state with both Federal and State Government. The distribution of legislative power between them is enumerated in the Ninth Schedule of the Federal Constitution set out in a Federal List, a State List and a Concurrent List. The main subjects in the Federal List are external affairs, defense, internal security, law, citizenship, finance, commerce and industry, shipping, communication and others. The State List comprises matters such as land, agriculture, forestry, local government, riverine fishing, Muslim law, etc. In the Concurrent List, where both Federal and State Governments are competent to legislate, there are subjects such as social welfare, protection of wildlife and town and country planning. By virtue of this listing, town planning matter (inclusive of coastal zone development planning) are the joint responsibility of both Federal and State Government.

At the State level, the major landuse planning authority is the State Planning Committee, which has extensive powers to promote conservation, use and development of all land in the state. It will also examine and approve all draft structure plans and local plans. Before permission for any proposed development can be given, the status of the land needs to be converted to the new landuse and further sub-divided according to the procedure laid down under the National Land Code. After land conversion and sub-division have been approved, the developer may apply for planning permission from the respective LA. The Town and Country Planning Act 1972 requires that all development must have planning permission prior to commencement of work. The next step is the building plan approval where it has to conform to both the landuse criteria specified in the local plan as well as the conditions attached for approval of conversion and sub-division.

## 6. PROBLEMS AND ISSUES IN COASTAL ZONE MANAGEMENT

The sector-based approach of development planning has worked relatively well during the past decades. However, in the past three decades, Malaysia has experienced very rapid rate of development. From 1986 to 1997, the country enjoyed an unprecedented rapid growth rate of 7.8% per annum. The manufacturing sector has also emerged as the largest contributor to the economy and the coastal zone; traditionally the centre of economic activities has come under greater stress. These have manifested themselves in environmental degradation and resource depletion as elaborated below: -

### **Coastal Erosion**

Malaysia was facing increasingly serious coastal erosion problem and in response to it, the National Coastal Erosion Study was carried out in 1984 under the auspice of EPU and the Department of Irrigation and Drainage (DID) was the technical secretariat of the study. The study which was completed in 1985 revealed that of the 4,809 km of shoreline in Malaysia, about 1,390 km (29%) were subjected to erosion of varying degree of severity. Based on the consideration of the rate and imminence of erosion and the economic value of the human activities threatened, coastal erosion sites have been classified into the following categories: -

- (a) Category 1 – Critical  
Areas suffering from coastal erosion where shore-based facilities are in imminent danger of loss or damage.
- (b) Category 2 – Significant  
Areas where shore-based facilities are expected to be endangered within 5 to 10 years if no remedial actions is taken, and
- (c) Category 3 – Acceptable  
Erosion areas that are generally undeveloped with minor economic losses if erosion continued unabated.

The distribution of various categories of erosion area is given in Table 2.

The economic and social consequences of coastal erosion and the concern generated have increased rapidly as the use of coastal land intensifies. Of the critically eroding sites, agriculture features by far as the most dominant human activity, followed by housing, transportation and recreation. Most of the agriculture land along the west coast of Peninsular Malaysia are sited at these critical sites where the coastal bunds which exclude sea-water intrusion have been breached by wave attack, followed by tidal flooding of the inland areas thus damaging the crops such as coconut, cocoa, oil palm and paddy. It also reduces soil fertility for future crops thereby affecting production and income.

In some areas, residential and commercial housing has been or soon will be damaged or destroyed by coastal erosion. Such endangered facilities include both permanent and temporary housing, international class hotels, private houses, schools and other public establishments. In other areas, erosion has damaged coastal roads resulting in delayed or interrupted travel and inconvenience. In extreme cases, land communication link is severed and traffic has to be rerouted to alternative roads while the severed road has to be relocated further inland. Erosion has also destroyed some beaches and drastically reduced the extent of many others. Although at present, only some of these beaches are used for recreation, the demand for recreational use of beaches is increasing. When beaches on which resorts and tourist centres are sited are destroyed, fewer people will visit the beaches resulting in decline in occupancy rate and affecting related spin-off business activities.

In some areas, erosion has occurred due to natural process but a large number of them are due to development activities on the coastline or coastal zone that are not properly planned or sited. Typical examples are: -

- Interruption of longshore sediment transport by engineering works such as land reclamation, dredging of navigation channels, construction of ports, groynes, breakwaters, jetties, etc;
- Removal of natural vegetation such as mangroves resulting in loss of a natural media to dissipate the wave energy;
- Reduction of sediment supply to the coast caused by engineering works in rivers such as dams, barrages, sand mining from river bed, etc;
- Unregulated or uncontrolled dredging and sand mining activities in near shore areas.

## **River Mouth Siltation**

In contrast to the problem of coastal erosion, the problem of siltation is affecting a large number of river mouths and ports/harbors. Malaysia has more than 150 river mouths and many of them are suffering from inadequate draft for navigation of fishing vessels as a result of siltation and increase in vessel size. In order to address this problem, the National River Mouths Study was carried out in 1992 under the auspice of EPU and with DID acting as the technical secretariat. The study was completed in 1994 has identified a total of 35 river mouths where conditions are critical meaning that inadequate water depth for navigation has resulted in serious economic losses to the local fishing communities. It has been estimated that an allocation of 300 million Ringgit Malaysia is required for capital works to address the problem at these river mouths.

## **Uncontrolled Sand Mining Activities**

In Malaysia, many land reclamation projects utilise sand extracted from offshore areas as fill material. When sand-mining activity is carried out near to the shoreline, it allows the bigger wave to reach the shoreline, increases the sediment transport rate and very often leads to coastal erosion problem. Sand mining in Malaysia is carried out under a licensing system. In granting approval for this activity, the authority would specify the location and size of the area for sand extraction after taking into account comments from various government agencies concerned with coastal zone management. However, some of these operators may not necessarily comply fully with the conditions specified, particularly with respect to the extent of the sand mining area permitted. Such uncontrolled activity can lead to serious negative impacts on the coastal zone including shoreline erosion, destruction of habitat and pollution.

Of late, a large number of land reclamation projects are been carried out or are being planned. These include massive proposed projects in Kedah, Selangor, Melaka, Perak, Perlis and Pulau Penang. It has been estimated that all these reclamation projects would require a total fill material of 2 billion cubic metres. This is a massive figure and there is some uncertainty as to whether offshore sand deposits are sufficient to meet this demand without jeopardising stability of the coastline. The Malaysian Government has commissioned the National Sand Source Study to quantify the location and quantity of offshore sand deposits from the Straits of Malacca that can be mined for reclamation purpose without causing negative impacts to the coastal environment. The study has just commenced and will be completed in the year 2001. Meanwhile, the Government is also studying the possibility of using Vessel Tracking and Monitoring System to monitor the activity of dredging vessels to ensure that they fully comply with the conditions laid down for their operation.

## **Loss of Coastal Forests, Coral Reefs and Seagrass Beds**

There are three major types of coastal forests in Malaysia, namely mangroves, peat swamp forests and freshwater swamp forests. Mangrove forests total about 641,000 hectares and made up about 2% of the total land area (see Table 3). Between 1970 and 1990, about 130,000 hectares of these forests were converted to other uses such as agriculture and aquaculture. The main threat to the preservation of mangroves come

from reclamation for agriculture and aquaculture which often encounters major problems due to potential acid-sulphate soils, at times leading to abandonment of the project after a short time. In Malaysia, peat swamp forests are normally found just behind the coastline and the total area is about two million hectares with Sarawak having about 75% of the total and 60,000 hectares are found in Sabah whereas the rest are found in Peninsular Malaysia. About 297,000 hectares of these forests have been cleared, mainly for agriculture purpose.

Another major habitat, coral reefs is also increasing threat. Many have been damaged from high sediment load brought down by river flow due to upstream land clearing and logging activities, particularly in Sabah. The final major ecosystem, seagrass bed is also under stress. Although the exact size of seagrass bed in Malaysia has not been determined, 10 genera and 14 species of these marine plants have been documented along its coastline. They are important habitat for marine creatures like dugong. In the early part of 1999, the death of a number of dugong in the Johor Straits highlights the loss of their seagrass habitat.

### **Over-Exploitation of Fishery Resources**

The estimated yield potential of fishery resources for inshore areas up to 12 miles off the coast of Malaysia is around 588,200 tonnes and that of offshore areas up to the Exclusive Economic Zone is 421,800 tonnes. There is considerable over-exploitation of the inshore fishery resources, particularly in the West Coast of Peninsular Malaysia where total fish landing in 1990 is 510,471 tonnes and hence exceeds the potential yield of 321,800 tonnes (see Table 4). There has been a decline in catch rate. Other signs of over-exploitation are the lower catch-per-unit effort, decline from 130 kg/hour in 1970 to between 40-60 kg/hour from 1980 onwards; increase of the proportion of trash fish composition in each catch landed and the relatively constant landing figure despite the use of better equipment and technology. This decline is partly caused by the loss of mangroves and other wetlands, which function as breeding ground of a large variety of fish species and prawns. Its importance can be seen from the fact that about 32% of total fish landings in Peninsular Malaysia are mangrove-related species

### **Marine Water Quality Deterioration**

The marine water quality in Malaysia has been declining. In 1997, 37% of monitoring stations had results exceeding the Proposed Marine Interim Standard for total suspended solids, oil and grease and *E. coli* (originating from domestic sewage). Traces of heavy metals have also been detected in coastal water of Perak, Pulau Pinang, Selangor and Negri Sembilan (refer Table 5).

### **Loss of Habitats and Wildlife**

Many habitats have been lost to the advent of development and this is the major cause of loss of wildlifes in Malaysia. As the coastal zones is being developed, wildlife in most cases are not able to adapt to the new environment, their number dwindles as food and place of refuge for breeding disappears. The major groups of wildlife threatened are birds, turtles, dugongs, proboscis monkeys and crocodiles. Malaysia has four species of turtles nesting on its coast, namely leatherback, green turtle, Hawksbill turtle



and the Olive Riddley turtle. It was reported that nesting population has declined by as much as 60-99% since the 1950's.

## 7. CONFLICTS IN COASTAL RESOURCES UTILISATION

Most of the problems of environmental degradation and resource depletion in the coastal zone as described stems from conflict in resource use. They manifested themselves in the form of

- Conflict between upstream and coastal activities,
- Conflict between local population in the coastal zone and developers/investors from outside, and
- Conflict between immediate economic gains and long-term sustainability (ecological and economic) of the coastal landuse.

EPU has identified twelve use-categories in Malaysian coastal areas. They are navigation and shipping; communication; environmental protection and ecosystem conservation; exploration and extraction of minerals and hydrocarbon resources; fishery; aquaculture and mariculture; tourism and recreation; research and education; human settlement; coastal land reclamation; military and naval defense and finally waste disposal and pollution. Each of this resource use has the potential to give rise to cross-sectoral and intra-sectoral conflicts.

Under the former, environment and ecosystem protection (sustainable development) conflicts with development activities. The three key ecosystem, coral reefs, mangrove and sea grass bed faces grave threat to their survival from sedimentation and water pollution resulting from development activities. Another major contributor to this conflict is coastal land reclamation, which by its very nature is detrimental to marine and coastal ecosystem, biological diversity and water quality. This could be discerned from EIA reports submitted for all major coastal reclamation activities.

Tourism activities lead to habitat modification and destruction and a decline in marine water quality. Many tourist facilities also lack proper sewage and solid waste treatment and disposal facilities resulting in marine and coastal pollution. This problem is particularly acute for popular resort islands. There are also equity issues when public beaches are developed by private interest who then refuse public access to these beaches and discriminate against the public who cannot afford to pay. Development of aquaculture has lead to destruction of mangrove forests. In Sabah, the use of destructive fishing methods, in particular explosives has caused damage to coral reefs. Human settlement both in the coastal areas and the upstream areas has given rise to problem of pollution from domestic sewage and industrial pollution.

As for conflict within the sector, this is best exemplified by conflict between traditional fisherman and commercial fishing operators. Commercial fisherman trawl on a regular basis the inshore areas, a zone reserved for traditional fisherman. In 1998, a total of 971 arrests were made for various fisheries offences by local fisherman, most of which for violation of fishing zone regulation. Other instances of this conflict are access to public beaches, which are being increasingly denied to the public by resort and hotel developers.

## 8. EXISTING MANAGEMENT FRAMEWORK WEAKNESSES

There are a number of weaknesses in the present management framework for coastal zone management in Malaysia. All three tiers of Government in Malaysia, namely the Federal, State and local Government is involved in one way or another in coastal zone management. In many cases, a series of small decisions made by various levels can have a snowballing effect where development in the coastal zone is concerned, such as the mushrooming of resorts, chalets and hotels along the country's coastline. Due to the large number of agencies involved, there is urgent need to improve the existing consultative mechanism because issues of coastal zone management cut across many sectors.

Furthermore, there is a division between the Federal and the State Government as far as jurisdiction over coastal water is concerned. Coastal waters from the foreshore up to three nautical miles offshore is under the jurisdiction of the State Government whereas the seabed from three to 12 nautical miles offshore is under the jurisdiction of the Federal Government (under the Emergency (Essential Powers) Ordinance No. 7/1969).

Landuse planning has great impact on the health of the coastal zone and power is under the respective state governments. The existing tax and revenue-sharing structure generally does not encourage the states to favour preservation. A major part of state revenue is derived from land tax whereby the more 'intensive' the landuse, the higher is the tax imposed. Furthermore, premium for land conversion and subdivision is another major source of state revenue. Land in their natural condition is generally unalienated land that yields no revenue for the state and therefore pressure on the states to permit conversion and exploitation of such land, sometimes to the detriment of the environment.

Numerous laws support the work of the government agencies in protecting the coastal and marine environment but enforcement is sometimes less than satisfactory due to constraint in manpower and other resources. This is further constrained by the fact that there is not a single set of comprehensive legislation that governs, manages or control an activity and its effect in the coastal areas of Malaysia. There is also shortage of expertise at the state and local government level to better plan and manage the coastal resources.

## 9. CONSERVATION EFFORT FOR THE COASTAL RESOURCES

Currently, the Danish Cooperation for Environment and Development (DANCED) is funding an Integrated Coastal Zone Management in Malaysia Project. The study has estimated the economic benefits of the Malaysian coastal zone from resources utilisation as RM 2.2 billion per year (refer Table 6). Additionally, there are offshore activities that are not computed, such as production of oil and natural gas (RM 13.6 billion in 1998), trade (RM 230 billion in exports-imports), ports and shipping (RM 3 billion) and sand mining. Furthermore, the coastal zone provide ecosystem for breeding of fish and other aquatic species, recreation, tourism development and efforts should rightfully be directed to preserve this fragile ecosystem.

Malaysia has adopted the policy of sustainable development since Seventh Malaysia Plan. This policy also applies to the coastal zones. In this regard, we can distinguish two different types of conservation measure. One is sustainable use of resources whilst the other is total protection of areas of region so that habitats and ecosystems are available for current and future use. A large number of protective measures have been implemented as follows: -

### **Resources Conservation**

To conserve fishery resources, a number of measures have been implemented: -

- Direct limitation of fishing in the coastal water;
- Establishment of closed fishing area whereby the more efficient commercial fishing gears are prohibited from operating in inshore water up to 5 nautical miles.
- Establishment of management zones whereby trawlers and purse-seiners are restricted to operate in designated zones.

In order to conserve forestry resources in the country (inclusive of coastal zone), a system of protected forests totaling about 1.39 million hectares (4% of total land area) has been established. Virgin Jungle Reserves along coastal forests and mangrove have been gazetted and the total acreage is 112,767 hectares to date. These include the famous Tanjung Tuan Reserve in Melaka, Pulau Kecil Forest Reserve near Port Weld, Sg. Miang Forest Reserve in Pahang and the Bako National Park in Sarawak.

The Marine Parks Malaysia Order 1994 has established a system of marine parks for the whole of Malaysia. 8 marine parks have been set up covering 40,000 hectares in Peninsular Malaysia and 20,533 hectares in Sabah. Wildlife sanctuaries and bird sanctuaries/reserves totaling 630,000 hectares have also been established. These include Kuala Selangor Nature Park designed to provide a safe feeding and resting area for migratory birds. A number of measures to conserve turtle have also been implemented including: -

- Gazetting of the Fisheries (Prohibition of Methods of Fishing) Regulation 1990 which bans the use of drift gill nets with mesh size of more than 10 sizes;
- Establishment of the Rantau Abang Turtle Sanctuary in 1990;
- Gazetting of the waters off the coast of Merchang to Kg. Kuala Abang, Terengganu as prohibited fishing areas;
- Establishment of six turtle hatchery centres to hatch turtle eggs and these hatchlings will be released to the sea.

### **Environmental Impact Assessment for Development Projects**

The Malaysian Government has enacted the Environment Quality Act, 1974 (EQA). This is a Federal law, which impose some form of regulatory control on all development activities from the consideration of potential impact on the environment. It is therefore in support of the concept of sustainable development and sound coastal zone management. The Environmental Impact Assessment Order of 1987 (Prescribed Activities) spells out a list of development activities which require mandatory submission of EIA reports for prior approval of the Department of Environment

(DOE). Examples of projects in coastal zone, which fall under the prescribed activities, are: -

- Land development schemes for converting forest to agricultural lands which involve an area of more than 500 hectares;
- Drainage of mangrove swamps which involves an area of more than 50 hectares;
- Conversion of mangrove swamps for industrial, housing or agricultural areas exceeding 50 hectares;
- Reclamation of coastal area which involves an area of more than 50 hectares;
- Agriculture projects which involve clearing of mangrove swamps of more than 50 hectares;
- Clearing of mangrove swamps in islands surrounded by national marine parks;
- Sand mining covering an area of more than 50 hectares;
- Construction of coastal resorts or hotels exceeding 80 rooms;
- Construction of recreational facilities in islands surrounded by gazetted marine parks;
- Construction of port or expansion of existing ports involving an increase of more than 50% in handling capacity.

DID provide assistance to the Department of Environment in the form of comments on EIA submissions for projects affecting rivers, coast and water resources. On the average, the Coastal Engineering Division of DID provides comments on about 30 EIA reports for proposed developments in the coastal zone each year. In recent years, many of these reports are supported by hydraulic studies using sophisticated computer models which predict impacts that arise as a result of the proposed development in the zone. CED assists DOE in identifying deficiencies in these studies and suggests imposition of conditions to minimise any negative impacts that may arise from these developments.

### **Coastal Erosion Control**

In cognizance of the consequences of coastal erosion, the Malaysian Government has since 1987 adopted a two-pronged strategy (short-term and long-term) for control of the problem. The short-term strategy is construction focused and reactive in nature, i.e. to protect existing facilities and properties in the critical category. The long-term strategy is management focused and aims to obviate the need for expensive protective works in the future. This is achieved by according due consideration to the consequences of coastal erosion in the planning and development of projects within the coastal zone through an integrated and coordinated development strategy and plan. The short-term measure thus requires structural solutions such as the construction of revetments, breakwaters, nourishment, etc. whilst the long-term plan aims to control erosion through instituting non-structural measures such as landuse planning and control.

In order to develop suitable institutions to oversee the long-term strategies, the Malaysian Government set up the National Coastal Erosion Control Council (NCECC) and the Coastal Engineering Technical Centre (CETC) in 1987. The NCECC has its secretariat at the Implementation Coordination Unit of the Prime Minister's Department and is chaired by its Director General. It acts as a policy formulation body

to plan and coordinate the coastal erosion control program involving the Federal and State Government, and the private sector. Its responsibilities are: -

- Prepare guidelines on the preparation of coastal erosion control program and distribution of financial responsibility for the program;
- Determine general procedures and coordinate development in the coastal zone to reduce need for constructing coastal erosion control works in the future;
- Prepare necessary legislation for effective management and development of the coastal zone, and
- Formulate and establish necessary coastal erosion control institutions.

The Government also established the Coastal Engineering Technical Centre (CETC) in the Department of Irrigation and Drainage and it is now known as Coastal Engineering Division (CED). CETC's responsibilities are: -

- Implement coastal erosion control works for the critical areas;
- Provide technical support to NCECC;
- Provide technical advisory services to other government departments and agencies in processing of development applications in the coastal zone;
- Maintain a coastal engineering databases to support planning and design of coastal engineering works in the country.

Immediately after it was set up, CETC began to implement an erosion control program with a budget allocation of 400 million Ringgit Malaysia to protect 74 critical erosion sites. This program is partly funded by a loan of 43 million U.S dollars from the Asian Development Bank. The progress of implementation to date is as follows: -

|   |           |
|---|-----------|
| Sites with completed protection works   | 43        |
| Sites with ongoing construction works   | 7         |
| Sites with feasibility study and detailed design of protection work in progress | 9         |
| Project postponed/cancelled   | <u>15</u> |
| Total   | 74        |

The entire program is expected to be completed by the end of year 2000.

There are currently 64 sites with a total length of 220 km in the significant erosion category. Although important economic and social activities are carried out in these areas, such activities are presently not threatened by coastal erosion but may be so within the next 5 to 10 years. CED carries out periodic review of the problem and updates the status of erosion classification because at present it is not economically justifiable yet to build any protection works. CED has just appointed a consortium of surveyors to prepare a digital contour map of the coastline area for the whole of Malaysia by using aerial photographs taken of the coastline. The work consists of two phases. Under Phase 1, spot heights will be extracted from the aerial photograph taken during the 1980's. The contour line is then generated and the shoreline identified. Under Phase 2 of the work, new aerial photograph of the entire coastline of the country will be taken and the shoreline extracted from these photographs thus completing a comprehensive dataset of 2 sets of shoreline to enable the department to monitor the

shoreline changes during the past decade. This monitoring process will be repeated once in 3 to 5 years to provide continuous record of the shoreline changes.

Over the last 13 years, CED has developed considerable expertise in the planning and design of coastal engineering works. It has acquired a set of sophisticated computer modeling programs, namely MIKE21 and LITPAK from Danish Hydraulics Institute for modeling coastal processes induced by waves, tides and currents and has developed expertise in the use of these computer models to better predict changes in the coastal zone.

In designing mitigation measures against coastal erosion, reliable field data concerning the coastal environment is necessary. As is usually the case in most countries, relevant coastal and shoreline in Malaysia are currently collected by many government agencies, private sector organisation, university scientists and consultants. Moreover, except for tidal elevation and shore-based wind data, data on other important parameters such as waves and current are hardly collected and even if they are, the collection program is tailored to a specific site and of short duration.

To coordinate coastal and shoreline data collection program, the NCECC authorised the establishment of the Coastal Engineering Data Collection Committee in August 1989. CED heads the Committee, which is made up of all institutions involved in collecting data useful for coastal engineering. Towards this role, CED currently plays the role of a national data bank of coastal information. It has set up a data management system incorporating Geographical Information System (GIS). Work is currently going up to incorporate data on wave, tidal elevation, coastal bathymetry, shoreline condition and other relevant information into the database.

CED has also initiated a long-term coastal data collection program since 1987. The shore-based Littoral Environment Observation Program where near-shore coastal engineering data such as incident wave height, period and direction, wind speed and direction, current speed and direction, beach slope and beach forms are visually observed on a daily basis by shore-based observers using simple hand-held instruments. On a larger time scale, beach profiling, which registers profile changes over time, is also conducted.

In order to increase the effectiveness of the management approach, the Government issued Administrative Circular 5/87 that requires all government agencies and departments to forward all proposed developments in the coastal zone to CETC for comment. This complements the coverage of the EQA in that it requires development proposals falling outside the purview of the EQA to be submitted to DID for comment from the hydraulic/morphological stand point.

After this circular was issued, CED began to be actively involved in providing technical comment on such proposed developments received from all over Malaysia. On the average, up to about 100 applications is processed each year. Many of these proposed developments contain features which are highly undesirable from coastal engineering view point, such as the use of vertical-sided sea-wall as erosion protection works (which would induce toe scour) and absence of adequate set-back. CED has identified many shortcomings in development project design and had advised the

respective planning authorities to recommend changes to these design or institute additional requirements to avoid negative impacts to the environment.

To ensure better compliance with this requirement, additional clout was rendered to the circular by expanding it into a formal set of guideline called 'DID Guideline No. 1/97 - Guideline on Erosion Control for Development Projects In the Coastal Zone' which was approved by the Cabinet in January 1997. The guideline describes in detail the data requirements and the scope of impact evaluation for the various types of development in the coastal zone namely shorefront development, backshore development, land reclamation, offshore sand mining and river mouth dredging. Amongst the major recommendations are: -

- Set-back of 60 metres for development in sandy coasts;
- Set-back of 400 metres for muddy coast measured from the seaward edge of mangrove vegetation;
- Preservation of sandy dunes in their natural state and banning of development on sand spits and sandbars;
- Banning of sand mining in nearshore areas less than 1.5 km from the Mean Low Water Line or 10 metre water depth whichever is further from the shore

Elements of this guideline have also been included in relevant guidelines of the Town and Country Planning Department and Department of Environment EIA guideline for coastal developments.

Adoption of the above administrative guideline has helped to contain the escalating coastal erosion problem as seen from the Figure 3. The number of critical erosion sites had increased from 47 in 1987 to 60 in 1990 and then to 74 in 1995 but have since stabilised, indicating that the number of improperly planned or layout coastal development projects have been greatly reduced.

## 10. STRENGTHENING OF COASTAL ZONE MANAGEMENT CAPACITIES

During the last few years, the Malaysian Government has undertaken a number of initiatives and studies to further strengthen the management of the coastal areas as follows: -

- *The South Johor Coastal Resources Management Project (SJCRMP)* was completed in 1992 under assistance of USAID. Two major outputs from study are the coastal environmental profile for South Johor and the Coastal Resource Management Plan for South Johor.
- *A draft National Policy for Coastal Resources Management (NCRMP)* was formulated in 1993, which recommended setting up of a national Coastal Resources Management Council. It was also recommended that the Council will be assisted by a Coastal Resources Technical Working Group in implementing the policy. Similar institutional arrangement is to be set up in all the states with the responsibility of developing the Coastal Resources Management Plan and oversee the implementation of the National Coastal Resources Management Policy. Furthermore, a National Resources

Management act is to be enacted to strengthen and formalise the policy and its implementations.

A number of other coastal resources management studies have also been carried out as enumerated below: -

- *Regional Environmental Impact Assessment and Shoreline Management Plan of West Coast of Sabah* was completed in early 1999 which provides a framework of strategic guidelines and sustainable policies for the effective management of the coastline. It confines development projects to areas where anticipated environmental impacts are acceptable and identify overall design configuration that would lead to minimum impact on the marine environment.
- *Integrated management Plan for the Sustainable Use of the Johor Mangrove Forests* was started in 1997 to prepare a management plan for sustainable use of mangrove in Johor and strengthen the capacity of the state administration in management of mangrove forests.
- *National Conservation Strategies* has also been formulated and it calls for formulation of a National Coastal Zone Management Plan and designation of a single agency to coordinate effort and another agency to coordinate implementation of the plan.
- A study to develop the *National Integrated Ocean Policy* was completed in 1995. The study recommended expansion of the National Marine Council into the National Ocean Council and that it should be assisted by a series of Inter-Agency Task Forces with responsibilities such as administrative, restructuring of ocean governance, development of an integrated national ocean policy and sectoral and multi-sectoral problem assessment.
- The draft *National Wetlands Policy* has been completed in November 1998 and its goal is to manage wetland sustainably for their environmental and socio-economic functions in order to contribute to the continued progress and well being of the nation. It has also outlined 10 strategies for implementation.
- Malaysian Government also participated in documenting the environmental profile of the Straits of Malacca under the multilateral program *GEF/UNDP/IMO Regional Program for the Prevention of and Management of Marine Pollution in the East Asian Seas*. The study has compiled information's on the policies, strategies and practices of the littoral states and other organisations on matters related to marine pollution and collected data on living and non-living resources of the Straits.
- With assistance from the Food and Agriculture Organisation, the Malaysian Government has prepared a set of guidelines for aquaculture development in 1996 and has commenced on preparation of a code of practice for the industry.



## 11. ELEMENTS OF INTEGRATED COASTAL ZONE MANAGEMENT

As Malaysia marches towards the new Millenium, the Government is working towards implementing of integrated coastal zone management (ICZM) to better manage and conserve its coastal resources. The framework to be introduced will comprise the following elements: -

- Formulation of an Integrated Coastal Zone Management Policy;
- Enactment of a Coastal Resources Management Act;
- Formation of Integrated Coastal Zone Management Council at both the Federal and the Level;
- Development and implementation of integrated coastal zone management plans for all coastal areas throughout the country;
- Development of mechanism for public participation in decision making on development and utilisation of coastal resources.

Development of the first item, i.e., an integrated coastal zone management policy is now ongoing under the *Integrated Coastal Zone Management in Malaysia Project* funded by DANCED. Under this project, three ICZM institutional strengthening project is carried out in the states of Penang, Sarawak and Sarawak and a federal component is carried out in EPU. Under each of the state project, an environmental profile of the coastline in each state and an ICZM plan is being prepared. Capacity building in coastal zone planning and management within the state agencies will also be carried out. Under the Federal component, the project will help to develop a national coastal zone policy for Malaysia. It is expected that the policy will emphasise the qualities of sustainability development and involve recognition of the legitimacy and contribution of every use of the resource in the coastal zone.

Within the framework of the policy, the federal government will be responsible for: -

- (a) Providing the overall coordination and general guidelines for the sustainable development and conservation of coastal resources;
- (b) Support each state's efforts in developing a statewide ICZM plan and provide technical and financial support on a continuous basis;
- (c) Review all state plans prepared under the program to ensure its consistency and comprehensiveness in relation to the federal guidelines and approve continued funding support subjected to periodic review;
- (d) Introduce and update education, research and data collection program for planning and management of the coastal zone at local universities to assist in the development of sound plans;
- (e) Develop a centralised database to monitor program implementation;
- (f) Develop a public information and awareness program on the importance of the coastal ecosystem to minimise abuse of these resources.

Formation of Integrated Coastal Zone Management Council (ICZMC) at both the Federal and the Level will be the next prerequisite. The 1996 Workshop for the Drafting of NCRMP had proposed that the National Coastal Erosion Control Council may be restructured and its role enlarged to become a National Coastal Resources Management Council. The new council will be responsible for implementing the duties mentioned above.

At the State level, the respective State Economic Planning Units may be the secretariat for the state-level ICZMC, which will be responsible for developing the State ICZM plan. The plan will include an environment profile of the coastal zone of the respective state and provide guidance on the implementation of specific activities by the various state agencies. It will also provide a land use guide for the preparation of local plan by the local authorities.

## 12. CONCLUDING REMARKS

The Malaysian coastal zone is the most productive ecosystem in the country. It houses a majority of the population and industrial activities and represents a unique environment, which requires special attention in its planning, development and management. The Malaysia Government recognises the pressing concern and need for integrated coastal zone management. As a first step, an integrated coastal zone resource management policy is being developed. This will form the basis for setting up of appropriate institutional mechanisms and legislative measures to provide an integrated framework for implementation of specific programs to conserve the valuable resources in the coastal zone. This is in line with its vision of becoming a developed industrial nation by the year 2000 as encompasses in Vision 2000.

## ACKNOWLEDGEMENT

I would like to thank the organisers of ISCEM'99, for inviting me to present this paper at the International Symposium and Exposition on "Coastal Environment and Management : Challenges in the New Millenium". I would also like to record my deepest appreciation to the Coastal Engineering Division of the Department of Irrigation and Drainage Malaysia and in particular to Mr. Tan Teow Soon for his assistance in preparing this paper.

## REFERENCES

1. Economic Planning Unit. 1985. *National Coastal Erosion Study Report*.
2. Department of Irrigation and Drainage. 1997 . *Garispanduan JPS 1/97-Guidelines on Coastal Erosion Control for Development Projects In the Coastal Zone*.
3. Department of Environment. 1998. *Malaysia Environmental Quality Report 1997*.
4. Economic Planning Unit. 1999. *Integrated Coastal Zone Management – Status Paper..*

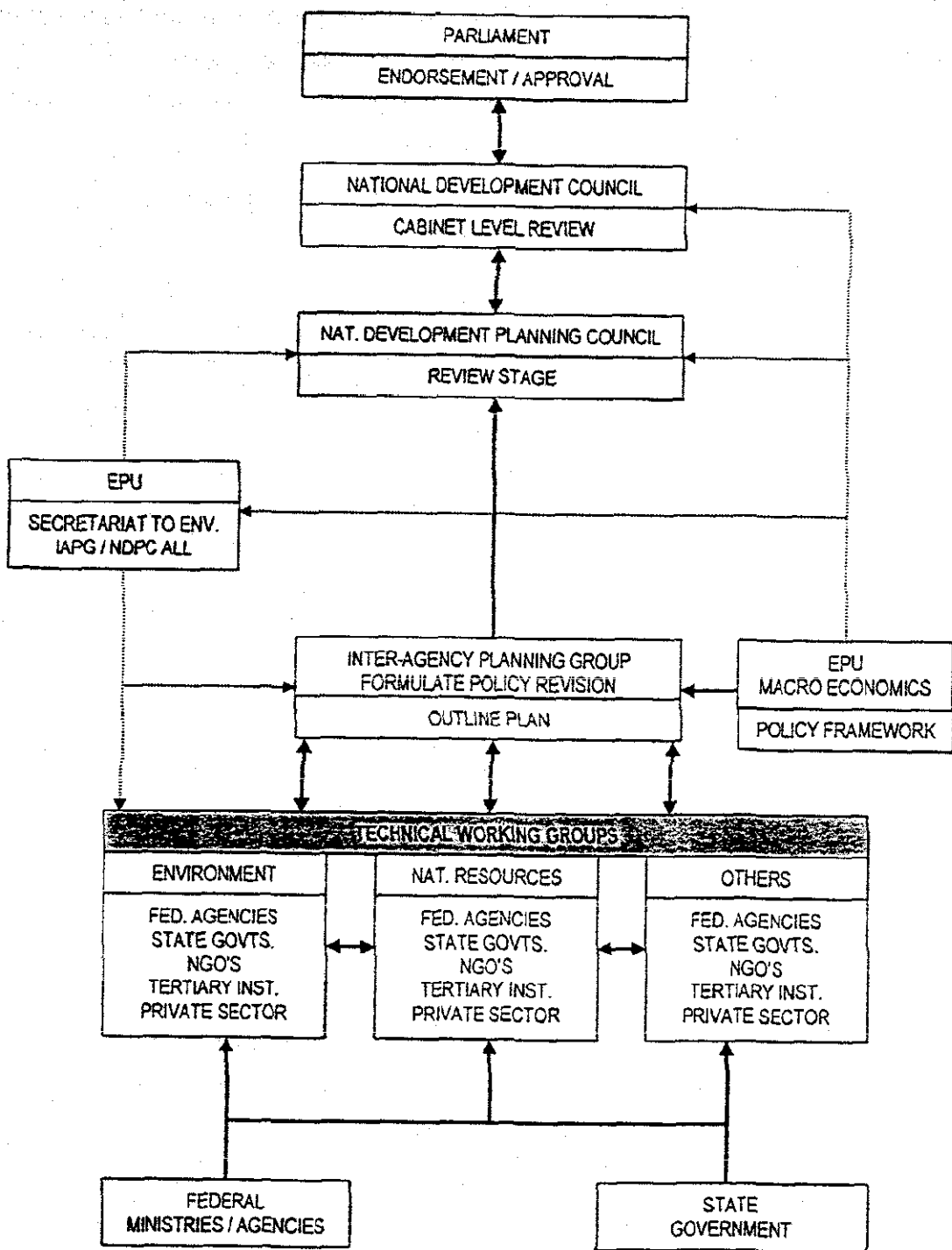


Fig. 1 – Development Planning Process In Malaysia

Source : *Integrated Coastal Zone Management – Status Paper*  
Economic Planning Unit

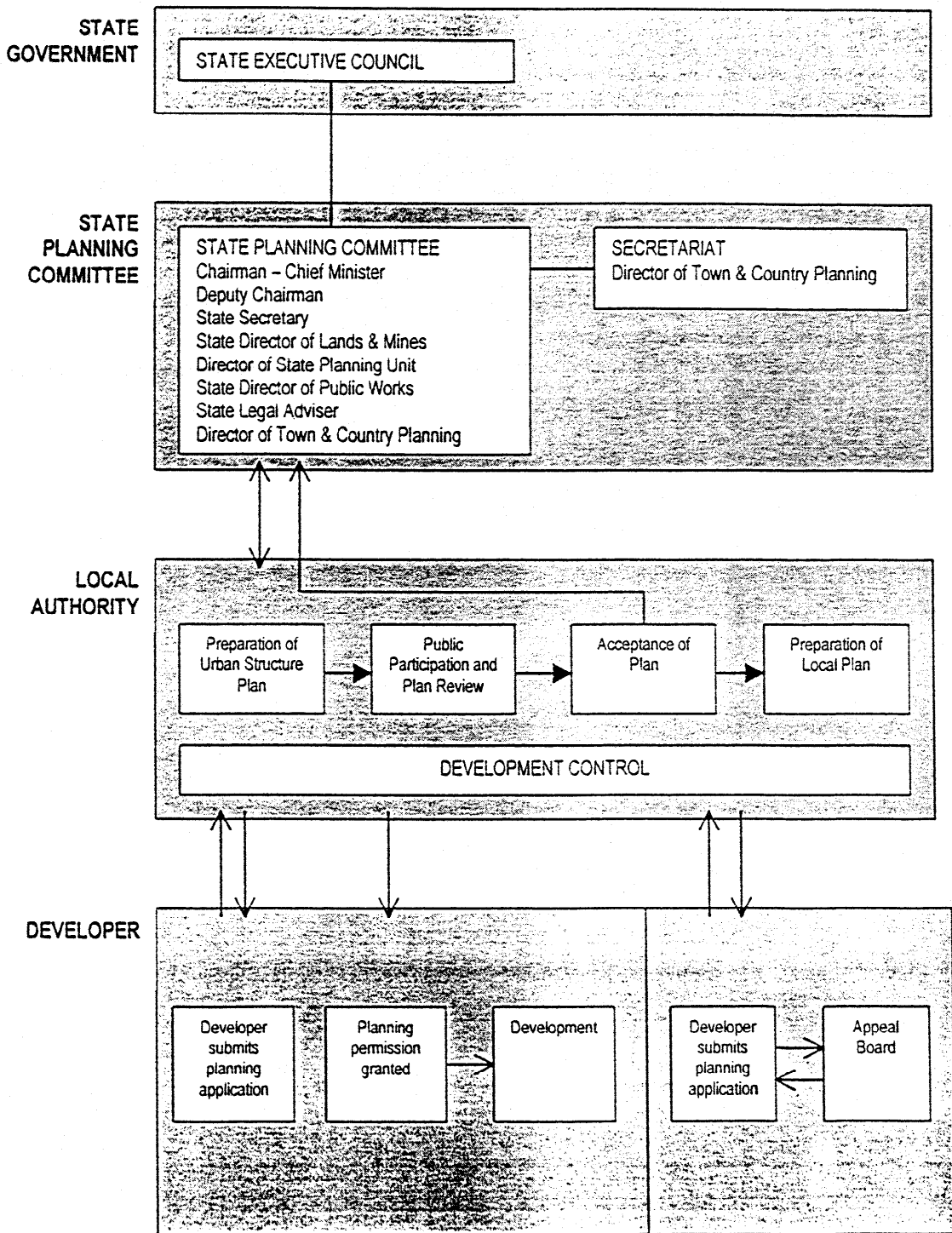


Fig. 2 – Outline of Planning Procedure Under the Town and Country Planning Act, 1976

Source : Integrated Coastal Zone Management – Status Paper  
Economic Planning Unit

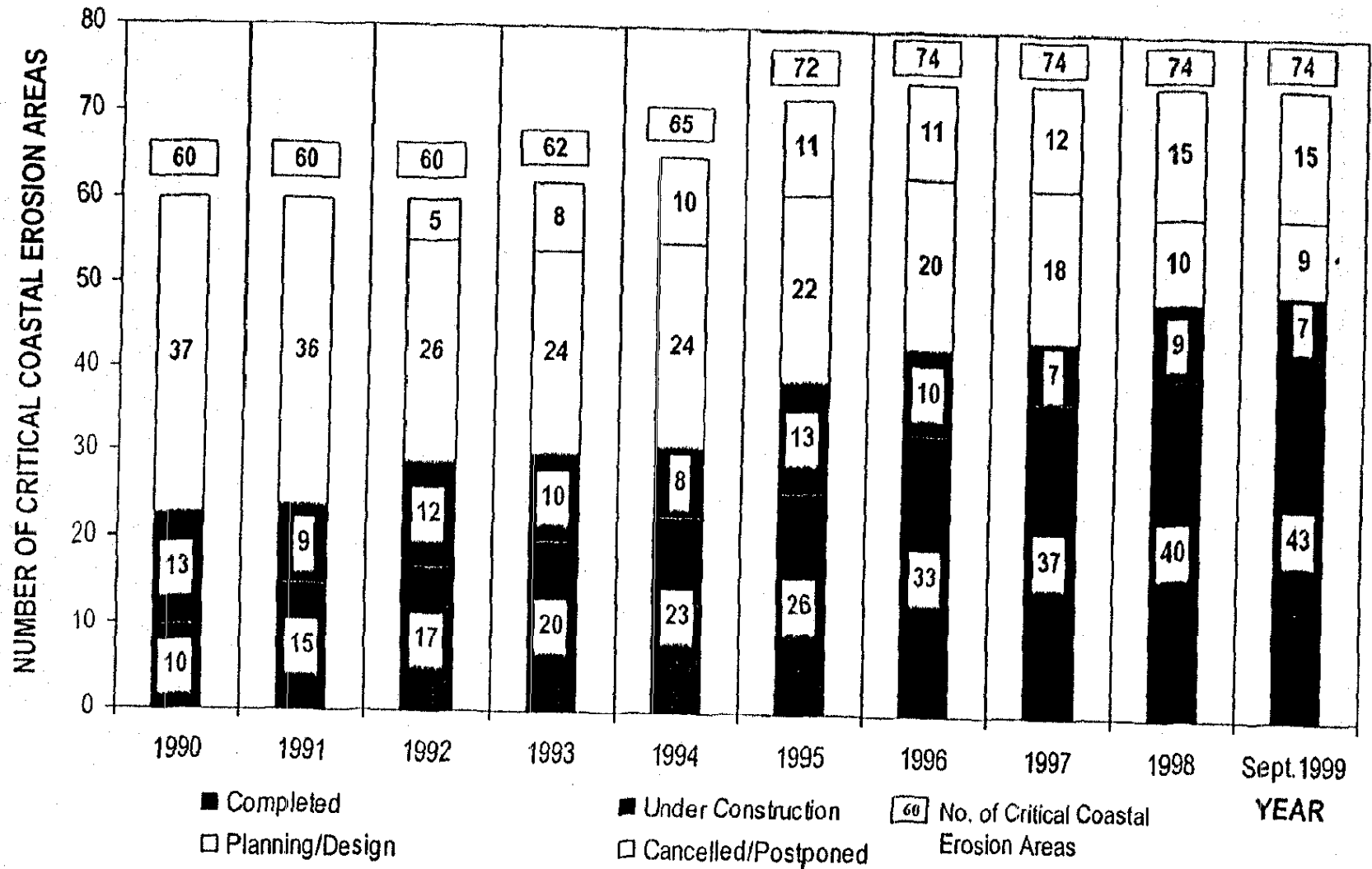


Fig. 3 - Status in Implementing Coastal Erosion Control Works in Critical Erosion Areas Since 1990

Source : Internal Document, DID Malaysia

**TABLE 1****GOVERNMENT AGENCIES INVOLVED IN  
COASTAL ZONE MANAGEMENT IN MALAYSIA**

| Agency  | Objectives and Functions  |
|---|---|
| Prime Minister's Department   | Plan, formulate and coordinate all matters pertaining to the implementation of national policies.   |
| Economic Planning Unit, Prime Minister's Department                               | Formulate policies, strategies and programs for short and long-term economic development of the nation.   |
| Implementation and Coordination Unit, Prime Minister's Department                 | Monitor and coordinate implementation of development programs and projects in ensuring the achievement of objectives of national development policies   |
| State Economic Planning Unit  | Formulate policies, strategies and programs for short and long-term economic development of the respective states   |
| Department of Town and Country Planning, Ministry of Housing and Local Government | Administers and enforces the Town and Country Planning Act 1976 to ensure that Development Plans form the basis for planning and control of use and development of land   |
| Department of Irrigation and Drainage, Ministry of Agriculture                    | Provide infrastructures and services in irrigation, flood mitigation, river conservancy, coastal protection and develop a hydrological database for water resources development   |
| Department of Environment, Ministry of Science, Technology and the Environment    | Enhance and improve the quality of the environment, to balance the goals of economic development and environmental control for sustainable utilisation of natural resources. It administers and enforces the Environmental Quality Act 1974 and assesses EIA reports for prescribed activities. |
| Ministry of Transport   | Plan and formulate transportation policies to provide for development and implementation of an efficient, safe and integrated transational system   |
| Department of Fisheries, Ministry of Agriculture                                  | Increase food production to meet domestic and export demands, to sustain production levels of inshore fisheries and expand deep-sea fishing, accelerate growth of aquaculture and increase value of fishery products. It manage gazetted marine parks in Peninsular Malaysia                    |

|  |  |
|--|--|
| Department of Forestry, Ministry of Primary Industries                                     | Manage the forest resources sustainably for the continuous production of forest goods and services and their optimum utilisation, compatible with environmental requirements   |
| Department of Agriculture, Ministry of Agriculture   | Increase farm productivity through effective transfer of technology and research, involve farmers in technology use and increase contribution of agriculture sector to the economy   |
| Department of Minerals and Geosciences Malaysia, Ministry of Primary Industries            | Encourage optimum development of the mining industries and carry out geological survey activities  |
| Public Works Department, Ministry of Public Works  | Develop the infrastructure and public utilities such as roads, water supplies, buildings, airports, ports and jetties to meet the needs of the nation  |
| Department of Wildlife and National Parks, Ministry of Science, Technology and Environment | Conserve wildlife species with the goal of fulfilling the needs and interests of the people, create and manage National Parks, Wildlife Reserves and Sanctuaries   |
| Ministry of Culture, Arts and Tourism  | Develop and promote the national culture; develop and promote tourism as a major industry in the country.  |
| Department of Veterinary Services, Ministry of Agriculture                                 | Develop the livestock industry, and all aspects of animal and veterinary public health   |
| Marine Department, Ministry of Transport   | Establish an organised and safe sea communication system   |
| Land and Mines Department, Ministry of Land and Cooperative Development                    | Formulate laws and land policies and develop human resources in land administration geared towards achieving the objectives of the National Development Policy   |
| Malaysian Industrial Development Authority, Ministry of International Trade and Industry   | Promote and coordinate industrial development. It administers manufacturing license under the Industrial Coordination Act 1986.  |
| Department of Housing and Local Government, Ministry of Housing and Local Government       | Help set up local authorities which can render efficient and modern urban services and also to provide public amenities and recreational facilities.   |
| Local Authorities – City Council, Municipal Council and District Council                   | Perform local government functions namely provision of urban services, collection of assessment tax, licensing, financial management and enforcement. The Town and Country Planning Act 1976, the Street, Drainage and Building Act 1974 empower local authorities as local planning, control and development agencies |

**TABLE 2**  
**DISTRIBUTION OF COASTAL EROSION AREAS IN MALAYSIA**

| State        | Length of<br>coastline<br><br>(km) | Category<br>1<br><br>(km) | Category 2<br><br>(km) | Category 3<br><br>(km) | Total length of eroding<br>coastline |             |
|--------------|------------------------------------|---------------------------|------------------------|------------------------|--------------------------------------|-------------|
|              |                                    |                           |                        |                        | (km)                                 | (%)         |
| Perlis       | 20                                 | 4.4                       | 3.5                    | 6.4                    | 14.3                                 | 71.5        |
| Kedah        | 148                                | 22.6                      | 2.6                    | 12.4                   | 37.6                                 | 25.4        |
| Pulau Pinang | 152                                | 36.7                      | 19.1                   | 1.1                    | 56.9                                 | 37.4        |
| Perak        | 230                                | 20.8                      | 26.3                   | 93.1                   | 140.2                                | 61.0        |
| Selangor     | 213                                | 55.3                      | 32.9                   | 66.1                   | 154.3                                | 72.4        |
| N. Sembilan  | 58                                 | 2.0                       | 9.6                    | 12.9                   | 24.5                                 | 42.2        |
| Melaka       | 73                                 | 9.2                       | 22.1                   | 3.0                    | 34.3                                 | 47.0        |
| Johor        | 492                                | 18.8                      | 53.2                   | 165.7                  | 237.7                                | 48.3        |
| Pahang       | 271                                | 9.6                       | 2.8                    | 107.8                  | 120.3                                | 44.4        |
| Terengganu   | 244                                | 20.0                      | 12.8                   | 122.4                  | 155.2                                | 63.6        |
| Kelantan     | 71                                 | 5.0                       | 10.9                   | 37.6                   | 53.5                                 | 75.4        |
| W.P. Labuan  | 59                                 | 0                         | 5.5                    | 25.1                   | 30.6                                 | 51.9        |
| Sarawak      | 1,035                              | 9.0                       | 22.8                   | 13.7                   | 45.5                                 | 4.4         |
| Sabah        | 1,743                              | 12.8                      | 3.5                    | 279.2                  | 295.5                                | 17.0        |
| <b>TOTAL</b> | <b>4.809</b>                       | <b>226.2</b>              | <b>227.6</b>           | <b>946.5</b>           | <b>1,400.3</b>                       | <b>29.1</b> |

**Notes**

Category 1 – Critical Erosion Areas

Category 2 – Significant Erosion Areas

Category 3 – Acceptable Erosion areas

*Source : DID – Internal Documents*



**TABLE 3**  
**DISTRIBUTION OF MANGROVE RESERVES AND**  
**STATE LAND COVERED WITH MANGROVES IN MALAYSIA**

| State          | Area in Hectares |                                   |         |
|----------------|------------------|-----------------------------------|---------|
|                | Forest Reserves  | State Land Covered With Mangroves | Total   |
| Johor          | 17,029           | 8,050                             | 25,079  |
| Kedah          | 7,949            | -                                 | 7,949   |
| Kelantan       | -                | -                                 | -       |
| Malacca        | 338              | 100                               | 438     |
| Negri Sembilan | 540              | 727                               | 1,267   |
| Pahang         | 2,483            | 6,990                             | 11,473  |
| Penang         | 451              | -                                 | 451     |
| Perak          | 43,502           | -                                 | 43,502  |
| Perlis         | -                | -                                 | -       |
| Selangor       | 15,090-          | -                                 | 15,090  |
| Terengganu     | 1,295            | -                                 | 1,295   |
| Sabah          | 317,423          | 49,927                            | 367,350 |
| Sarawak        | 34,992           | 133,000                           | 167,992 |
| Total          | 441,092          | 200,794                           | 641,886 |

*Source: Coastal Resources Management Policy for Malaysia -  
Forestry Department of Peninsular Malaysia, Sabah and Sarawak*

**TABLE 4**  
**TOTAL FISH LANDINGS, NUMBER OF FISHERMAN AND**  
**FISHING BOATS BY REGION IN MALAYSIA**

| Parameter               | West Coast of Peninsular Malaysia | East Coast of Peninsular Malaysia | Sabah and Sarawak | Total          |
|-------------------------|-----------------------------------|-----------------------------------|-------------------|----------------|
| Total Fish Landings     |                                   |                                   |                   |                |
| - (Tonnes)              |                                   |                                   |                   |                |
| - (% total)             | 510,471<br>53.6                   | 309,432<br>32.5                   | 131,404<br>13.9   | 951,307<br>100 |
| Potential Inshore Yield |                                   |                                   |                   |                |
| - (Tonnes)              | 321,800                           | 266,400                           | Not available     | Not available  |
| Number of Fisherman     |                                   |                                   |                   |                |
| - (Number)              | 39,897                            | 19,904                            | 28,693            | 88,494         |
| - (% total)             | 45.1                              | 22.5                              | 32.4              | 100            |

*Source: Malacca Straits Environment Profile, TWG-1-97.*

TABLE 5

## STATUS OF MARINE WATER QUALITY IN MALAYSIA (1997)

| State        | Parameters Exceeding Interim Standard (%) |                |                        |                |         |         |          |         |      |         |        |
|--------------|---|----------------|------------------------|----------------|---------|---------|----------|---------|------|---------|--------|
|              | No. of stations                           | No. of samples | Total Suspended solids | Oil and grease | E. Coli | Cadmium | Chromium | Mercury | Lead | Arsenic | Copper |
| Pahang       | 17  | 58             | 100                    | 100            | 41.4    | 0       | 0        | 0       | 0    | 0       | 0      |
| Johor        | 42  | 170            | 15.3                   | 98.2           | 35.3    | 0       | 0        | 0       | 0    | 0       | 0      |
| Kedah/Perlis | 24  | 89             | 85.4                   | 83.1           | 1.1     | 0       | 0        | 2.2     | 0    | 0       | 4.5    |
| Kelantan     | 10  | 40             | 65.0                   | 75.0           | 15.0    | 0       | 0        | 0       | 0    | 0       | 2.5    |
| Melaka       | 10  | 17             | 52.9                   | 52.9           | 47.1    | 0       | 0        | 11.8    | 0    | 0       | 0      |
| Pulau Pinang | 25  | 128            | 45.3                   | 41.4           | NA      | 0       | 0        | 0       | 0    | 0       | 0.8    |
| Perak        | 13  | 46             | 78.3                   | 71.7           | 37.0    | 0       | 2.2      | 0       | 4.3  | 0       | 0      |
| Sabah        | 31  | 110            | 18.2                   | 100            | NA      | 0       | 0        | 0       | 0    | 0       | 0      |
| Sarawak      | 17  | 50             | 24.0                   | 100            | 24      | 0       | 0        | 0       | 0    | 0       | 80     |
| Terengganu   | 24  | 50             | 94.0                   | 98.0           | 18.0    | 0       | 0        | 0       | 0    | 0       | 0      |
| N.Sembilan   | 13  | 36             | 88.9                   | 100            | 22.2    | 0       | 0        | 30.6    | 0    | 30.6    | 0      |
| Selangor     | NA  | NA             | NA                     | NA             | NA      | NA      | NA       | NA      | NA   | NA      | NA     |
| Total        | 226                                       | 794            |                        |                |         |         |          |         |      |         |        |
| Average      |   |                | 60.7                   | 83.7           | 21.9    | 0       | 0        | 4.1     | 0.4  | 2.8     | 8.0    |

Notes : NA = Not available

## Marine Interim Standards (Water Quality)

| TSS     | OG     | E-coli           | Cd       | Cr       | Hg         | Pb       | As       | Cu       |
|---------|--------|------------------|----------|----------|------------|----------|----------|----------|
| 50 mg/l | 0 mg/l | 100MPN/<br>100mg | 0.1 mg/l | 0.5 mg/l | 0.001 mg/l | 0.1 mg/l | 0.1 mg/l | 0.1 mg/l |

Source : Malaysia Environmental Quality Report 1997 – Department of Environment.

**TABLE 6**  
**ECONOMIC SIGNIFICANCE OF COASTAL**  
**RESOURCES AND ACTIVITIES IN MALAYSIA**

| Benefits/Revenue              | Value<br>(Ringgit Malaysia) | Economic Significance/ Assumptions   |
|-------------------------------|-----------------------------|--|
| Inshore fisheries             | 600 million/year            | 1.42% of GDP and provides 80,000 employment opportunities  |
| Mangroves and wood products   | 100 million/year            | Firewood, charcoal and poles valued at RM 5,000/hectare  |
| Swiftlet/Bird nests           | 6.8 million/year            | -  |
| Coastal tourism               | 1.5 billion/year            | RM 9 billion expenditure by tourists   |
| Oil and gas                   | 13.6 billion/year           | Derived from offshore areas  |
| Other materials (sand mining) | Not available               |  |
| Trade                         | 200 billion/year            | Sea trade is 90% of total trade value in year 1998.  |
| Ports and shipping            | 3 billion/year              | Transport sector made up 9% of GDP and port and shipping contributes 35% to the transport sector |
| Expenditures/Costs            | Value                       | Economic Significance  |
| Coastal erosion               | 400 million                 | Allocation given since Fifth Malaysian Plan  |
| Household sewerage Treatment  | 150 million/year            | Coastal population estimated to be 2.4 million   |
| Health service cost           | 20 million/year             | Cost of program for avoidance of diarrhea  |
| Coastal and marine pollution  | Not available               | From toxins to BOD from livestock industry   |
| Oil spills                    | Not available               | -  |
| Sedimentation                 | Not available               | Translated into port dredging cost   |

*Source: Integrated Coastal Zone Management Status Paper, EPU 1999*