

Executive Summary

SABAH SHORELINE MANAGEMENT PLAN

Introduction to the SMP and Executive Summary

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- A Maps of Management Units and their Respective Management Strategies



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The consultant team would like to thank the Ministry, the Environment Protection Department and members of the Steering and Technical committees for their valuable input and guidance.

In addition to primary surveys, a study of such a large geographical and topical coverage as a state wide SMP relies heavily upon access to secondary data within a large variety of fields, and the study would not have been possible to the level of detail obtained without the cooperation and input from a large number of primarily government agencies and individuals.

The consultant team would like to express our sincere appreciation for all inputs and feedback provided.



1 DOCUMENTATION LAYOUT

1.1 Overview

The Shoreline Management Plan (SMP) documentation constitutes the main output from a study conducted over the past 1½ years under the purview of the Environment Protection Department and the Ministry of Tourism, Culture and Environment.

The documentation is extensive. It represents a large body of data collection, studies, analyses, discussions and recommendations for a vast number of aspects relating to shoreline management in Sabah. The basic structure of the documentation is shown in Figure 1.1.

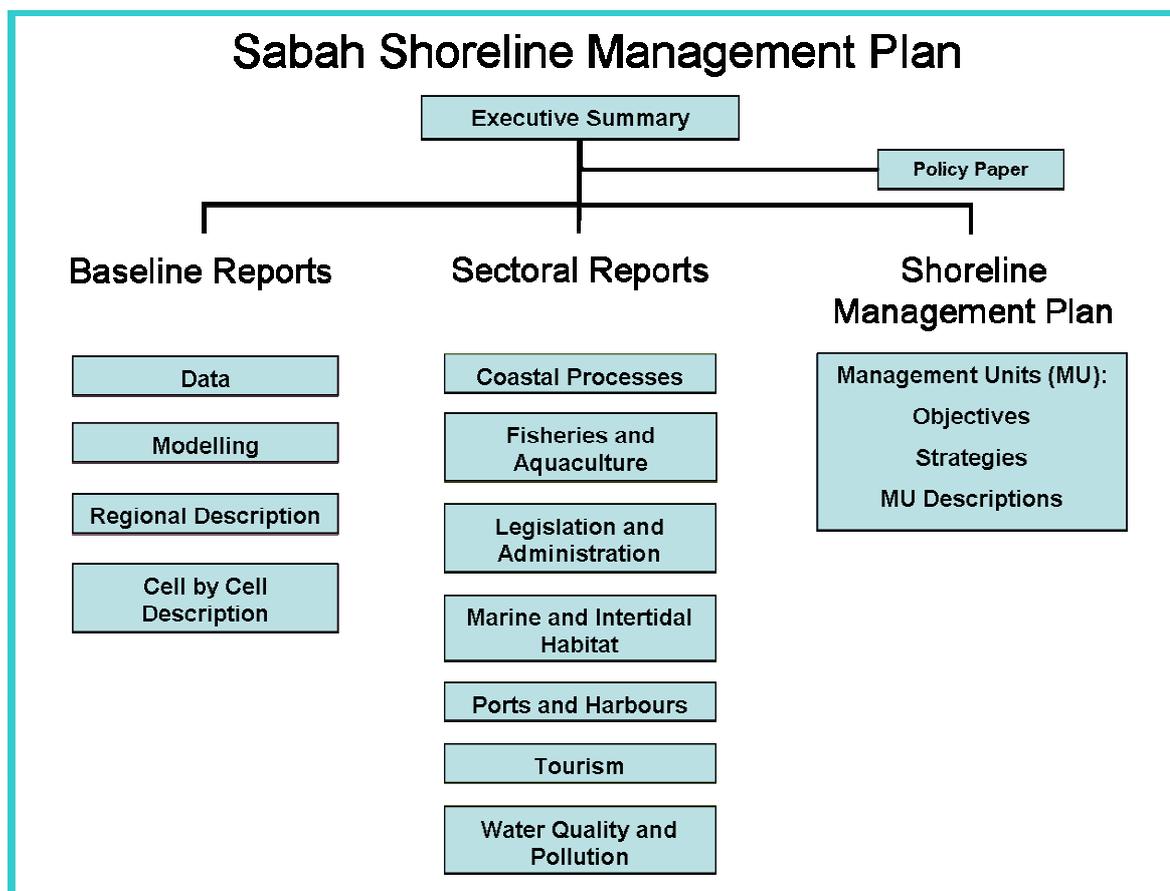


Figure 1.1 Documentation Layout

1.2 How to Navigate

Due to the vast size of the documentation, there are several separate hardcopy reports. To navigate, each individual hardcopy has a print of the documentation layout (Figure 1.1) as the first page. For each documentation layout, the relevant report location is highlighted.



1.3 Executive Summary



This is the Executive Summary; unless specifically guided to a particular component or report, this represents the first entry to the documentation.

1.4 Baseline Reports

The Baseline Reports document the baseline findings of the study. This forms the basis from which the rest of the study could proceed. The reports consist of:



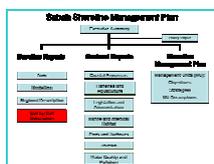
- **Data Report:** The Data Report lists the data sources identified and utilised under the present study, the details of the primary and secondary data sourcing, set up of the geographical information system and the actual data sets where relevant.



- **Modelling Report:** The Modelling Report documents the technicalities of all numerical modelling activities such that the readers of the baseline report need only to concern themselves with the environmental conditions rather than the technicalities of defining these conditions.



- **Regional Description:** The Regional Description describes the existing physical, ecological and human environment along Sabah’s Coastline as at end 2004. This provides an overview of the various sectors, such as fisheries, marine ecology, etc. on a regional, i.e. state wide, basis. This information is referenced and discussed in the Sectoral Reports.



- **Cell by Cell Description:** As can be imagined, Sabah is an extensive and complex study area and a large amount and variety of data exists. While the Regional Description provides an overview, the Cell by Cell¹ Description provides a more detailed description of each defined main coastal cell, with detailed, locally relevant descriptions and assessments of the coastline of Sabah. It represents a collation of observations, data collation and analyses, numerical modelling and photographic evidence for every stretch of the coast.

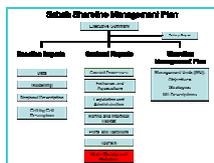
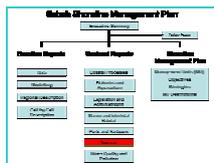
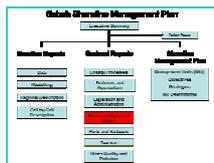
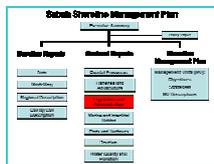
1.5 Sectoral Reports

Using the information contained in the Baseline Reports, a series of Sectoral Reports were prepared. Each Sectoral Report discusses a separate issue (or sector) of importance to the management of Sabah’s coastal resources:



- **Coastal Processes:** A key report that describes the underlying coastal processes shaping Sabah’s coastline, and which play a fundamental role in the selection of appropriate management strategies.

¹ The coastline of Sabah has been subdivided into 30 cells, based upon consistent sediment transport and morphological characteristics. It represents a middle tier of categorisation (the first tier is the entire coastline and the third is the Management Units).



- **Fisheries and Aquaculture:** A discussion on the state of the fishing industry in Sabah, with particular focus on aquaculture development and the site selection process. Aquaculture is highlighted as an alternative to the stagnate fishing industry.
- **Legislation and Administration:** A discussion on the existing legislation and administrative arrangements on federal, state and local levels that have influence upon planning and management in coastal regions of Sabah. Recommendations for improvement to the existing legislations and administrative structures are provided.
- **Marine and Intertidal Habitats:** A discussion of Sabah’s marine and intertidal habitats, which includes coral reefs and mangrove forests. These habitats are a fundamental part of Sabah’s coasts, and have relevance in many aspects of shoreline management.
- **Ports and Harbours:** This report discusses development potential and constraints of ports and harbours along the coastline of Sabah. It documents the legal framework that governs the development of ports and the physical and environmental factors that need to be considered in the planning and implementation processes.
- **Tourism:** This report discusses the rapidly expanding tourism industry in Sabah, including an overview of existing trends, attractions and issues. Strategic directions for future planning and management are also included.
- **Water Quality and Pollution:** This report investigates aspects relating to land based pollution loads and the subsequent consequences on coastal water quality in Sabah. Key issues are raised, and recommendations provided to mitigate pollution and improve coastal water quality.

1.6 Shoreline Management Plan

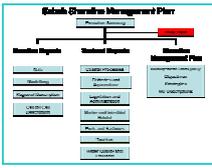
The Shoreline Management Plan is the main document. It zones the coastline into Management Units (MUs) for which management strategies are defined based on defined management objectives. The contents are:



- **Management Objectives:** The baseline studies highlighted a range of issues critical to the sustainable use of the shoreline through preservation, rehabilitation and development. These are expressed as generic management objectives to be targeted in each Management Unit.
- **Management Strategies:** Two main categories of management strategies are defined; Permitted (A) and Prohibited (B). There are a number of classes under each category, applicable to a selection of development types, land uses and specific environmental conditions.
- **Management Units (MUs):** 30 Cells have been defined, under which are 552 MUs. For each MU there is a site description, followed by preferred management objectives and management strategies. A series of maps are provided to illustrate the spatial distribution of each MU and their recommended management strategies.



1.7 Policy Paper



From a legislative perspective, the SMP has been prepared within the context of the Town and Country Planning Ordinance 1950 (as amended in 2002). The next step towards adoption of the study recommendations as law is the preparation of a Policy Paper. The Paper contains an overview and recommendations.



2 STUDY BACKGROUND

2.1 Introduction

Initially, the Sabah Shoreline Management Plan required the preparation of the East Coast of Sabah Shoreline Management Plan (SMP) and an update of the West Coast Shoreline Management Plan. This is now integrated into the single Sabah Shoreline Management Plan, or SMP.

The SMP study was executed under contract between DHI Water & Environment (Malaysia) Sdn. Bhd. and the Government of the State of Sabah through Environment Protection Department under the purview of the Ministry of Tourism, Culture and Environment.

2.2 Study Area

Sabah has a land area of approximately 74,000 km², inclusive of islands. The coastline is approximately 1,500 km in length; if all coastal features are considered (islands, lagoons, headlands, etc), it is approximately 4,500 km.

Sabah is divided into 24 administrative districts of which only five districts have no land in the coastal zone; Ranau, Tenom, Nabawan, Keningau, and Tambunan (Figure 2.1).

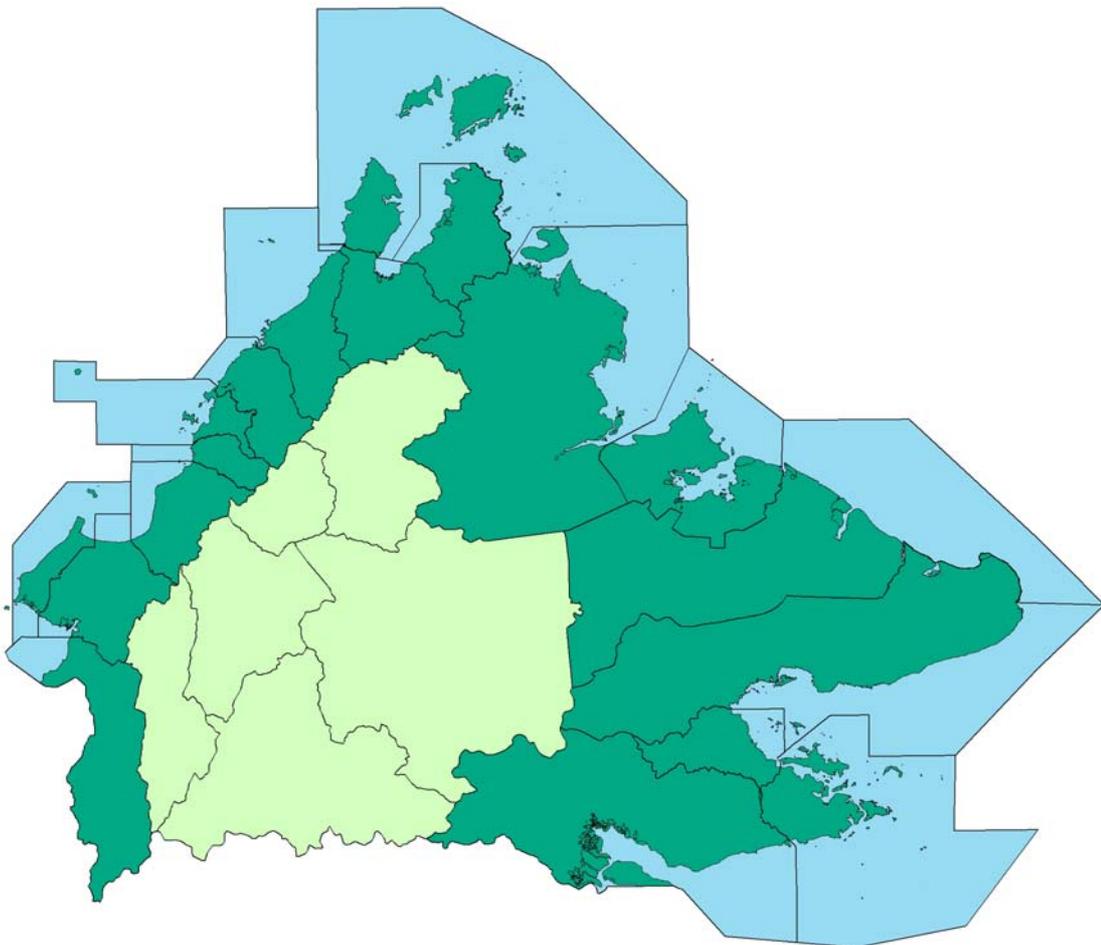


Figure 2.1 Districts of Sabah (light green indicates those districts which have no coastal boundaries).



2.3 Shoreline Definition

The landward coverage is defined as approximately 1 km inshore of the mean high water spring mark, or to the landward limit of the coastal mangrove system. In cases where there is a well-defined coastal road, the landward limit is taken at the coastal road, although the landuse characteristics on the shoreward side of the road will be taken into consideration.

The seaward limit is taken as the limit of the sediment plume excursions from the main rivers, which typically covers the sea out to about 3 nautical miles offshore. In general the seaward limit runs parallel to the coastline. The SMP strategies are mainly for the existing land and nearshore areas, while sea areas are generally not specifically mentioned.

There are numerous offshore islands along Sabah's coastline. In general, these islands have not been specifically covered by primary survey under the SMP unless they are within 2 nautical miles of the shore and are heavily populated, or known to possess important natural resources which are not well documented. These islands have been covered by secondary data and remote sensing only.

2.4 Study Objectives

The overall aim of the SMP study is to generate a Shoreline Management Plan, which establishes a clear framework of strategic guidelines and sustainable policies for effective management of the State's shorelines, which can be put before State Cabinet for approval and subsequent gazetting and implementation under existing legislation in order to:

- Identify areas presently at risk from coastal erosion and/or those areas likely to become endangered by coastal erosion in the future, and prioritise the requirement for coastal protection initiatives based upon the magnitude of the erosion and the environmental benefit resulting from the protection works
- Identify areas presently suffering marine pollution or those areas likely to become polluted in the future and prioritise the requirement for intervention at the pollution source and/or other mitigation or abatement strategies
- Regulate development in the shoreline area to avoid incremental coastal erosion and other negative environmental impacts
- Identify areas of environmental significance that should be protected or otherwise conserved and/or enhanced
- Identify hinterland issues that are causing shoreline impacts and the required steps to control or otherwise mitigate these issues
- To define objectives within the coastal tourism industry by weighing the benefits of developing this sector against other sector planning issues and environmental considerations
- To identify areas most suitable for future expansion of coastal medium and heavy industry in terms of marine access (ports and jetties) and coastal processes, taking into account relevant hinterland planning issues.

The study, which covers the entire coastline of Sabah, is regional in nature. The objective is therefore to concentrate upon coherent regional strategies and policies rather than specific detailed local management options.

The SMP accounts for the general policies of sustainable development; including integrated management of coastal resources, optimisation of development potential,



providing for the socio-economic welfare of the existing and future population, and environmental conservation and preservation. In order to accomplish this, the SMP has identified specific management objectives for the four main environmental sectors:

- Physical/Chemical
- Biological/Ecological
- Socio-Cultural
- Economic

Based upon these sectoral objectives, the coastal area is divided into Management Units (MUs); defined as sections of coast with consistent sectoral characteristics for which a number of appropriate management strategies can be identified. As the study adopts an integrated approach to shoreline management, strategies for hinterland use that are consistent with and supportive of the shoreline management units are also proposed.

2.5 Terms of Reference

In response to the request and specifications received from ECD², technical and financial proposals for the preparation of the Shoreline Management Plan for the East Coast of Sabah and the updating of the Shoreline Management Plan for the West Coast of Sabah were submitted in September 2002.

The proposal was based on the Terms of Reference provided by ECD, in addition to DHI's extensive experience in Shoreline Management Planning gained from:

- The West Coast of Sabah Shoreline Management Plan carried out for the Sabah State Government between 1997 and 1998.
- The North Pahang Shoreline Management Plan carried out for the Federal government between April 2000 and end 2002.

At the Federal level, Shoreline Management falls under the jurisdiction of Jabatan Pengairan dan Saliran (JPS) who has, over the course of the North Pahang Shoreline Management Plan, established guidelines for the execution of SMPs in Malaysia. The present proposal is consistent with the JPS methodology adopted for North Pahang.

To provide the maximum quality of deliverables for the SMP, certain tasks were added to the base requirements of the TOR. In particular:

- Additional public participation
- Oblique aerial surveys

Official Contract agreement between DHI and ECD, now EPD, was finalised on 15th September 2003.

2.6 Study Framework

The study was divided into three main phases.

- Phase I – Inception Phase: A familiarisation phase, to identify particular shoreline issues which require focus during the subsequent phases of the study. From this, the subsequent work plan was detailed.

² Jabatan Konservasi Alam Sekitar (ECD), 11th September 2002, reference: JKAS(S)/PK/100-44/7 Klt.3(28).



- Phase IIA – Baseline Study: A description of existing conditions in the coastal zone of the project area, based on existing data, field surveys and numerical modelling, used as reference for the analysis and formulation of the SMP.
- Phase IIB – Identification of Management Objectives: From the Baseline Study, the establishment of management objectives which address the socio-cultural and economic considerations and the physical and biological environment.
- Phase IIC – Preparation of SMP: The identification of Management Units (MUs), defined as stretches of shoreline with coherent characteristics in terms of natural coastal, morphological, biological, land use, and socio/cultural conditions.
- Phase III – Implementation and Updating of Plan: Following feedback from the Technical and Steering Committees, government and district workshops, specific plans have been drawn up for each Management Unit.



3 EXECUTIVE SUMMARY

3.1 Baseline Study

Topics covered in the baseline study are outlined in Table 3.1.

Table 3.1 Overview of topics covered in the baseline study

Place	Physics	Biology	Use	Other
Land	catchment hydrology	terrestrial & mangrove vegetation	oil palm plantations forestry aquaculture infrastructure/utilities industry	socio-economy socio-cultural
Coast	coastal morphology		sand mining	
Sea	Hydrography	marine ecology	fisheries	
All	water quality - salinity - fine sediment	water quality - pollution	waste disposal sewage tourism	legislation and administration selected issues
Comments	baseline processes	baseline environment	sustainable dev. economical dev.	perception feasibility

3.1.1 Catchment Hydrology

Water quality in coastal waters depends heavily upon the quantities of fine sediment and pollutants being discharged from land. Pollution loads from land depend on the nature and extent of industry, population and agriculture present in each catchment, and also on the distance from the coastline and runoff quantity. For sediment, the generation of soil erosion is governed by soil type, terrain and land use, while the amount transported to the coastline is governed by runoff quantity and distance. The presence of rivers and other flow paths influence the transport efficiency to the coasts.

Using existing data and numerical modelling, the catchment hydrology of Sabah has been described, including quantitative aspects (how much water) and qualitative (pollution in the water).

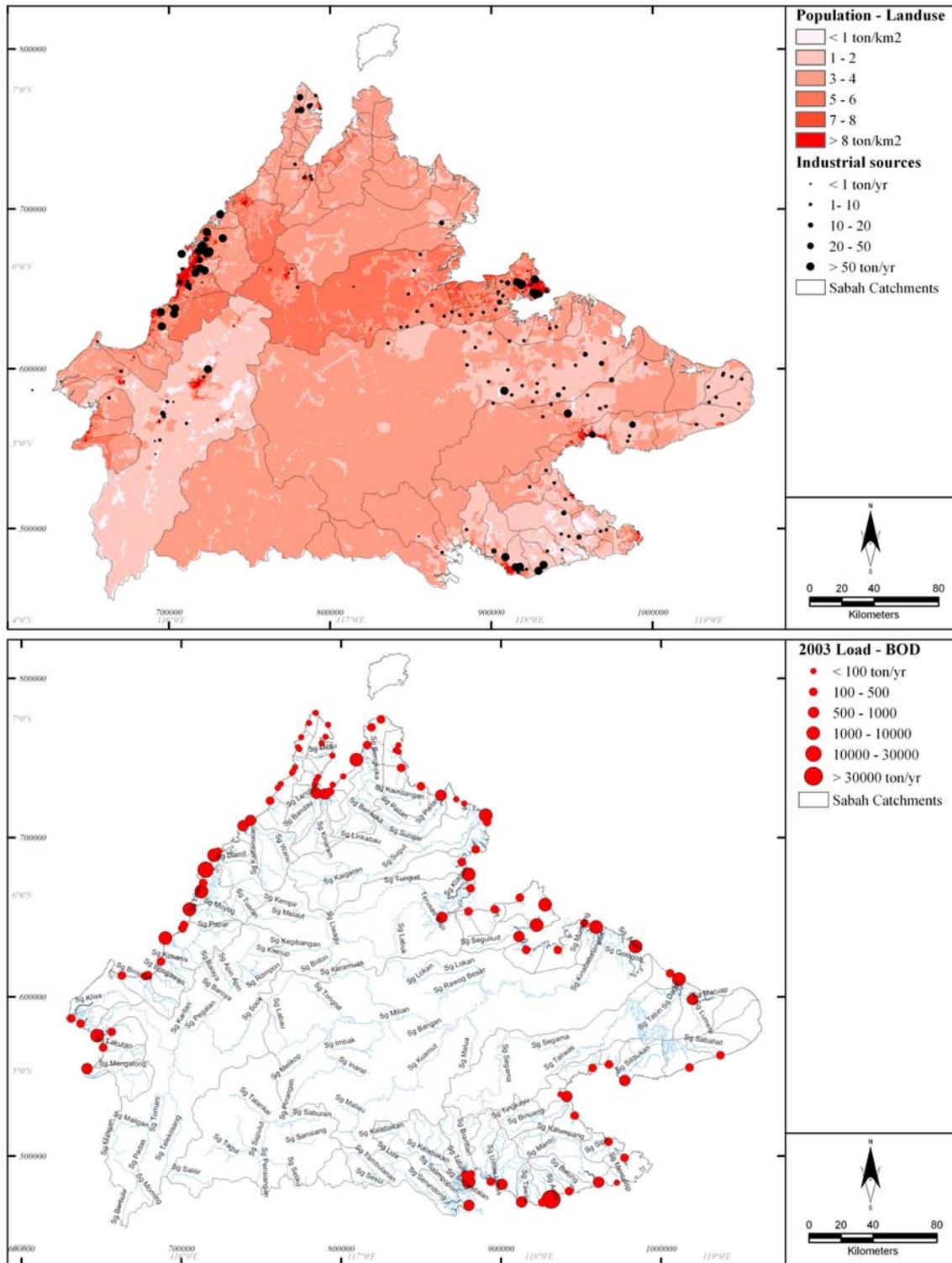


Figure 3.1 Identification of pollution generation of BOD in the catchments (top), and the resulting sources discharging into the coastal waters (bottom), generated from data and catchment modelling

3.1.2 Coastal Hydraulics

Sabah is bordered by the South China, Sulu and Celebes Seas, see Figure 3.2. The driving forces of the dynamics in the South China, Sulu and Celebes Sea are bathymetry, oceanographic conditions at borders (e.g. tides), hydrology of the adjacent watershed (e.g. river discharge) and meteorological conditions (e.g. wind).

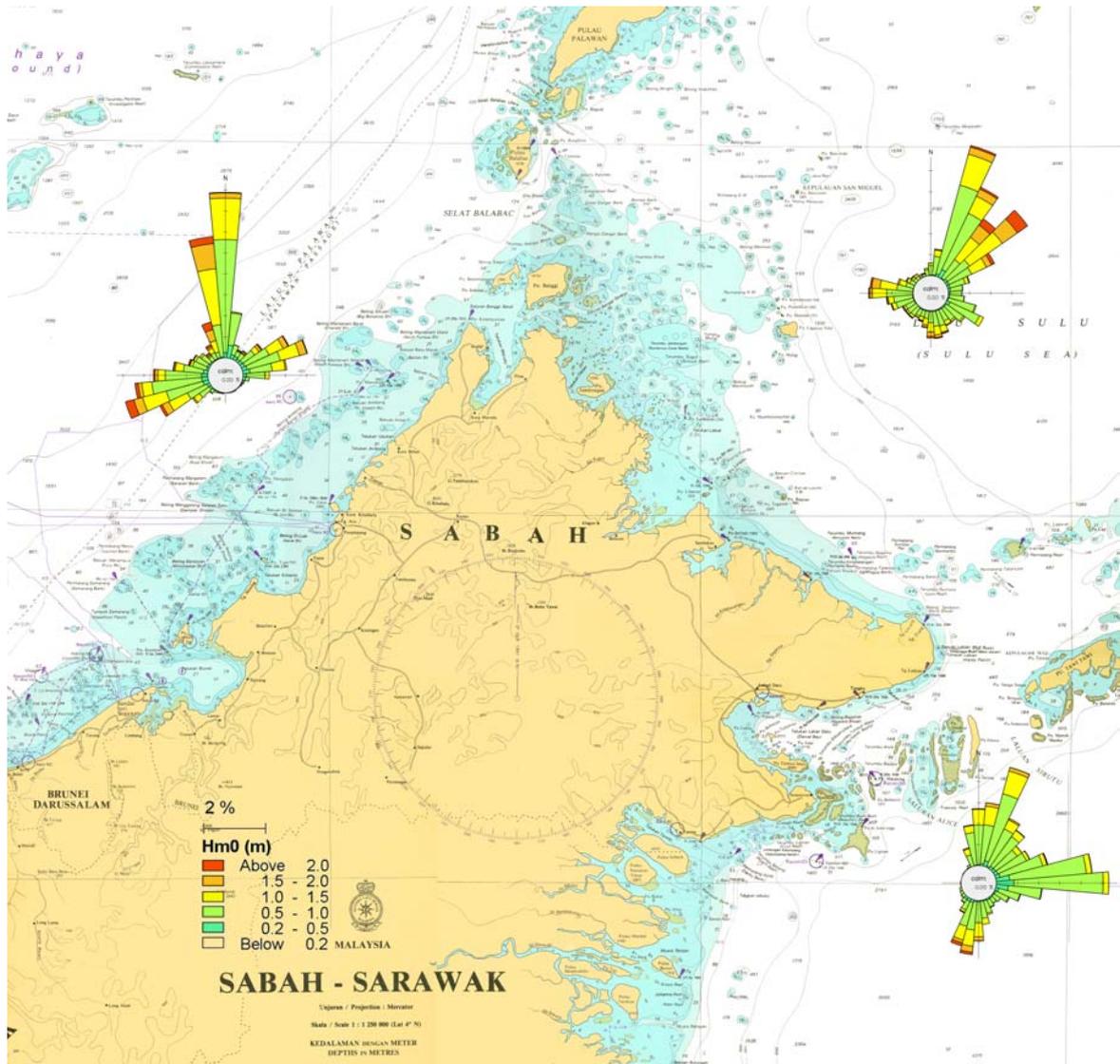


Figure 3.2 Overview of bathymetry and wave climate surrounding Sabah.

The dominating water level variations along the shorelines of Sabah are due to the astronomical tides propagating from the Pacific Ocean into the South China, Sulu and Celebes Sea (typhoons and tsunamis are rare events). Diurnal (daily) tides dominate in the South China Sea and the Sulu Sea, while semi-diurnal (twice daily) tides dominate in the Celebes Sea. Large water level differences between the Sulu and Celebes Sea create locally strong currents.

The northeast monsoon wind causes a wind set-up in the South China Sea and an anti-clockwise circulation tendency. The southwest monsoon causes a clockwise circulation tendency. Wind relaxation generates stronger currents compared to seasonal wind fields. The coastal currents close to land are significantly influenced by local winds. On a much more local scale, wave generated currents within the breaker zone are generated along coastlines exposed to waves.

Representative offshore wave conditions are illustrated as wave roses in Figure 3.2. For the west coast of Sabah, the monsoon generated waves in the offshore regions to a large extent run parallel to the coastline and have to travel across the offshore Sunken Barrier Shoals and refract in the order of 90° to reach the coastline. In doing so, the waves lose a large



proportion of their energy, resulting in a relatively mild wave climate along the west coast of Sabah.

The wave exposure along the east coast is somewhat similar to conditions along the west coast. At the northern part of the east coast, which is facing the Sulu Sea, the shoreline is sheltered against offshore waves due to the many reefs and islands present off the coast, and much of the shoreline is in fact a low impact coastline fringed with mangroves. Further to the south in the Kinabatangan area, the wave exposure increases.

3.1.3 Water Quality

The water quality conditions along the coastline of Sabah are forced by catchment runoff and hydrodynamics (the motion of water).

- Runoff from land (catchment hydrology) transports suspended sediment, nutrients, pollutants and fresh water, and is the prime forcing of water quality conditions along Sabah's coastline. The transport depends heavily on land use in the catchment area and, more specifically, changes in land use.
- After land-based runoff, hydrodynamic conditions (hydrography) are the second most important forcing of water quality conditions along the coast. The hydrodynamics govern the mixing of runoff water with the ambient sea water. In a semi-enclosed bay or estuary the water exchange or mixing rate can be slow (long flushing times), while along an open straight coastline the water exchange and mixing can be much faster.

Areas such as Brunei Bay, Tawau and Marudu tend to accumulate pollutants, while the waters offshore from Kota Kinabalu, which are better flushed, tend to disperse pollutants faster which minimises the extent and duration of high pollution concentrations.

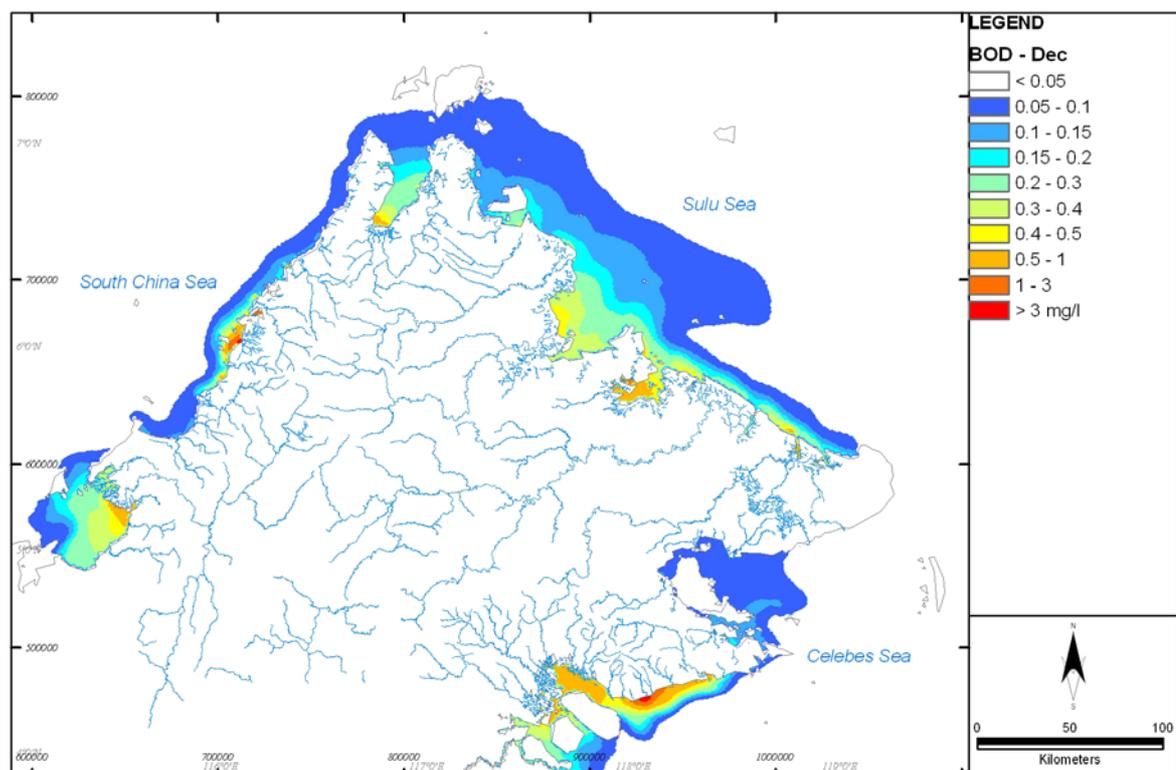


Figure 3.3 Map of simulated BOD concentrations for December 2003 (from model simulations)



3.1.4 Salinity Distribution

Freshwater runoff from the catchments enters the coastal environment at the river mouths and mixes with salt water masses. The extent of low salinity water has a consequence upon the environment and marine habitats; for example mangrove forests are found in shallow brackish water areas.

In any given area, high river discharge and long flushing times result in low salinity conditions, while small river discharge and short flushing times result in high salinity conditions. Areas with the lowest salinity concentrations can also potentially have the worst water quality (although pollution loads do not only depend on the amount of discharge water). The lowest salinities are found along the coastline towards the Sulu Sea, and especially in Marudu, Labuk and Sandakan Bay. Low salinities are also found in Brunei Bay and sometimes in Tawau Bay. These are the locations where the biggest potential for water quality problems exists. Along the open coastline in front of Kota Kinabalu and in Darvel Bay, salinity concentrations are higher. This is due to higher water exchange and limited river inflows.

3.1.5 Suspended sediment

Sediment is eroded from the land surface and carried by river water to the coastline. Upon reaching the coast, the sediment plumes are advected by the currents and dispersed horizontally. The sediment plumes also move vertically; sediment can settle through the water column and deposit onto the bed or be eroded and re-dispersed from the bed up into the water column. Sediment plumes play an important role in limiting the distribution of natural habitats such as coral reefs and seagrass beds.

The largest areas influenced by high suspended sediment concentrations are found in Tawau Bay and the Indonesian bays south of Tawau Bay, Labuk Bay and Kinabatangan Coastline see Figure 3.4. The sediment loads to most of Sabah's coastline has increased due to landuse changes, mainly related to logging and large scale land conversion for oil palm plantations. Along much of the coastline facing the Sulu Sea a 5-10 km band is influenced, with a narrower band towards the South China Sea.

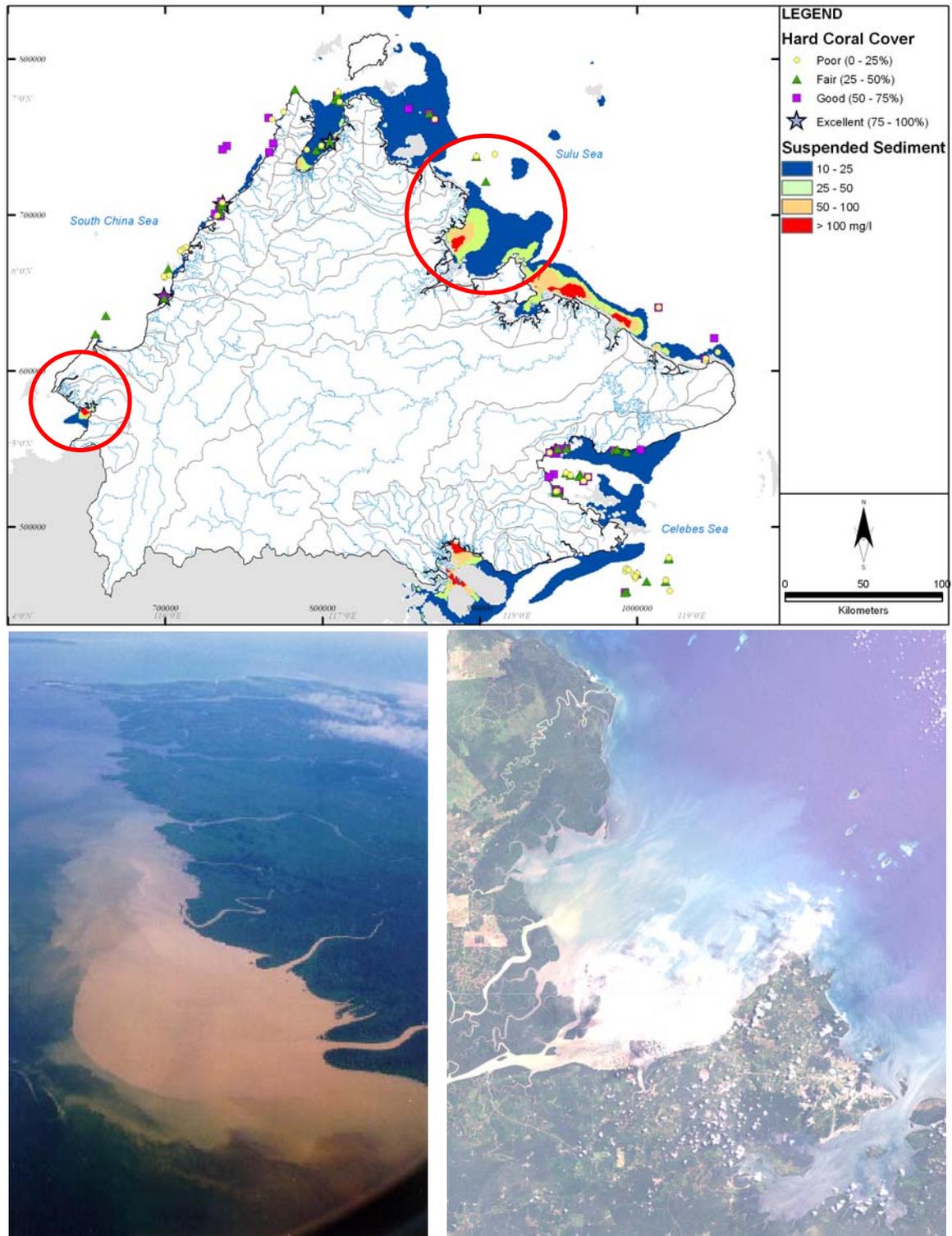


Figure 3.4 Model simulation of mean suspended sediment concentration in mg/l for 2003 (top), showing coral reef locations and their quality (note that other un-surveyed reefs exist that are not shown on this map). Circled areas can be compared to the photographs showing suspended sediment plumes at the entrance of Sg Padas (bottom left) and Sandakan area (bottom right).

3.1.6 Coastal Morphology

Any properly designed coastal project on or along sandy beaches exposed to waves will have to consider the morphological evolution in the area. Some of the relevant concerns may include potential erosion/deposition problems relating to long term stability, potential



morphological impacts of the project on adjacent coastlines/areas, maintaining or creating beaches suitable for recreational purposes and undesirable siltation (e.g. in marinas, navigational channels, etc). Coastal morphology is related to sediment transport, which is mostly driven by waves and currents.

An overall classification of the coastline of Sabah is presented in Figure 3.5. Sandy beaches are mainly found along the west coast. The best quality beaches are found in the northern region, within the district of Kudat. In general, beaches on the east coast are scarce and of poor quality in terms of aesthetics. The best beaches along the east coast are generally found on the offshore islands. There are some narrow intermediate to good, beaches in Lahad Datu District from Tungku and towards the eastern tip of Borneo, many of which are under threat from hinterland development, typically oil palm plantations.

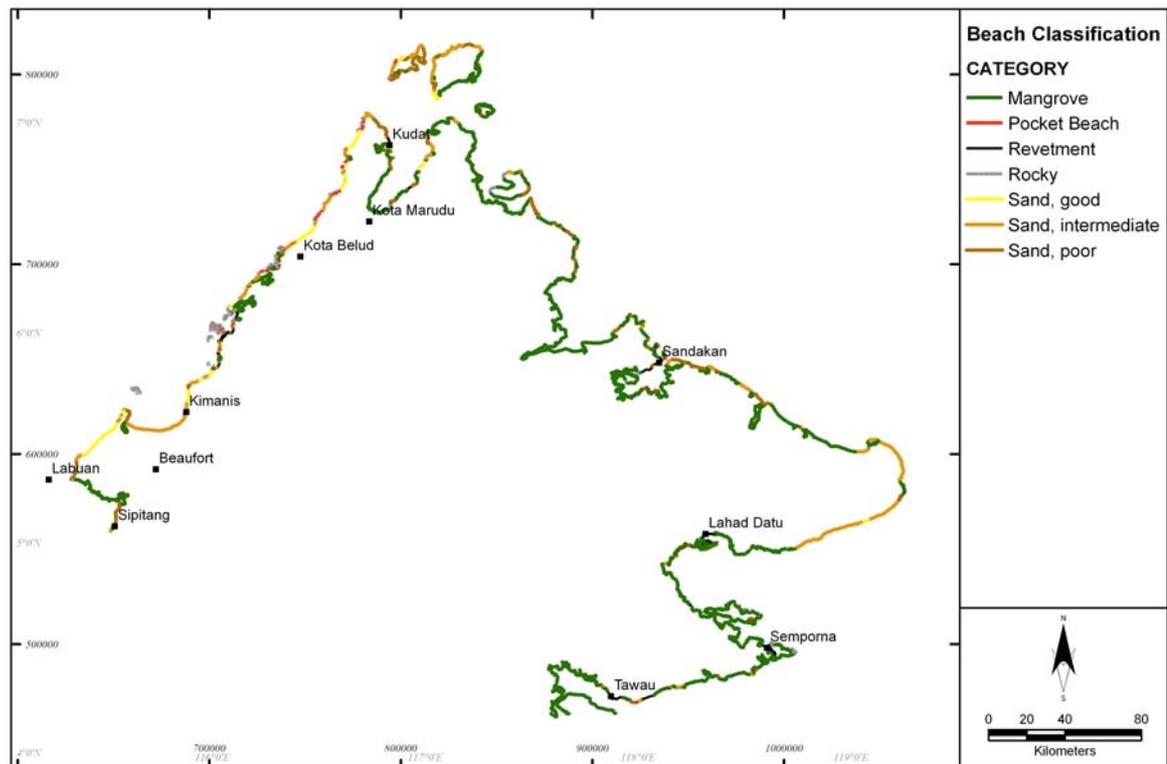


Figure 3.5 Coastline classification.

The main net transport rates along Sabah's West Coast are from northeast towards southwest. Although relatively exposed to waves from the South China Sea, the West Coast is partly protected against waves by the offshore Sunken Barrier Shoals, which run in a string parallel to the coast. The waves also refract considerably to reach the coast during the main northeast and southwest monsoon period. The northeast monsoon waves tend to dominate, which results in the equilibrium beach orientation being directed towards the northwest. Many of the numerous pocket beaches are rotated such that the southerly end approaches this direction.

The littoral transport rate along much of Sabah's East Coast is restricted by the absence of littoral beaches. Most of the shoreline is mangrove fringed and the seabed and beaches may be muddy. There are, however, long sections of coastline (for instance along the Kinabatangan stretch from Sandakan towards the East Tip of Borneo), which is mangrove fringed but where there is also significant transport over the wide tidal flats fronting the coast.



3.1.7 Terrestrial and Mangrove Vegetation

Major habitats around Sabah's coastline include islands and rocky islets, coral formations, rocky coastlines including promontories and headlands, sandy beaches, mudflats and estuaries. Several major biological ecosystems have developed within these habitats, dependent upon, amongst other factors, the particular combinations of physical, chemical and topographic conditions. The coastal vegetation around Sabah includes mangrove and nipah associations, peat swamp forests, lowland forest, rocky and sandy beach vegetation.

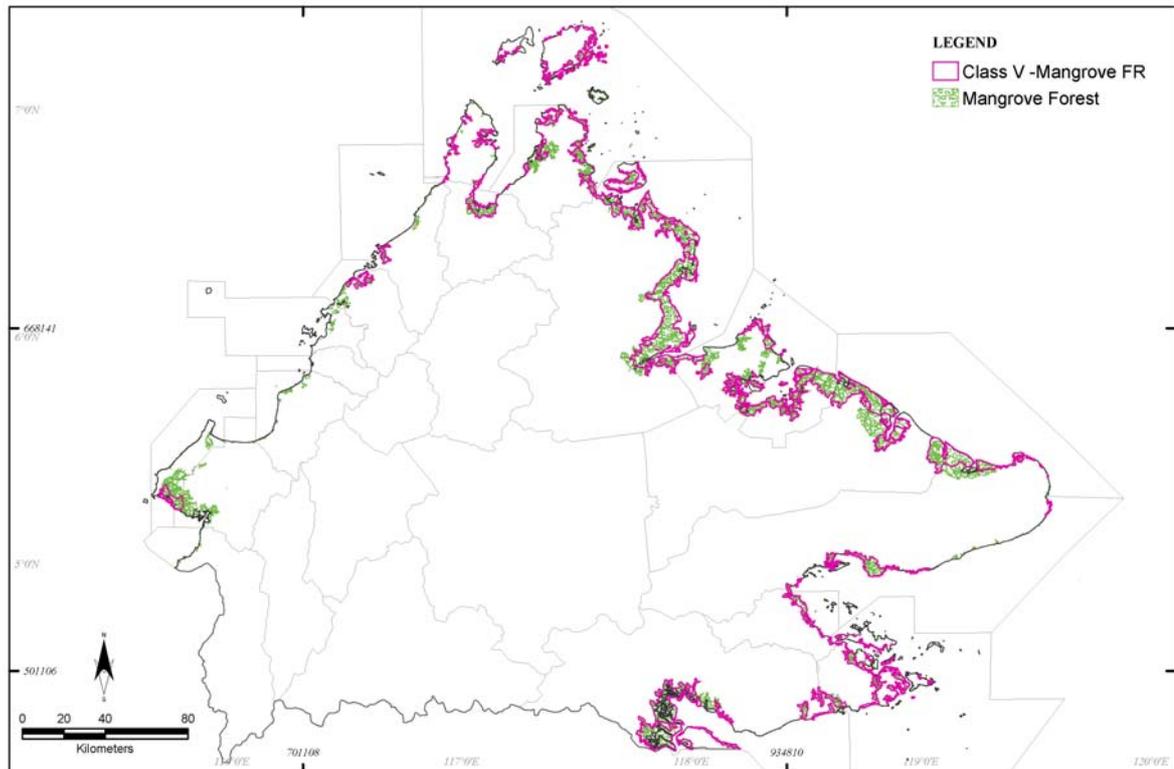


Figure 3.6 Mangrove resources in Sabah

3.1.8 Marine Ecology

The marine habitat is important to fisheries and tourism, both contributing to the state income, and to sustain the resource for coming generations. Both anthropogenic and natural impacts can have a pronounced influence on the distribution of the marine habitats. An ecological and local understanding of the marine habitat guides sound sustainable management of the coastal environment.

Two important marine environments dominate the coastline of Sabah, namely coral reefs and mangrove forests. Often associated with these reefs and mangroves are seagrass beds, which play an equally important role in ecosystem dynamics, but have a less extensive distribution along Sabah's coastline.

Seventy-five percent of all Malaysian reefs are located in the waters around Sabah. The coral reefs in Sabah have been rapidly and adversely impacted by human activities in past decades. In the southeast region, over fishing and fish bombing have degraded many of the reefs, while in the central east region, including Darvel Bay, fish bombing has had an adverse effect. In the north, both fish bombing and cyanide fishing threaten the reefs, particularly within Marudu Bay and north to Banggi and Balambangan islands. Along the



west coast, live coral cover has declined due to fish bombing, sedimentation, and the catastrophic tropical storm Greg in 1996, which affected many of the reefs in the Tunku Abdul Rahman Park.

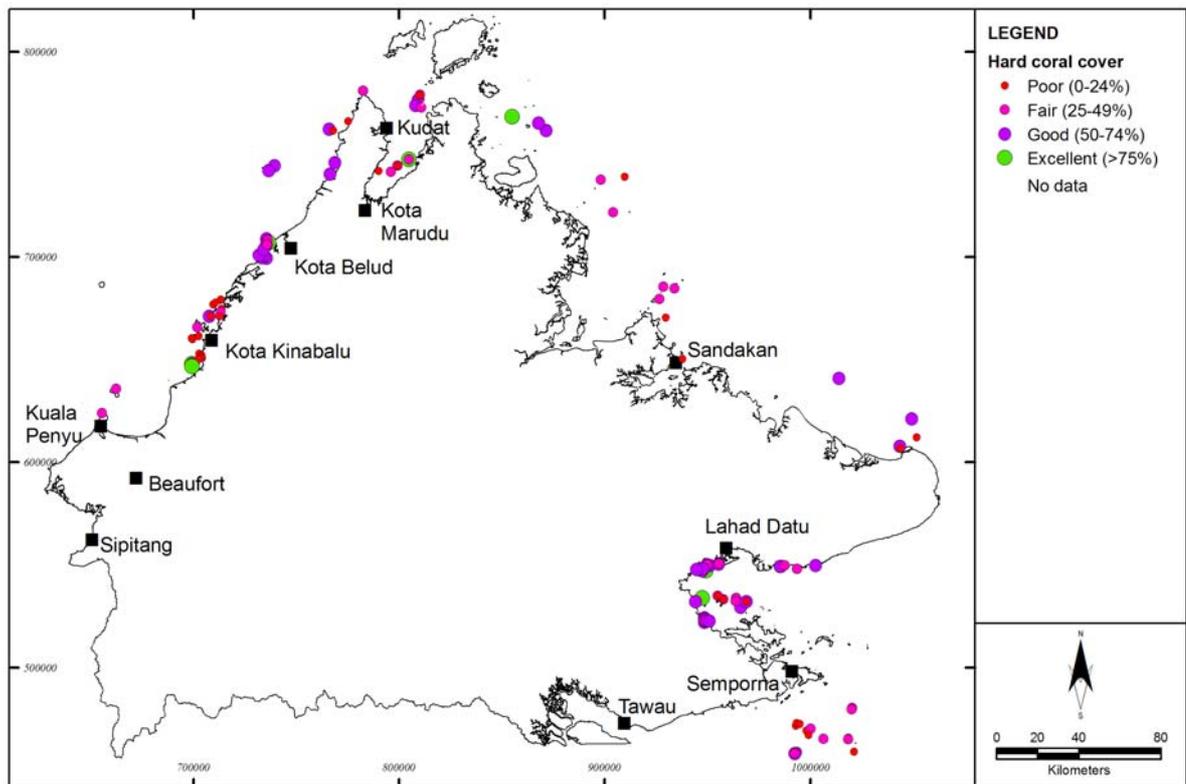


Figure 3.7 Location and quality of reefs around Sabah (for which data is available).

3.1.9 Socio-economic conditions

The major part of the population in Sabah is concentrated in the coastal area exploiting, sometimes overusing and sometimes misusing, the natural resources and polluting the nearshore environment. The coastal population will govern and influence the directions for managing the shoreline.

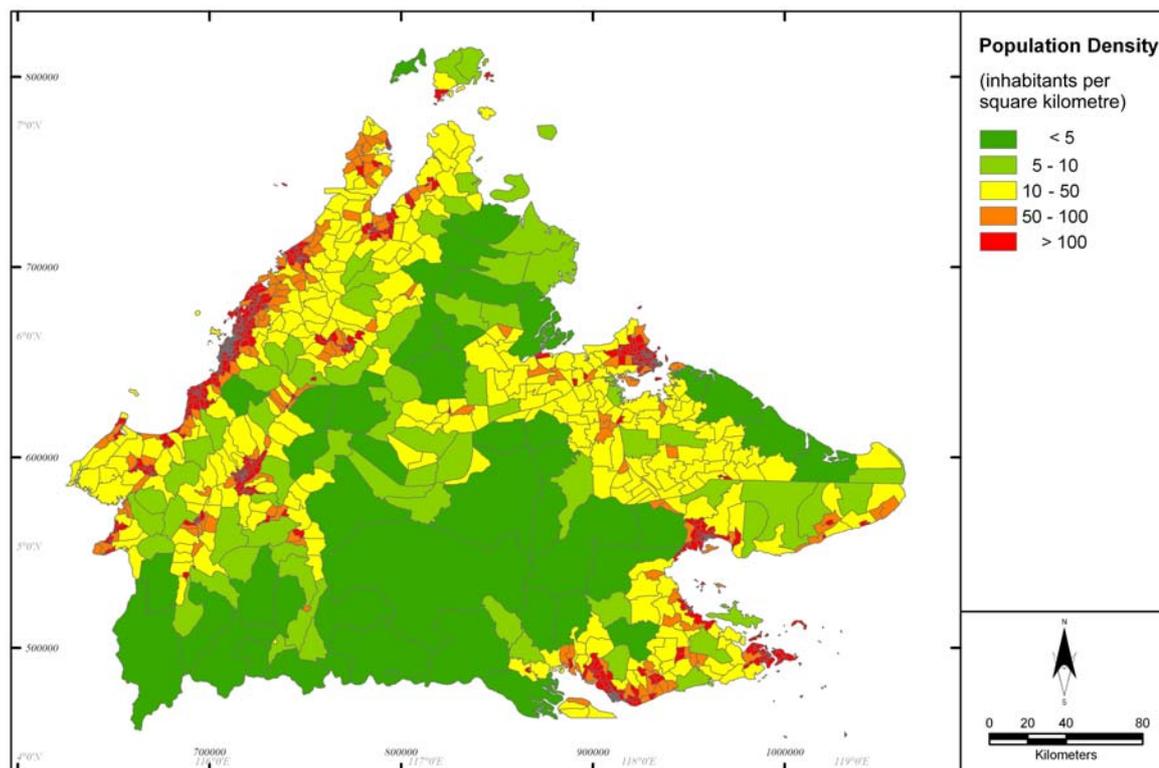


Figure 3.8 Map of Sabah showing population density in coastal areas

3.1.10 Legislation and Administration

There is a comprehensive body of legislation to protect the many components of the environment. The most relevant to the Shoreline Management Plan are:

- Environment Protection Enactment 2002
- Town and Country Planning Ordinance, 1950 (Amended 2002)
- Sabah Water Resources Enactment 1998
- Sabah Fisheries Act 1985 and Sabah Inland Fisheries and Aquaculture Enactment 2003
- Forest Enactment 1968

3.2 Sectoral Reports

3.2.1 Coastal Processes

Proper design of a coastal project needs to consider morphological evolution, including:

- Potential erosion/deposition problems at the site, relating to long term stability.
- Potential morphological impact of the project on the adjacent coastlines/areas.
- Maintaining or creating beaches suitable for recreational purposes.
- Undesirable siltation, e.g. in marinas, navigational channels, etc.

All the above topics are related to sediment transport. An existing stable beach will not always remain stable; many beaches are in a dynamic equilibrium where the sediment out-flux from a certain coastal section is balanced by the influx to the same section. If this balance is disrupted, it is likely to lead to a morphological response with deposition in some areas and erosion in other areas.



Coastal defence options

The loss of land to coastal erosion is always a sensitive issue, particularly when the shoreline is fairly well developed as is part of the Sabah coastline. There is no single solution to coastal erosion, although local effects can be mitigated through structural intervention, or nourishment. However, structural intervention almost inevitably results in an increase in coastal erosion down-drift.

Revetments together with seawalls is the most widely used form of protection along the Sabah coastline. Also observed in some areas was the practice of dumping a string of old tyres along the shoreline; this is not an effective or attractive option and is not recommended. Beach nourishment is recommended for eroding beaches with high recreational value so as to avoid impacts to the beach aesthetic. In Sabah, this has been recommended for Tg. Aru beach in Kota Kinabalu.

Setbacks

Coastal setbacks are measures to direct certain types of development and activities away from the immediate coastline; minimising threats of coastal erosion and flooding within lifetime of development, maintaining a sacrificial buffer for natural erosion, establishing a buffer for agricultural runoff (sediment, nutrients, herbicides, pesticides) into the aquatic environment, habitat protection and maintaining public access to the coast.

The setback width applied in this SMP and a discussion on legislation and enforcement issues is given in Section 3.6 below.

Sand mining

Sand mining can have large effects on the coastal morphology and marine environment if not managed properly, and appropriate guidelines and control measures need to be in place to avoid large negative impacts, including an assessment of the 'carrying capacity' of the river in terms of sand extraction.

EIAs for river sand mining should address the potential coastal impacts in addition to the local riverine impacts. An overall assessment inclusive of cumulative impacts may, however, be beyond the individual EIAs, and it is thus recommended to carry out a more regional impact assessment of river sand mining to estimate the carrying capacity of relevant river systems where river sand mining is taking place or potentially will be carried out in the future.

There are at least two river systems in Sabah, Papar and Tuaran, where the discharge of coarse sediments from the river is vital for the coastal sediment balance, and where the carrying capacity is presently clearly exceeded. It is recommended that detailed modelling of the coastal sediment budget and the river sand transport in Sg. Papar is prioritised, while for Sg. Tuaran, no sand mining should be allowed as long as the coastlines are eroding.

Coastal Reclamation

In the SMP context, coastal reclamation is generally discouraged, but there are some areas where the positive effects are judged to outweigh the potential negative impacts, and where reclamation in a properly planned manner is recommended. These include the KK water front, where minor reclamation works could act to improve the overall streamlining of the water frontage; and Tawau, Sandakan and Lahad Datu town frontages.



The West Coast of Sabah SMP (1999) also included several large-scale cluster reclamation developments. These are discussed in more detail in Section 3.5 below.

3.2.2 Fisheries and Aquaculture

Fish stocks in Sabah are currently in decline, due to:

- poor fishing practices (fish bombing, over fishing, cyanide poisoning, etc)
- mangrove depletion (decreases habitats and breeding grounds)

To manage fisheries sustainably to satisfy the demand from the local and international markets for the long term, specific recommendations are:

1. Undertake a detailed investigation into fisheries in Sabah, including statistics on catch amounts, available stocks, catch effort etc.
2. Enforce fishery law
3. Promote aquaculture

Specific to point 3, aquaculture has good potential in Sabah (which is already recognised). However, poor farming practices result in poor yields and create significant environmental damage. Recommendations in this regard include:

1. All farms (irrespective of size) require EIA approval
2. All farms should pay an annual fee to the Department of Fisheries which can be used to monitor farm environmental effects and to rehabilitate adversely affected areas (in other words getting the aquaculture industry to pay for cleaning up their own mess).
3. Prawn aquaculture is the most common form of aquaculture within Sabah; it is unfortunately also the most polluting. Many farms have significantly reduced yields after a few years due to environmental issues, and often become unviable and close. Specific to prawn aquaculture:
 - Diversification is recommended.
 - Where prawn farming is desired (it is a popular dish), mitigation methods need to be adopted including limiting farm size, fallowing sites, and installing aeration and water treatment devices.
4. An updated Aquaculture Masterplan should be prepared, that investigates site selection and state-wide management of aquaculture. This plan should also include a methodology to promote a suitable aquaculture site selection policy.

3.2.3 Legislation and Administration

Planning of the coastline is important for Sabah. This is a strategic issue because the natural processes (and hence the management recommendations) often extend across district boundaries. The emphasis of the SMP is for planning of the coastline rather than the actual boundary jurisdictions.

The existing legislations and administrative structures, with accompanying powers to carry out effective management and development of the coastline, are adequate in conserving, protecting and enhancing Sabah's coastline. No major changes to the existing legislations or the responsible departments that administer them are recommended. However, what is needed is the implementation of these mechanisms more effectively and efficiently in order to achieve a quality environment through better planning and coastal management. Specific recommendations include:



1. Departmental and Local Authority cooperation
2. Empowerment of Design Standards
3. Streamlining of the legislative framework
4. Streamlining the approvals process for developers
5. A specific policy for Island Development
6. Planning Policy Guidance (PPG) for the SMP
7. Awareness Raising and Public Participation
8. SMP Monitoring and Review
9. Enforcement
10. Review of Fines and Penalties for Offenders
11. Staffing

3.2.4 Marine and Intertidal Habitats

Marine and intertidal habitats are an essential component of our near shore environment because they provide the environmental conditions that many types of marine life need to survive. The loss of coral reef can lead to diversion of the coastline by erosion, which further will destroy the inshore seagrass habitats and further deteriorate the mangrove fringe. Fish, marine mammals and marine reptiles often utilise coral reefs, seagrass beds and mangroves at some stages during their life cycle.

In order to allow for sustainable exploitation of marine and intertidal environment, to ensure continued socio economically important uses of the marine environment and still preserve the rich marine biodiversity, a policy is recommended to integrate coastal management. This should take into account the relationship between land and sea and include multi-sectoral uses.

Marine waters should be zoned according to their permitted uses and conservation resources. Incompatible uses should be restricted or prohibited, and development proposals should ensure that the conservation objectives for that area are achieved. While substantial investments are needed to protect marine resources, the investment will pay off in the long term by providing sustainable employment of, for example, fishermen and creating new jobs in eco-tourism and resource management.

Based on recent satellite image interpretation there is approximately 327,684 ha of mangrove forests within Sabah. According to Department of Forestry data, around 97% of the mangroves are protected. This proportion would appear to fulfil conservation objectives, however, it must be noted that in some cases, the Forestry Department mangrove forest reserves cover non-mangrove areas. Based on DHI's calculations for actual mangrove forest areas under forest reserve, the figure comes up to approximately 88% of the total mangrove area in Sabah.

Further, the protection afforded by the forest reserve designation is called into question when there are obvious instances of encroachment into the forest reserves by pond farmers and squatters, and worse still land alienation (land titles) within the reserve boundaries itself (see Figure 3.9). Based on DHI's calculations, the total amount of titled or alienated land within the mangrove forest reserves is 12,017 ha.

In addition to land alienation within mangrove forest reserves, alienation of land within non-gazetted mangroves is also widespread, covering an estimated 4,158 ha of the total of



38,124 ha of non-gazetted mangroves³. This is a problem with respect to the recommendation to gazette all mangrove areas as Class V Mangrove Forest Reserves.

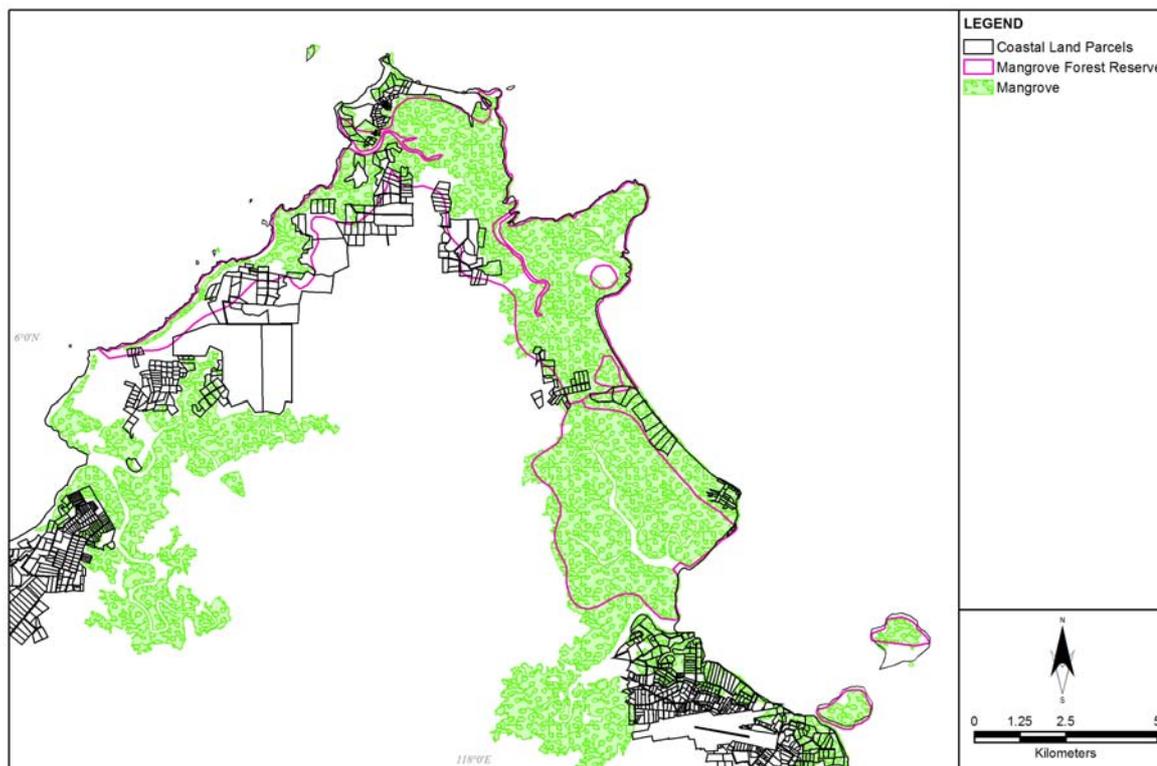


Figure 3.9 Mangrove area, mangrove forest reserve boundaries and coastal land parcels in the Sandakan area.

All development within mangroves should be avoided due to the impacts on fisheries resources, coastal sedimentation, and erosion; if any kind of construction/cutting down of mangroves that lead to a loss of mangrove forest is deemed necessary, a formal EIA process must be followed that addresses relevant issues including tidal prism alterations, salinity and fish stock issues.

Other specific recommendations with respect to marine and intertidal habitats include:

- Sewage treatment of waste
- Restrict reclamation in known fish spawning and nursery grounds
- Controls to fishing practice and catch limits be introduced through legislation
- Protected areas should be actively defended against illegal activities
- Currently ungazetted mangroves in good health should be gazetted as Class V Mangrove Forest Reserve under the 1968 Forest Enactment. The majority of existing Class V Mangrove Forest Reserve should be regazetted as Class I Protected Mangrove Forest under the same enactment.
- Tighter controls and enforcement of existing legislation
- Prioritisation of resources for integrated management towards sensitive areas

³ This figure is derived from Forest Reserve delineation provided by Dept. Forestry and Land parcels along the coastline provided by Lands & Survey Department. Note that this may be a conservative estimate as DHI had no data on land titles further than 1km from the coastline.



Priority areas for implementation of these recommendations and other integrated management initiatives have been identified as follows:

- Darvel Bay
- Klias mangroves
- Mengkabong estuary
- Ambong and Usukan Bay
- Marudu Bay

3.2.5 Ports and Harbours

Seaports are an important transportation and trade linkage, especially for Sabah located north of the Borneo Island. Their uses include national security, trade and commerce, shipping and transportation, tourism and marine resources.

When constructing port facilities it is recommended that wherever possible all jetties, piers, etc be constructed using concrete or wood piles. This type of construction minimises impacts on coastal morphology or littoral drift when compared to earth filled jetties or wharf. A definition or modification to the Harbour limits of Kimanis, Kunak, Weston, Bakapit, Kota Marudu and Tungku Harbours is recommended.

In order to ensure that the construction and operation of ports cause minimal impacts to the surrounding environment, environmental impact assessment studies need to be conducted around the areas prior to any planning for port development. The relevant legislation to be considered includes State Environment Protection Department and Federal Department of Environment requirements.

3.2.6 Tourism

Tourism is well established as a major industry, both in Malaysia and Sabah, and is the second largest earner in overseas revenue behind manufacturing. The significance of tourism to Sabah's economic well being is now being recognised. Sabah now must move forward and learn to balance its commodity and agricultural development side by side with its nature based tourism, in a sustainable fashion. Recommendations include:

- Clear demarcation of tourism zones, with specification in types of tourist where possible
- EIA process for all tourism developments
- Additional major hotel complexes
- small eco-tourism resorts or lodges on isolated beaches and islands
- limiting concentrations of tourist developments that could strain beach resources
- Reduce litter in coastal waters
- Use of environmentally sensitive energy and water infrastructure
- Promote local employment
- Provide security to tourism sites
- Finalise gazettelement and management plans of the two new Marine Parks off Semporna and Kudat
- Consider possible new products; canoe safaris, mangrove boat tours, increase yachting and boating



3.2.7 Water Quality and Pollution

In many places in Sabah, coastal water quality is poor. It appears to be getting worse. It would seem that there is a tendency for the population to ignore the problems, but in many cases the problems are becoming too big to ignore. Satellite images are now easily accessible, which show how extensive and invasive uncontrolled development is in Sabah and the consequences this is having on water quality and pollution.

If current practice continues without any change, concentrations and quantities of most forms of pollution will double around the coastal waters in Sabah in the next 20 years. This will have disastrous consequences upon the coastal environment. If existing guidelines are implemented and current regulations enforced, pollution would be reduced by up to 50%. If Sabah was to become a leading eco-tourist destination comparable to other developed countries, pollution loads would need to be reduced by approximately 40% to 60%.

Reducing pollution loads, which is the key to improving the coastal water quality, is beyond the scope of this study. However, a number of recommendations (or goals) are listed for consideration:

- Enforcement
- Implement a task force to investigate how to reduce litter in Sabah
- Public awareness campaign to make Sabahans recognise that there is a pollution problem
- Sewer and treat all urban areas in Sabah
- Improve water quality monitoring networks to demonstrate pollution problems, to identify polluters and to track progress
- Prepare and present satellite images on a regular basis to make the community aware of what is happening in Sabah

These recommendations imply enforcement of existing legislation and guidelines, strong political and public decisions, and a realisation of the extent of the existing problems. Therefore, the main recommendation to resolve water quality issues is to instil a sense of responsibility for the coastal environment and in the long term sustainability of its resources to Sabah's decision makers and general population.

3.3 Policy Paper

The SMP has been prepared within the context of the Town and Country Planning Ordinance 1950 (as amended in 2002). The next step towards its adoption as the main Policy Document for Sabah's coastline is the preparation of a Policy Paper, to be brought before the Central Town and Country Planning Board (generally called Central Board). Once the Central Board has adopted the SMP, it can then be sent to the Yang di-Pertua Negeri for final approval and finally to the State Cabinet for gazetting.

Once gazetted, the SMP is expected to be adopted by all coastal planning authorities and implemented through existing and new development plans. It should be noted however that the SMP only applies to the coastal zone, and that existing development plans still apply otherwise.

The Policy Paper is in some respects an "Executive Summary of the Executive Summary"; a collation of the key recommendations and conclusions that are pertinent to the policy makers, with emphasis on legislative matters.



3.4 Shoreline Management Plan

3.4.1 Management Objectives

A range of issues critical to the sustainable use of the shoreline through preservation, rehabilitation and development have been identified in the Baseline and Sectoral Studies. These issues are expressed as generic management objectives for the four main environmental sectors:

- **Physical/Chemical (PC):** this sector includes morphology, development, met-ocean conditions, construction and water quality related objectives.
- **Biological/Ecological (BE):** this sector includes objectives relating to the marine, intertidal and terrestrial habitats and biological resources
- **Socio-cultural (SC):** this sector includes objectives relating to the economic and social welfare of the coastal population
- **Economic (E):** this sector is primarily related to State-wide commercial objectives

Each sector contains a series of subsectors, under which are the Management Objectives themselves. Despite the long list of Management Objectives (a total of 42), in several instances a more specific description of the objectives within Management Units is provided. Where this happens, additional descriptions are provided in the Management Unit Descriptions.

3.4.2 Management Strategies

There are 26 Management Strategies, grouped under 4 main categories:

- **Promoted:** High natural development potential, providing developments satisfy State and Federal development guidelines and conditions. Local Authorities are responsible for planning and assessing all proposals for development and, where appropriate, instigating provision of services and infrastructure. Management Strategies are:
 1. Nature Tourism
 2. High Density Tourism
 3. Low/Medium Density Tourism
- **Standard Conditions:** Development of new structures and amenities are permitted, providing they satisfy standard State and Federal development guidelines and conditions, in particular setback of new structures. Management Strategies are:
 4. Agriculture
 5. High Density Tourism
 6. Low/Medium Density Tourism
 7. High Density Housing
 8. Low/Medium Density Housing
 9. Heavy Industry
 10. Light Industry
 11. High Density Commercial
 12. Low/Medium Density Commercial
 13. Mixed Development



- **Restricted:** Restrictions on development activities arise due to carrying capacity limitations, the presence of natural, ecological or cultural resources, and morphological processes or other physical and chemical restraints. Management Strategies are:
 14. High Density Tourism
 15. Low/Medium Density Tourism
 16. Housing/Commercial
 17. Agriculture
 18. Industry
 19. Coastal Forest Buffer
 20. Nature Tourism
 21. Rural/Kampung Tourism
 22. Traditional Kampung Zone
 23. Existing or Required Shoreline Protection
- **Prohibited:** Development is prohibited due to the importance of natural or ecological resources, unsuitability due to likely risk of structural damage, or national security. Management Strategies are:
 24. Environmental Protection and Conservation
 25. Active Morphology and Inundation
 26. National Security Area

A description of each is provided:

1. **Promoted - Nature Tourism:** Areas where natural resources would benefit from the protection provided by appropriate eco-tourism development.
2. **Promoted - High Density Tourism:** Areas with ideal natural characteristics and resources for the development of major integrated resorts.
3. **Promoted - Low/Medium Density Tourism:** Areas with ideal natural characteristics and resources for tourism development but with carrying capacity constraints.
4. **Standard Conditions – Agriculture:** Areas currently under agricultural use.
5. **Standard Conditions - High Density Tourism:** Major integrated resort developments with more than 100 rooms.
6. **Standard Conditions - Low/Medium Density Tourism:** Small scale resorts and associated tourism infrastructure.
7. **Standard Conditions - High Density Housing:** Strata housing (apartments, condominiums) or very high density terraced housing with more than 50 units per Ha.
8. **Standard Conditions - Low/Medium Density Housing:** Bungalow or terraced housing with associated services including schools, shops, leisure and recreation facilities etc.
9. **Standard Conditions - Heavy Industry:** Industry which has or may have substantial emissions, including port and harbour facilities and petrochemical plants.
10. **Standard Conditions - Light Industry:** Industries with no significant emissions other than non-scheduled solid waste and standard sewage.



11. **Standard Conditions - High Density Commercial:** Strata commercial development (high-rise offices and shoplots).
12. **Standard Conditions - Low/Medium Density Commercial:** Typical development paradigm of rows of three-storey walk-up shoplots and offices, as well as other low density commercial development incorporating open spaces and malls.
13. **Standard Conditions - Mixed Development:** Mixed land uses such as resort and housing developments and combined tourism-commercial developments, but not industrial land uses.
14. **Restricted - High Density Tourism:** Carrying capacity reached if more than two high density resorts are in close proximity, or if the value of the existing resort depends on its seclusion.
15. **Restricted - Low/Medium Density Tourism:** Carrying capacity reached when adjacent properties exceeding a total area of approximately 3 Ha are developed for resort projects. Additional development in these areas should be low density with particular attention given to solid and liquid waste disposal. Carrying capacity can be increased depending upon the degree of landscaping, setback, available attractions nearby and provisions for wastewater and solid waste disposal. Also used for reserving areas for future tourism development when sufficient demand is deemed by the authorities to exist.
16. **Restricted - Housing/Commercial:** Carrying capacity reached at density of 75 apartments per Ha for high cost residential areas. For low cost residential areas, 100 apartments per Ha. Low/Medium density housing is also included; carrying capacity is assumed to be reached at 50 units per Ha. General office/shop (commercial) uses are also included in this category, where carrying capacity has been reached or expansion constraints exist.
17. **Restricted - Agriculture:** Agricultural developments restricted in order to protect the marine environment from agricultural runoff, including sediments, fertilisers and pesticides. Primarily this refers to large scale oil palm plantations.
18. **Restricted - Industry:** Carrying capacity reached if there are no more areas to expand into.
19. **Restricted - Coastal Forest Buffer:** Small scale development within coastal forest buffer zones, preferably related to public leisure and recreation and the tourism industry, and with minimal impact on the landscape. The primary aim is the preservation of the natural environment. Permitted uses include low density public recreation facilities designed to blend into the landscape.
20. **Restricted - Nature Tourism:** Nature-based tourism related to wildlife viewing, including viewing platforms and viewing sites, small scale jetties for river cruises, etc.
21. **Restricted - Rural/Kampung Tourism:** Low density tourism that protects the kampung and rural agricultural environment for the benefit of the community and tourism industry; encouragement of agro-tourism attractions, cottage industries, home stay accommodation, etc.
22. **Restricted - Traditional Kampung Zone:** This strategy refers to Kampung areas which have been identified for their sensitive cultural heritage or that represent excellent and well preserved examples of the traditional coastal Kampung (such as traditional fishing communities). Small scale Kampung agriculture, village housing,



local shops and aquaculture development (ie a pond for village consumption) is allowed to continue.

23. **Restricted - Existing or Required Shoreline Protection:** Areas which currently have shoreline protection or where coastal erosion threatens structures of economic value.
24. **Prohibited - Environmental Protection and Conservation:** Reinforcement of existing conservation areas such as marine parks and forest reserves and areas where, on a regional scale, development would be counter-productive when taking overall environmental costs into account. Certain types of development are permitted, even promoted, in many areas designated under this strategy. This includes fish cage aquaculture on sustainable scale within mangrove forest areas, basic public and tourism facilities for parks and wildlife sanctuaries.
25. **Prohibited - Active Morphology and Inundation:** Areas where the cost of coastal protection would exceed the economic value of any proposed development.
26. **Prohibited - National Security Area:** Areas associated with military installations.

3.4.3 Management Unit Descriptions

There are 552 Management Units. They are categorised on a Cell by Cell basis, with 30 cells defined for Sabah's coastline. Each cell represents a coastal reach of consistent sediment transport and morphological characteristics. It represents a second tier of categorisation (the first tier is the entire coastline and the third is the Management Units themselves).

Each Management Unit has at least one Management Strategy defined. Some Management Units have more, where different strategies are recommended in the hinterlands. Maps of each cell, showing the Management Units and their respective Management Strategies, is provided in Appendix A. Figure 3.10 is a map for the whole of Sabah (which can be difficult to read; see Appendix A for more details).

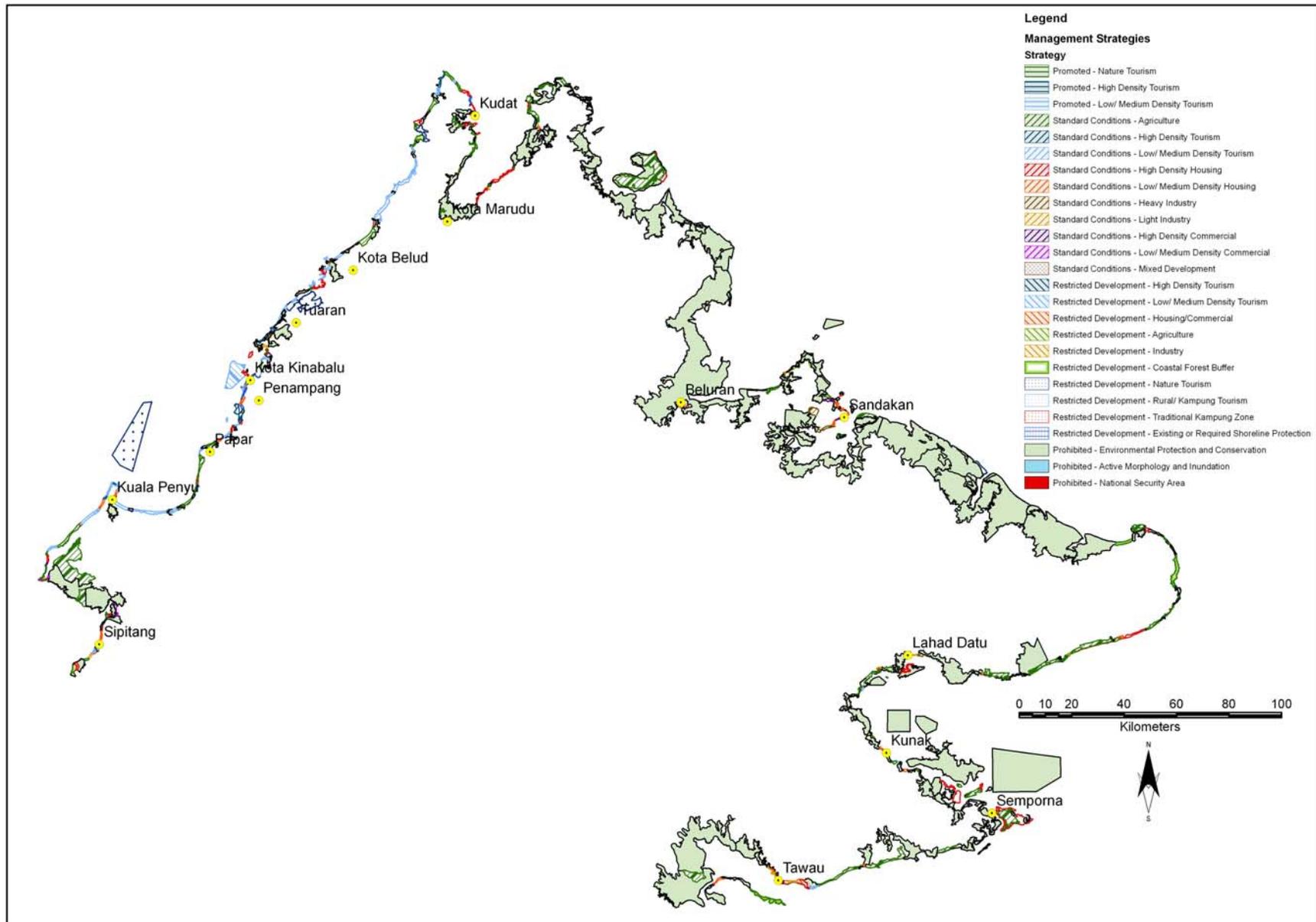


Figure 3.10 Management Units and their designated Management Strategies



3.5 Tourism Cluster Developments

To cater for the growth in tourism, the West Coast of Sabah Shoreline Management Plan from 1999 contained proposals for integrated tourism development clusters on reclaimed land. The objective was to minimise negative impacts associated with individual reclamation projects and maximise overall benefits by optimising aspects related to coastal morphology, water quality, hinterland drainage, infrastructure and architectural aspects.

The recommended scheme from the 1999 SMP has been adopted in the Putatan Local Plan, and several projects within the boundaries of the proposed development are currently in the late planning stages.

Unfortunately, the current implementation method has resulted in scattered individual projects on smaller parcels throughout the designated reclamation areas, which undermine the overall objectives.

To correct this, enforcement is required to phase development to allow some of the vital components of the scheme to work. Two options include:

1. Appoint a single developer to perform all reclamation, coastal protection and beaches, as well as basic infrastructure such as main roads, water supply and sewage system. The developer could be the state government or a representative, a financially strong investor/developer or a consortium of investors/developers with a common project management.
2. Strong regulation of individual developers based on a detailed masterplan undertaken by the government to control aspects such as perimeter design, phasing and timing, infrastructure and landuse.

The regulating authority overseeing masterplan development and implementation must have a strong technical and planning foundation, in particular with respect to such aspects as coastal and environmental engineering, planning, architecture / landscaping and economics.

3.6 Coastal Setback

Setback is a vital control mechanism for avoiding economic loss due to coastal erosion. In addition to the Water Resources Enactment, DID's "Guideline on Erosion Control for Development Project in the Coastal Zone" specifies guidelines for coastal setback. The guidelines are "*intended primarily for decision makers, project proponents as well as consultants involved in development projects in the coastal zone*".

This is a set of strong guidelines primarily directed towards coastal erosion issues, and if followed would very significantly reduce the number of coastal erosion problems. The SMP has generally followed the DID guidelines for setback limits with respect to coastal setbacks to prevent erosion.

Due to the regional character of the SMP study, the Management Units often contain large variations in adequate setback requirements; a minimum coastal setback of 60m is proposed with some areas having a wider setback e.g. 200m due to mitigate issues relating to high morphological activity or extensive inland plantations impacting on the shoreline, while in other sheltered or "hard surface" sections the limit can be relaxed. A general



“representative” setback has been specified for each MU, however, detailed, site specific limits should be covered as part of an EIA process.

As a response to the 2004 Tsunami, it was declared at the highest Federal and State Government levels that remaining mangrove forests must be preserved. This policy has been adopted in the SMP. Setback to a mangrove fringe is also recommended mainly to protect against intrusion into the mangroves as well as excessive runoff from agriculture or aquaculture into the mangroves. A buffer zone of 100 m to the mangrove fringe is considered suitable in most cases.

The existing legislation and guidelines may have prevented many cases of poorly designed projects, but they are clearly not entirely efficient in curbing all problematic projects (see for example Photo 3.1 below). The consistent violation of the regulations and guidelines may partly be due to ignorance and partly deliberate actions due to lack of enforcement. Violation of the Sabah Water Resources Enactment carries fines up to RM 50,000 or imprisonment up to five years, which in most cases is sufficient to work as a deterrent, but only if the regulations are widely known and enforcement carried out.

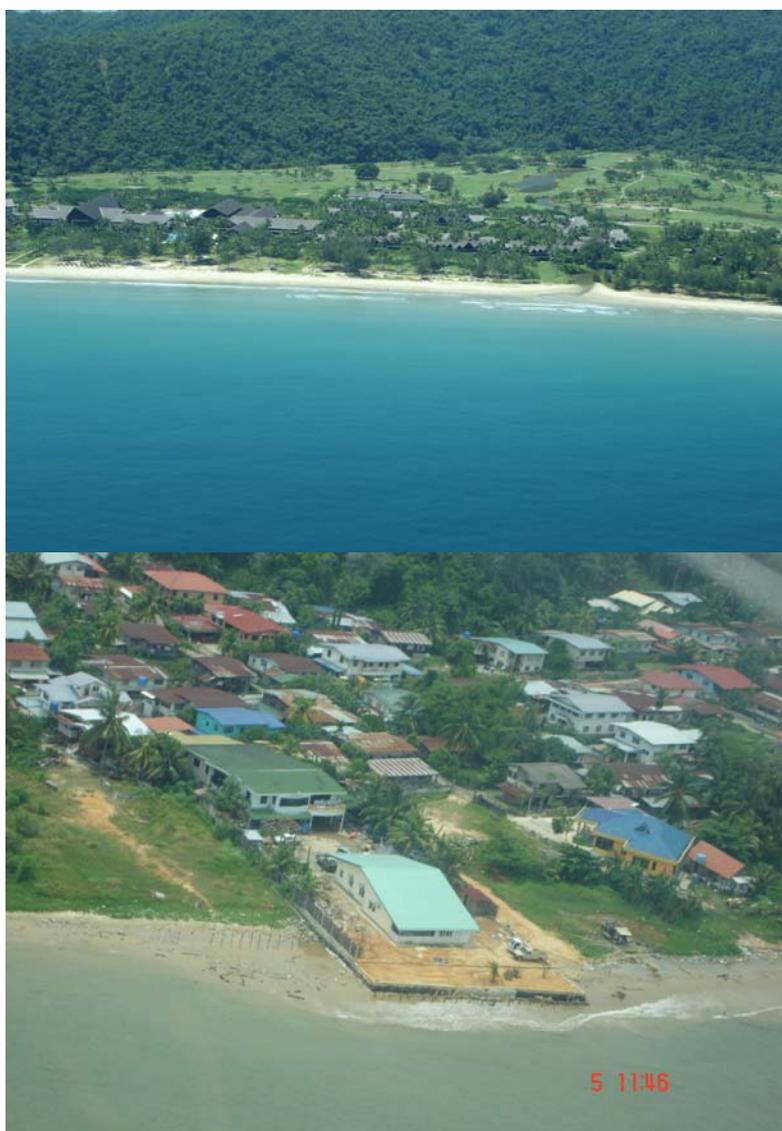


Photo 3.1 The good and the bad; the top photo shows an example of sound coastal setback with permanent structures in the order of 60 m from the high water mark. The bottom photo demonstrates a complete disregard for the rules (and laws of nature).



Another enforcement issue is the dynamic nature of the shoreline. In reviewing development plans against setback requirements, the authorities must use the coastline at the time of the review rather than the land title boundary. Otherwise, given the age and/or the inaccuracy of the land title boundary, the shoreline may be well landward of the line due to coastal erosion in the intervening years since the last update of the shoreline by the Land and Survey Department.

There is presently nothing in the various legislations relating to setback or the Sabah Land Ordinance that provides for the maintenance of the foreshore reserve in the face of shoreline retreat (erosion). Applicable elsewhere in Malaysia, the National Land Code provides that in the case of advancing sea (one assumes coastal erosion and/or sea level rise), land that has been alienated but thereafter becomes part of the foreshore reverts to the State. The foreshore reserve would automatically advance further inland.

It is recommended that the Sabah Land Ordinance is amended to include a similar provision.

3.7 Discussion

The Baseline Reports and Sectoral Reports highlight important regional issues:

- The coastline is a dynamic, harsh environment. Badly designed developments in the coastal zone can cause problems; to the developments themselves and also to neighbouring areas. In many instances solutions are expensive and difficult to solve.
- Sabahans have traditions and cultural ties to the sea. Maintaining these traditions and cultures defines the people of Sabah; it is important to preserve the environment in which they thrive. Fish stocks and traditional kampong lifestyles are now under threat in many cases.
- Aquaculture has obvious application in Sabah. The results of poor implementation of aquaculture can be seen elsewhere in South East Asia, and should not be allowed to happen in Sabah.
- Laws exist to manage development in the coastal zone. Integration between regulatory authorities and streamlining of the legislative framework are recommendations, however the most important aspect is in improving enforcement. Lack of staffing and funding are obvious reasons for lack of enforcement, however political will and public awareness of the issues are equally as important.
- Sabah's coral reefs and mangrove habitats are internationally renowned. These habitats are under threat from rampant development and unchecked and unsustainable exploitation of natural resources.
- Sabah has opportunities to expand its ports, harbours and shipping infrastructure, although the benefits of extensive expansion are uncertain. This does not preclude the need for appropriate management for state and local needs.
- Tourism is a growth industry in Sabah, and one that can benefit a large percentage of the population. Tourism can operate on many levels; big business down to local operations, directly catering for tourists across to secondary and support services. It should be encouraged. Further, Sabah's tourist attractions are mostly its nature – promoting tourism requires protecting the environment.



- Pollution in Sabah's coastal waters is bad. It is so bad that the environment, fisheries, tourism, and people's health are affected. It is a regional problem that goes beyond the borders and scope of this study and is a blight on Sabah.

The descriptions in the Management Units are the key to addressing these issues. The assigned Management Unit strategies may seem skewed towards environmental protection and conservation. In some ways this is correct; Sabah has vast tracts of mangrove forests and other fragile and important habitats along much of its coastline (particularly the East Coast), which should be protected and conserved.

This does not necessarily mean that the SMP is anti-development. In the majority of cases, development does not need to take place in the coastal zone. For example, agriculture does not need to be extended to the waterline, a buffer can be maintained to curb the effects of runoff into the aquatic environment. Aquaculture ponds do not need to be where mangroves presently are, and there are other and generally more sustainable methods for aquaculture which hold huge potential for future development. The emphasis is to recognise the value of the existing environment and preserve it for what it is; mangroves are environmental resources that enhance Sabah's beauty, natural resources, tourism market and fisheries market (for example). Damaging coral reefs via uncontrolled agricultural runoff affects the development of the tourism industry (another example).

The shoreline is only a part of Sabah, albeit an important one. Development and growth of Sabah is necessary and desired; the important point is how this proceeds and where. The SMP recommendations and strategies need to be considered in this state wide context, so that development plans and strategies are intelligently situated and selectively implemented. The SMP does this for the coastal zone and also highlights the necessary measures and steps to ensure sustainable development. It is up to the subsequent local and state plans to integrate this into the whole of Sabah.

3.8 Recommendations

The Management Strategies specified for each Management Unit are recommendations on a local scale, and the Sectoral Reports provide recommendations in a more regional sense.

In many instances in the study, issues relating to enforcement and public awareness were raised. Of all the recommendations, these two are probably the most difficult to implement. They imply enforcement of existing legislation and guidelines, strong political and public decisions, and a realisation of the extent of existing problems. Therefore, a fundamental recommendation is to instil a sense of responsibility for the coastal environment, and in the long term sustainability of its resources, to Sabah's decision makers and general population.