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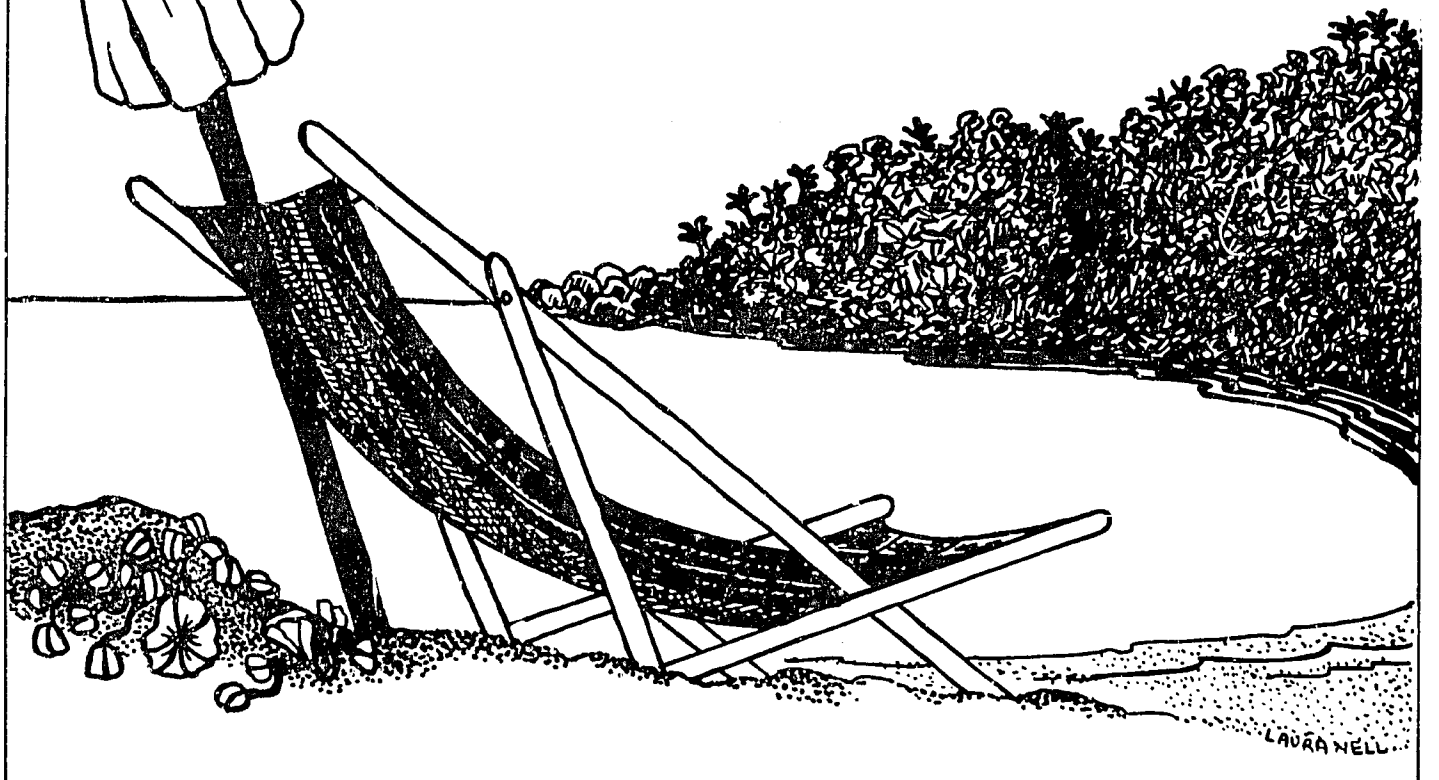
WHAT FUTURE FOR PHUKET?

An Action Plan To Maintain Environmental Quality In Patong, Karon, and Kata



Thailand Coastal Resources Management Project

WHAT FUTURE FOR PHUKET?

AN ACTION PLAN TO MAINTAIN ENVIRONMENTAL QUALITY IN PATONG, KARON, AND KATA PHUKET PROVINCE, THAILAND

March 1991

THAILAND COASTAL RESOURCES MANAGEMENT PROJECT
Office of The National Environment Board
The University of Rhode Island
Department of Technical and Economic Cooperation
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PREFACE

The Coastal Resources Management Project (CRMP) was established in 1987 to assist the Royal Thai Government in formulating a national Coastal Resources Management (CRM) program consisting of policies, measures, and effective actions to address priority CRM concerns in the Kingdom.

CRMP recognizes that success of a national program must be based on a realistic appraisal of what actions are necessary and can work at the local and provincial level. CRMP has approached its task by formulating and testing potential elements of a national CRM strategy through demonstration projects.

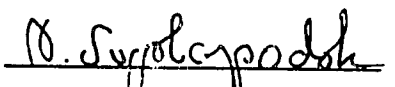
Phuket Province was selected as the site for one of CRMP's major demonstration projects. Phuket is a location where development and maintenance of environmental quality are inexorably linked. There is a pressing need for immediate government attention to development and resource management issues and experiences gained and lessons learned in Phuket will be helpful in many aspects of national policy formulation.

The Phuket Project has accomplished much: it has clearly identified and analyzed important coastal issues, and it has proposed realistic solutions to the most immediate problems. But the Phuket Project has gone beyond study and analysis. It has, with the cooperation of provincial and local governments, and the Province's vigorous private sector, acted to solve some of the immediate environmental problems facing Phuket. Thus, CRMP's Phuket demonstration project has provided a rich source of experience to help guide ongoing national policy formulation efforts.

This **Action Plan** defines the principal coastal issues that Phuket faces, summarizes actions already initiated and sets forth additional specific actions that need and can be taken to begin to address problems.

Under current conditions and government policies, however, Phuket cannot address all of the development and environmental issues it faces. Solving some of the most difficult problems -- controlling the pace and type of development now ongoing along the west coast, maintaining the island's magnificent scenery, restoring its once pristine waters, and maintaining its coral reefs -- requires significant policy reform at the highest level of government. Also required is strong public support to develop policies and plans, to implement these policies and plans, and to enforce regulations necessary to ensure compliance with these policies and plans. Such policy reform and increased political will is crucial not only to Phuket's future but to the sustainable development of all other coastal tourism sites in Thailand.

What is the future for Phuket? That depends on all of us. How we answer that question will affect not only Phuket, but all of coastal Thailand.



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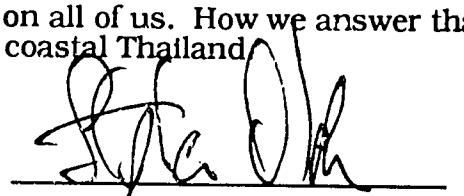

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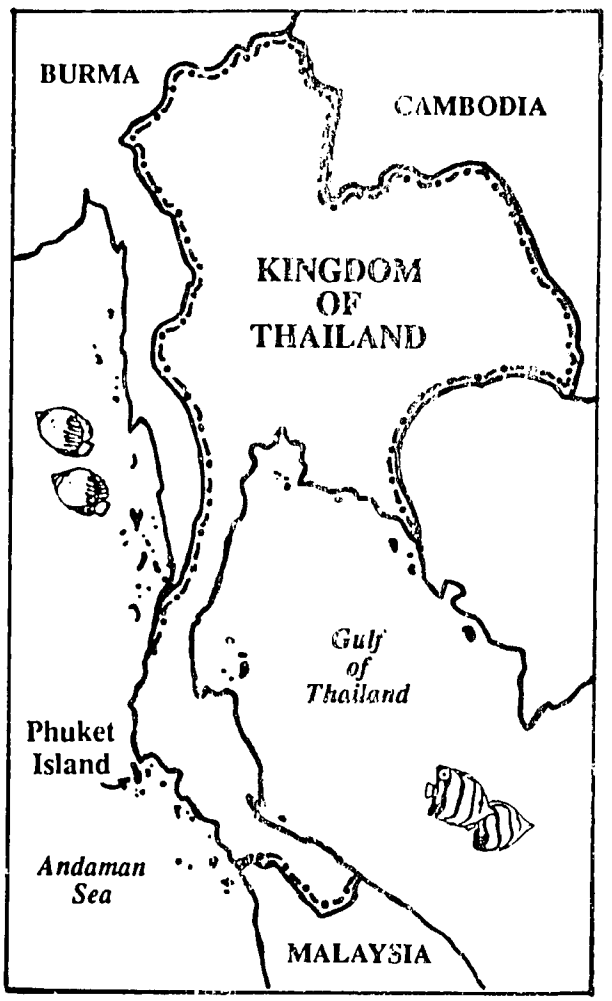
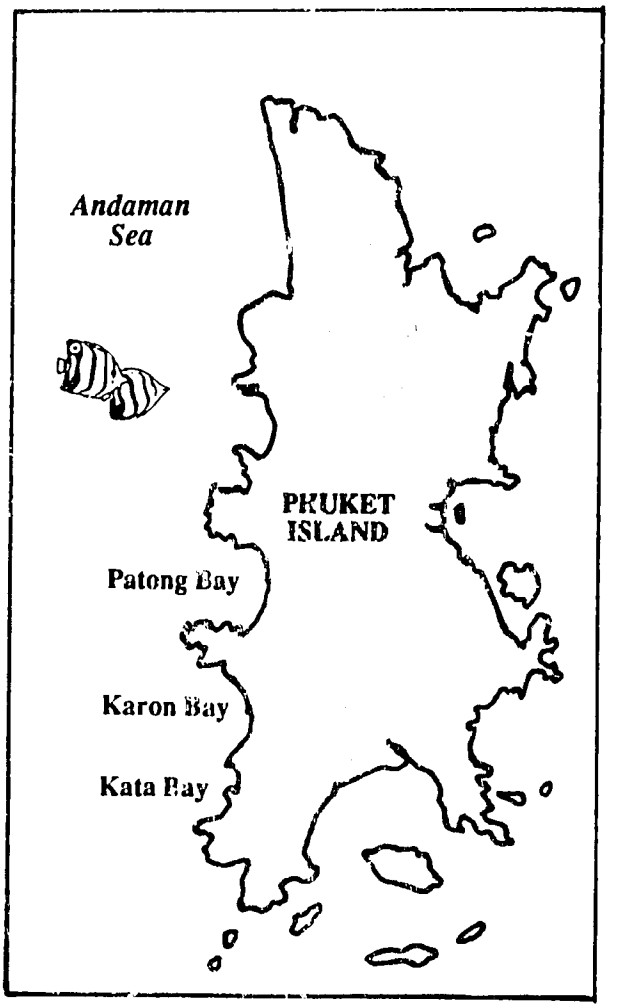
Executive Summary

This document examines the three most important resource management issues in Phuket Province and highlights their implications in terms of quality of life and a robust economy. In the first three chapters, environmental quality is examined as it is expressed in water quality, the condition of coral reefs, and land use. The many actions that are necessary to sustain Phuket as a tourism resort are detailed as recommendations at the end of each chapter. Chapter 4 addresses the issue of citizen support and participation in the process of implementing an effective set of management measures. Chapter 5 summarizes all recommended actions and the lead agency for each measure.

Those familiar with the practice of resource management know that in the real world progress is not made in a predictable and logical manner. In the real world, the amount and



KINGDOM OF THAILAND



PHUKET ISLAND

kind of progress accomplished depends upon the social and political will of a society, the energy and the vision of its leaders, and by unpredictable events that capture the imagination or require urgent actions. The immediate practical question is, "How do we get started?" This executive summary is an attempt to address the real world situation and suggests a strategic approach by which any interested individual or organization can build upon the many initiatives undertaken during the Coastal Resources Management Project's three years of activity in Phuket.

Build A Constituency. The first and overwhelming priority is to build a constituency desirous of maintaining the quality of Phuket. Leaders will emerge from within such a constituency and the political will to take action will then be generated. Once the necessary political will exists, purposeful and effective actions not possible in the past will become possible. Building a constituency requires promoting a better understanding of the problems, the opportunities, and the implications of losses or gains in Phuket's environmental quality. It is essential that the implications of the currently increasing losses in environmental quality be understood in terms of economic prosperity and quality of life. It is also essential that a long-term view is encouraged and made real.

A better understanding of problems and opportunities facing Phuket must be promoted among the many stakeholders. These can be divided into two major groups, government officials at all levels, and the private sector. The private sector includes residents and business people of Phuket and the powerful outside investors who see major opportunities for profit in the province. An effective constituency should include representatives from all of these groups. Governmental officials fall into two large categories: (1) Those who work for agencies of central government, and (2) Local officials, led by the Governor, who can greatly influence the development process and who can link the concerns of local citizens and business to the desires and concerns of central government and outside investors.

PRIORITIES ON PHUKET

For those living and investing in Phuket the immediate priorities may be grouped as follows:

Know What is Happening. A constituency will be formed only if people are aware of the problems that must be addressed. It is therefore of the utmost importance that information is gathered and broadly disseminated on such important indicators as:

- encroachment into reserved lands on the hilltops, on nearshore islands and on dunes;
- the numbers of tourists coming to Phuket, how they spend their time and their reactions to what they find;
- the condition of coral reefs;
- trends in water quality;
- the success with which sewage treatment plants are functioning;
- the incidence and severity of stormwater flooding, and
- the incidence of illness related to water quality.

These are indicators for the condition and use of the ecosystems of which we are all a part and upon which we all depend. Such information can be gathered and disseminated by governmental agencies, by businessmen, by school children and by their teachers. The results should appear in newspaper articles, in annual "State of Phuket" reports and in various technical reports The priority is to make such information available, to make people aware of long-term trends and above all to help people recognize their broader implications.

Protect the Beauty of Phuket. Each chapter identifies the actions that should be taken to keep Phuket beautiful. Some of these require collaboration between government and the private sector and some do not. They include many measures that contribute to clear, clean, and attractive waters along the bathing beaches; measures for protecting coral, measures for identifying and protecting the scenic quality of the hillsides as well as needs for garbage collection and traffic control.

Prevent Further Degradation of Water Quality. Good water quality is a symbol of good environmental quality. As Phuket's population continues to grow there are increasing dangers that the quantity and quality of drinking water, as well as the appearance and quality of the waters in which people swim will decline. Chapter 1 specifies a range of actions that can together protect and maintain water quality. They include: measures to assure that existing sewage treatment plants function efficiently, that existing and new facilities tie into sewage collection and treatment systems, that the performance of treatment plants are monitored and that their operators are properly trained, and that improper disposal methods are discouraged and eventually regulated.

These are the immediate priorities for action on Phuket. Actions such as these can have a significant impact on maintaining the many qualities of Phuket. More importantly, their implementation will help build a constituency. Actions in Phuket eventually must be complimented by significant initiatives from central government in Bangkok. Actions by central government will create the impetus for local action, helping prevent problems before they become serious.

PRIORITIES FOR CENTRAL GOVERNMENT

Formally Adopt the Regulations and Procedures Required to Activate Existing Laws. To make use of existing Thai law and activate the tools that can direct and manage the development process, several ministries must adopt the procedures and regulations required in order to control the intensity and types of activities in all watersheds. Such tools will be available when procedures and regulations are formally adopted pursuant to the Building Control Act, the Town and Country Planning Act, the National Environmental Quality Act and the Forestry Act. Yet it would be unrealistic to expect that such tools will be activated immediately. Experience in other countries suggests that several years is a realistic time frame, and then only if a constituency for action is working to promote such action.

Focus on the Supply Side of Tourism. An immediate priority that central government already has recognized and which needs full expression as quickly as possible in Phuket is a change in allocating resources from activities that promote increasing tourism demand to activities that sustain the quality of the "supply" -- in other words the resources that draw tourists into the Kingdom. Tourism is the major earner of foreign exchange for Thailand. Thus, tourism makes a very large contribution to the growth of the economy. Until now, government has with enormous success focused on increasing the volume of

tourism demand. The emphasis has been on international advertising, and in Phuket on such actions as upgrading the airport and encouraging large-scale investors to build resort facilities on the island. Now it is critically important that the focus now change from promoting increases in the quantity of tourists to protecting the quality of tourism attractions. This requires directing governmental financial resources to sewage treatment plants, drinking water supply systems, providing the personnel necessary for monitoring and regulation of those human activities that directly affect the quality of the attractions that bring tourists to Phuket.

The Role of the Governor. As the representative of central government, the Governor provides the leadership and sets the priorities for all local expressions of governmental policy. If high priorities are given to monitoring and disseminating information on the use and condition of the environment, on strengthening and empowering local initiatives in preserving and improving the quality of tourism attractions, and in enforcing existing regulations, these will help build a constituency concerned for the future of Phuket.

Strengthen Existing Monitoring and Training Activities. There is much that individual agencies and central government can do to both promote awareness of environmental issues and provide people with the skills to monitor environmental variables, interpret the results, manage water treatment facilities, protect coral reefs and mitigate the impacts of a rapidly increasing population.. Data can be released and interpreted. Chapters 1 through 4 specify innumerable actions that can be taken immediately. Although they will not in and of themselves halt the process of destruction and degradation, each can begin to create the context within which improved resource use and management can occur.

The next ten years will be critical for Phuket and for the future of tourism in Thailand. By the year 2000, the world will all know whether the magnificent qualities of Phuket have been destroyed or whether sufficient actions have been taken to maintain them for the enjoyment and the economic benefit of Thais and foreign visitors alike. This document identifies what must be accomplished if the future is to be good. How the necessary actions are taken will be a dynamic, somewhat, unpredictable process, requiring opportunistic behavior, strong leadership, and a dedicated constituency. For both Thailand and the world community the outcome is important and the responsibilities throughout government and for citizens, businessmen and investors are very great.

CONTENTS

FIGURES AND TABLES

ACRONYMS

BCA	Building Control Act
COT	Crown-of-Thorns Starfish
CRMP	Coastal Resources Management Project
DoF	Department of Fisheries
DoH	Department of Harbors
DPW	Department of Public Works
EIA	Environmental Impact Assessment
JICA	Japan International Cooperative Agency
LTD	Limited
MoI	Ministry of Interior
MTP	Master Town Plan
NGO	Non-Governmental Organization
ONEB	Office of The National Environment Board
PMBC	Phuket Marine Biology Center
RFD	Royal Forestry Department
RID	Royal Irrigation Department
SD	Sanitary District
STP	Specific Town Plan
TCPA	Town and Country Planning Act
TCPC	Town and Country Planning Commission
TCPD	Town and Country Planning Division
URI	University of Rhode Island
USAID	United States Agency for International Development

INTRODUCTION

One of Thailand's premier assets in attracting foreign tourism and the income it brings is its beautiful coastal environments. Will the asset be maintained? Can citizens and government work together to assure their own environmental and economic sustainability? These questions challenge coastal tourism areas worldwide. For Phuket Province and for similar coastal areas in Thailand, they will be answered within the 1990s.

Thailand's efforts to increase international tourism have produced spectacular economic results. The tourist industry grew by more than ten percent annually from 1987 through 1990, and has become the Kingdom's leading earner of foreign income. Coastal sites are rapidly becoming the leading tourism destinations in Thailand.

Phuket has been placed at the forefront of possible vacation destinations for both Thai and foreign tourists. The *Visit Thailand* promotional campaign greatly increased the number of international tourists visiting Phuket, with the west-coast, side-by-side beaches of Patong, Karon, and Kata being the most popular and rapidly growing. Phuket's own population also grew to service the increasing number of visitors. In Patong, Karon, and Kata, land prices soared as new hotels were built and existing hotels expanded to meet increasing demand. These beach resorts have many large and attractive new hotels and shopping areas, reflecting substantial planning and investment by developers. The tourist boom has brought great wealth to landowners. It has brought new jobs to the working class. From these points of view, the tourism boom has been beneficial to local citizens as well as to the national economy.

Phuket has become dependent on the tourism industry. This strong dependency assumes that the supply of international and Thai tourists will remain strong. In reality, the supply of tourists depends on the maintenance of a high quality environment, and tourism could decrease in response to international factors, such as the price of fuel or political instability.

The explosive building and growth brought by the tourist boom also has brought many negative impacts, which must be identified if they are to be corrected. Phuket's, natural beauty and many environmental qualities have suffered due to the rapid, largely unmanaged growth of the tourism industry. Citizens and government together are beginning to take action but solutions to problems of pollution and inappropriate land use are difficult to correct. Unless Thailand takes more affirmative action to protect its coastal environment, the reality will be that great environmental beauty and economic potential become degraded.

For several years, residents and tourists of Patong Beach in Phuket have stated that they did not want to become another Pattaya, which because of over-development and environmental degradation is now being avoided by many vacationers (numbers fell by ten percent in 1989 in spite of a twenty percent increase in nationwide tourism).

Simply stated, Patong, Karon, Kata, and other coastal areas on Phuket have grown economically but at a cost of major losses in environmental quality. In addition, growth has exceeded most earlier expectations, so that roads, sewers, parks, and

other infrastructure are now inadequate to meet present demands. Furthermore, planning and funding for future infrastructure needs are not keeping pace with population and commercial growth. As more people move into these communities, and as more facilities are built to encourage more tourists, these place additional pressures on the environment, further reducing the environmental quality.

Because Phuket and other coastal areas in Thailand have never before faced rapid growth, they lack sufficient land-use control, regulatory, and enforcement capability. There are no mechanisms effective in finding, and where necessary, controlling the development process, where additional population and development will harm the environment for existing residents and businesses.

The challenge to Phuket Province and to its individual communities is to promote a healthful, attractive environment. Time is critical. The ability to correct environmental problems -- water pollution, degraded scenic qualities, congestion, flooding, erosion -- will become more difficult and expensive if delayed. With prompt action, degradation can be slowed, some losses can be regained, and attractive environments with robust economies can still be assured. For example, by providing modern sediment control and wastewater treatment throughout the Patong, Karon, and Kata watersheds, local beaches will remain healthful and attractive, and coral reefs and marine life will survive.

The challenge will not be easy. The payoff is that by assuring a healthful, attractive environment, Phuket will be able to enhance and maintain a robust sustainable economy.

Purpose of the Action Plan

The purpose of *What Future for Phuket? An Action Plan to Maintain Environmental Quality in Patong, Karon, and Kata Watersheds*, is to provide in one document, a summary of key environmental and development problems facing Phuket and set forth a realistic course of action to begin to address these problems. This **Action Plan** cannot by itself resolve the basic problems in Patong, Karon, and Kata that are threatening the ability of the ecosystems to produce wealth and an acceptable quality of of life. It can begin the process.

The focus of this **Action Plan** -- on the three west coast watersheds of Patong, Karon, and Kata: on the issues of water quality maintenance, coral reef protection and land-use management; and on the process by which development decisions are made -- was determined both through studies by teams of Thai and American experts and consultation with the government and people of Phuket.

The **Action Plan** is organized into six chapters. Chapters 1, 2, and 3 address the Plan's principal issues. For each issue, findings of fact are first presented to briefly summarize the significance of the issue; the current situation with regard to that issue in Phuket with an emphasis on Patong, Karon, and Kata; CRMP initiatives that have been carried out to understand and address the issue; and the current management situation. These are followed by Recommended Policies, Measures, and Actions. The recommendations in the **Action Plan** can be implemented under Thailand's existing laws if the political will is strong and adequate budget is available. Following the recommendations in each chapter are brief sections on "implications for national policy." In these sections, weaknesses and gaps of the existing national management structure are identified. These topics require attention in Thailand's national effort to formulate an effective national policy framework for coastal resources management.

Chapter 5 sets forth the implementation scheme for the **Action Plan**, arranged by issue.

Chapter 6 is a bibliography of CRMP technical reports and other publications, on which the **Action Plan** is based.

Why Plan for the Watershed?

Watersheds are widely considered as the optimal unit for environmental planning. CRMP chose to formulate its recommendations for the relatively small (Patong, Karon, and Kata each cover less than 20 square kilometers) but rapidly developing watersheds where the cause-and-effect linkages between activities on the hillsides and activities in the bottomlands would be most apparent. Although it is the bottomland that is rapidly being developed, most hillsides have been converted from natural forest to rubber plantation. If development proceeds as it has in many other places many hillsides ultimately will be converted to steep neighborhoods, which will result in greater rates of soil erosion. At the same time, several hillsides are being excavated to obtain earth-fill, which will be hauled into former rice paddys prior to hotel construction. Hillside scars degrade the beauty of the watershed and increase the silt loading, which will exacerbate urban bottomland flooding. The most inexpensive water supply for a community may be derived from reservoirs and wells in the hillsides, but hillside development may degrade the quality and quantity of water available for consumption. These linkages are apparent in Patong, Karon, and Kata watersheds (Figure 0.1).

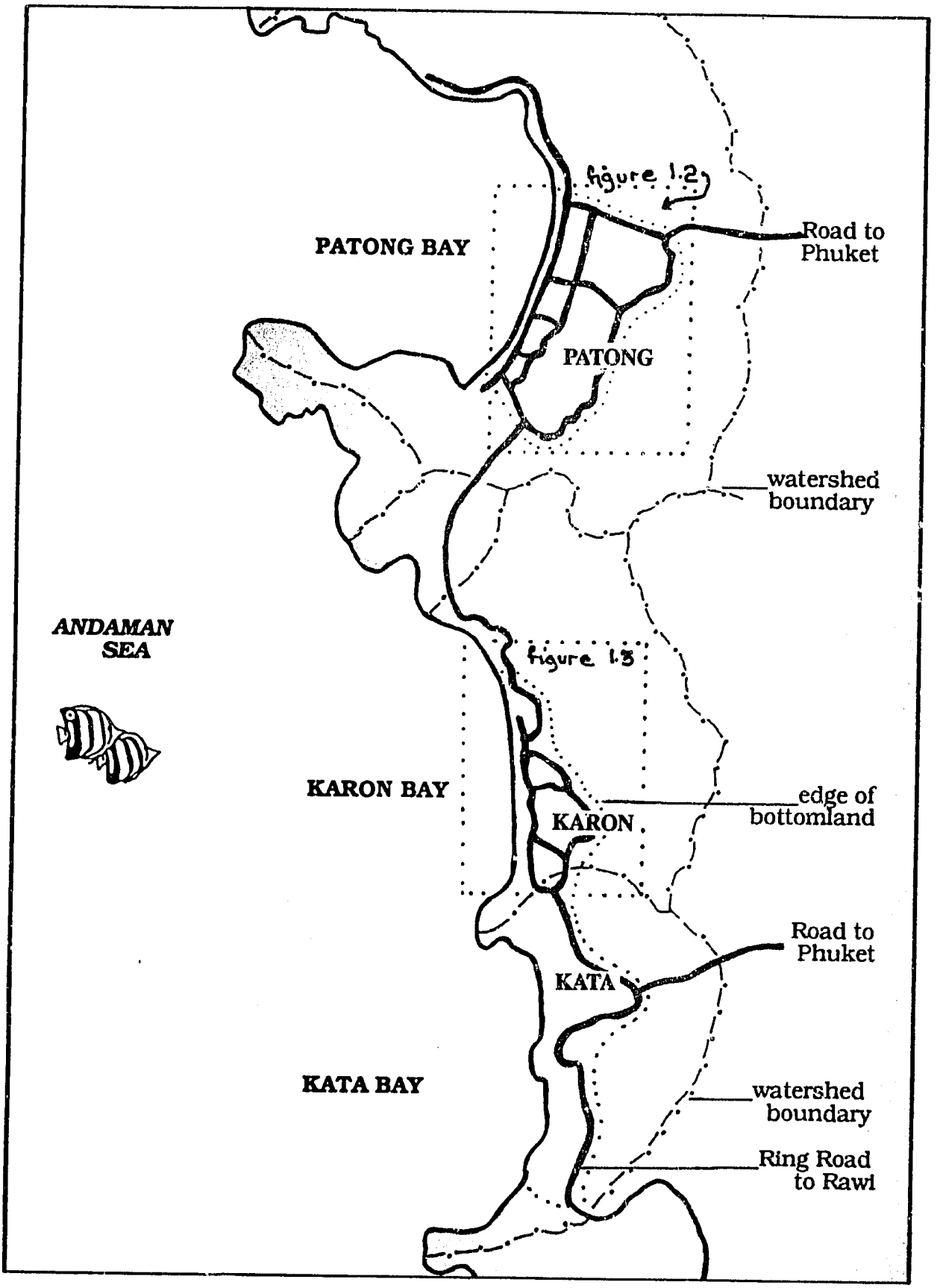


Figure 0.1. Overview of Patong, Karon, and Kata Watersheds.

1. Maintaining Good Water Quality

1.1. Findings of Fact

1.1.1. Importance of Good Water Quality

Good quality water is essential for coastal tourist resorts where beautiful beaches with clear water are the primary attraction. Maintenance of good water quality at such locations is essential for the following reasons:

(1) Health. Adequate supplies of good quality water for drinking, bathing, and water-contact recreation is essential to protect public health.

(2) Environment. Good water quality is essential to protect aquatic and marine life, including seagrasses, fish, algae, and corals.

(3) Aesthetics. Good quality water, without odors, is critical to assure attractive and pleasant surroundings.

(4) Economics. It is much easier and cheaper to maintain good water quality than to attempt to restore it, after it has been polluted.

Unless the necessary level of wastewater treatment is provided in advance of population increases, a bay may become polluted enough for citizens and tourists to avoid the area. Once an area gets the reputation of poor water quality, funds to correct the problems may be difficult to obtain and it may prove to be impossible to regain former levels of water quality and a positive image.

1.1.2. Water Quality In Phuket

Water pollution is associated with areas of dense human settlement, especially where sewage treatment is inadequate or lacking. In Phuket, few homes are connected to adequate sewage collection and treatment systems. Many hotels fail to operate their wastewater treatment systems properly. The result is that Phuket Town, Patong, Karon, Rawi, and many other densely settled western and southern bays on Phuket Island have contaminated marine, surface and groundwaters.

Urban flooding and siltation of surface waters and marine waters also is associated with areas of dense human settlement, especially where drainage-ways are under-sized, relative to increased populations; large areas of land have been cleared of vegetation, and often paved; and marshes and rice paddys have been earth-filled, often to construct more buildings and paved areas.

In general, it may be concluded that coastal water quality off the west coast of Phuket remains generally good, but is declining. Figure 1.1 shows several known water quality problems on and around Phuket Island, as of 1991.

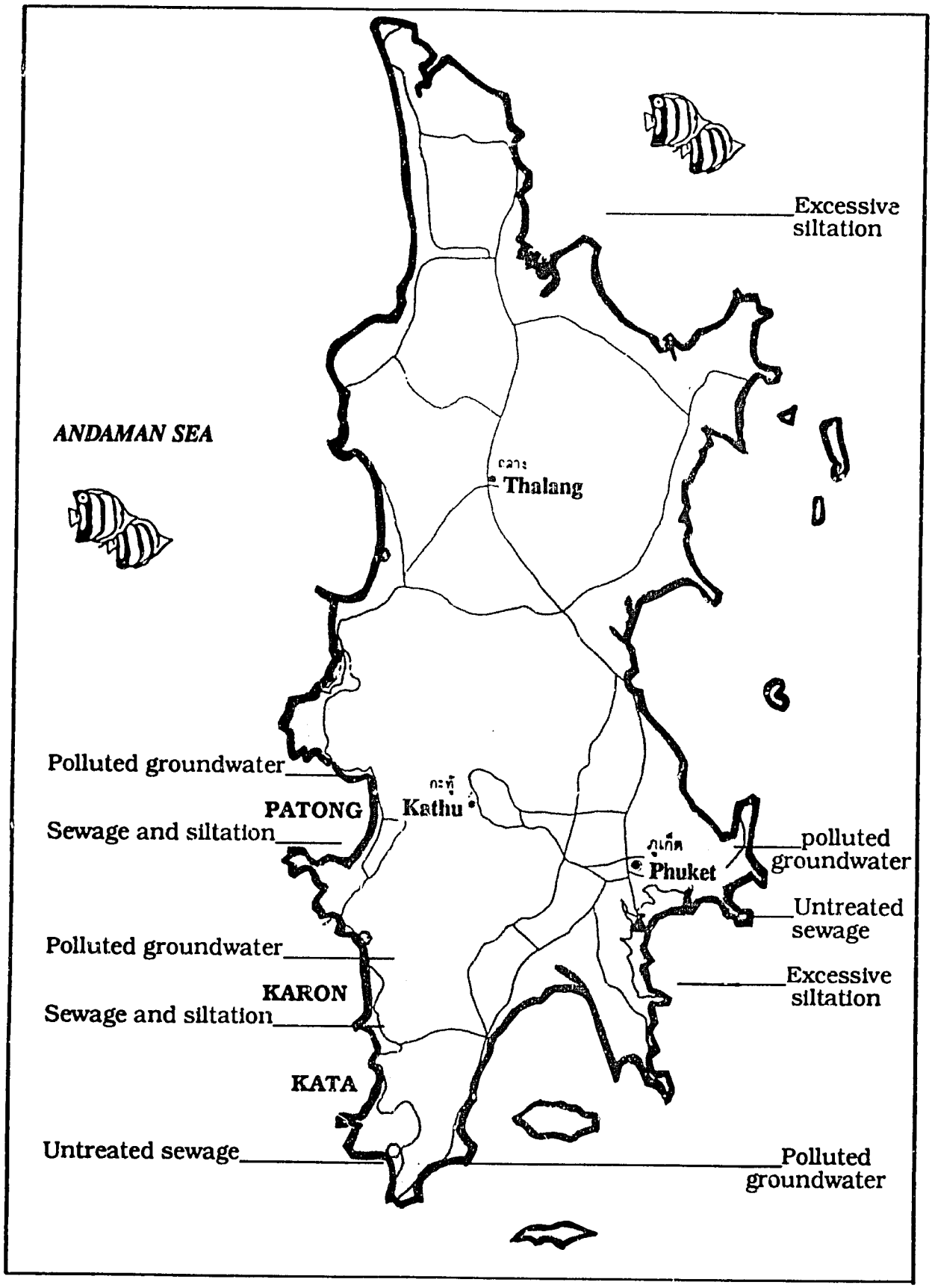


Figure 1.1. Illustrative Water Quality Problems On and Around Phuket.

1.1.3. Water Quality in Patong, Karon and Kata

CRMP investigated drinking and coastal water quality in Karon, and less intensively in Kata and Patong watersheds. CRMP found significant problems and disturbing trends in all three watersheds due primarily to sewage discharges. In addition, there are increasing water shortages and increasing erosion, sedimentation, and siltation in each watershed (Figures 1.2 and 1.3).

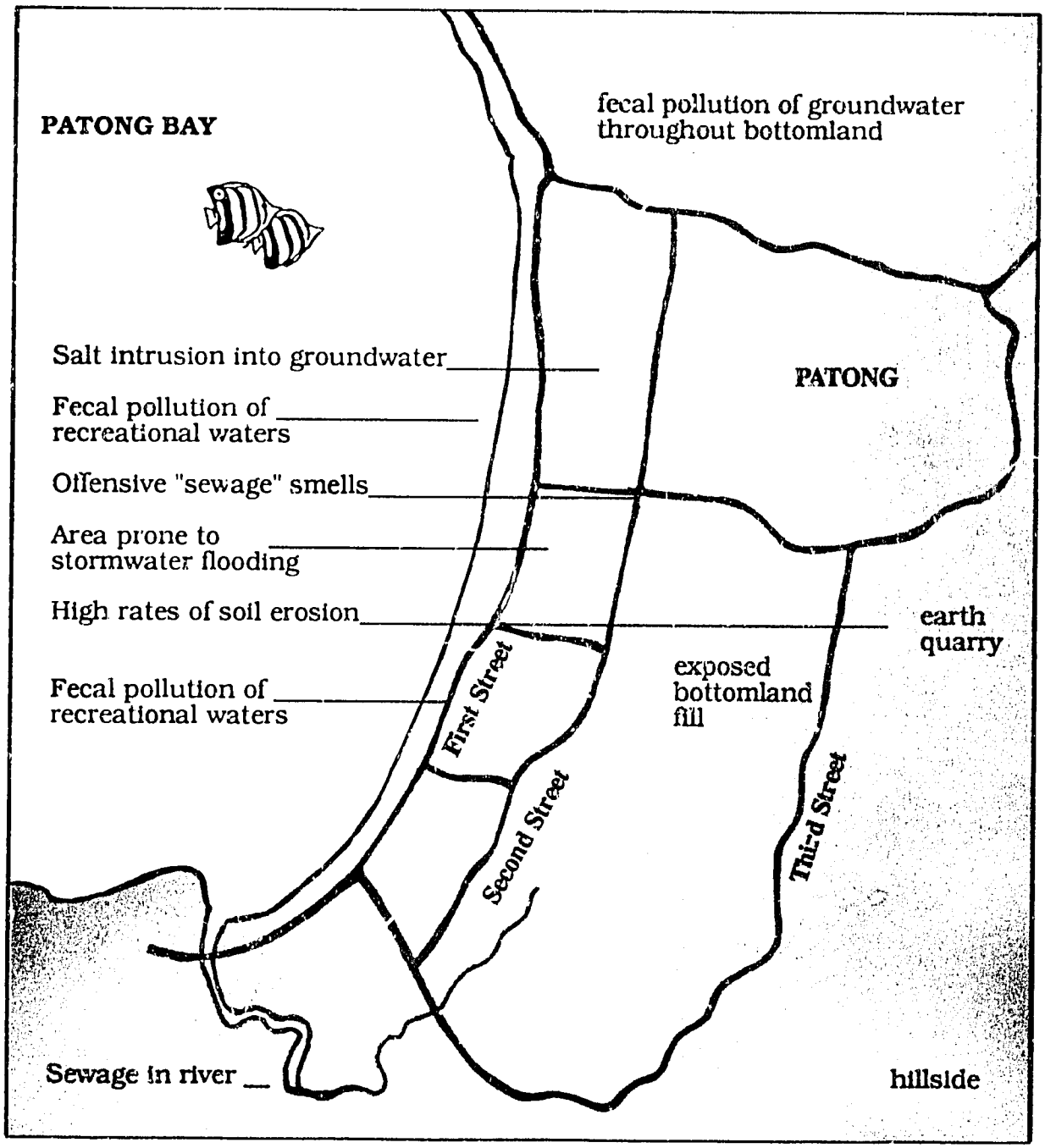


Figure 1.2. Illustrative Water Quality Problems in Patong Basin Bottomland.

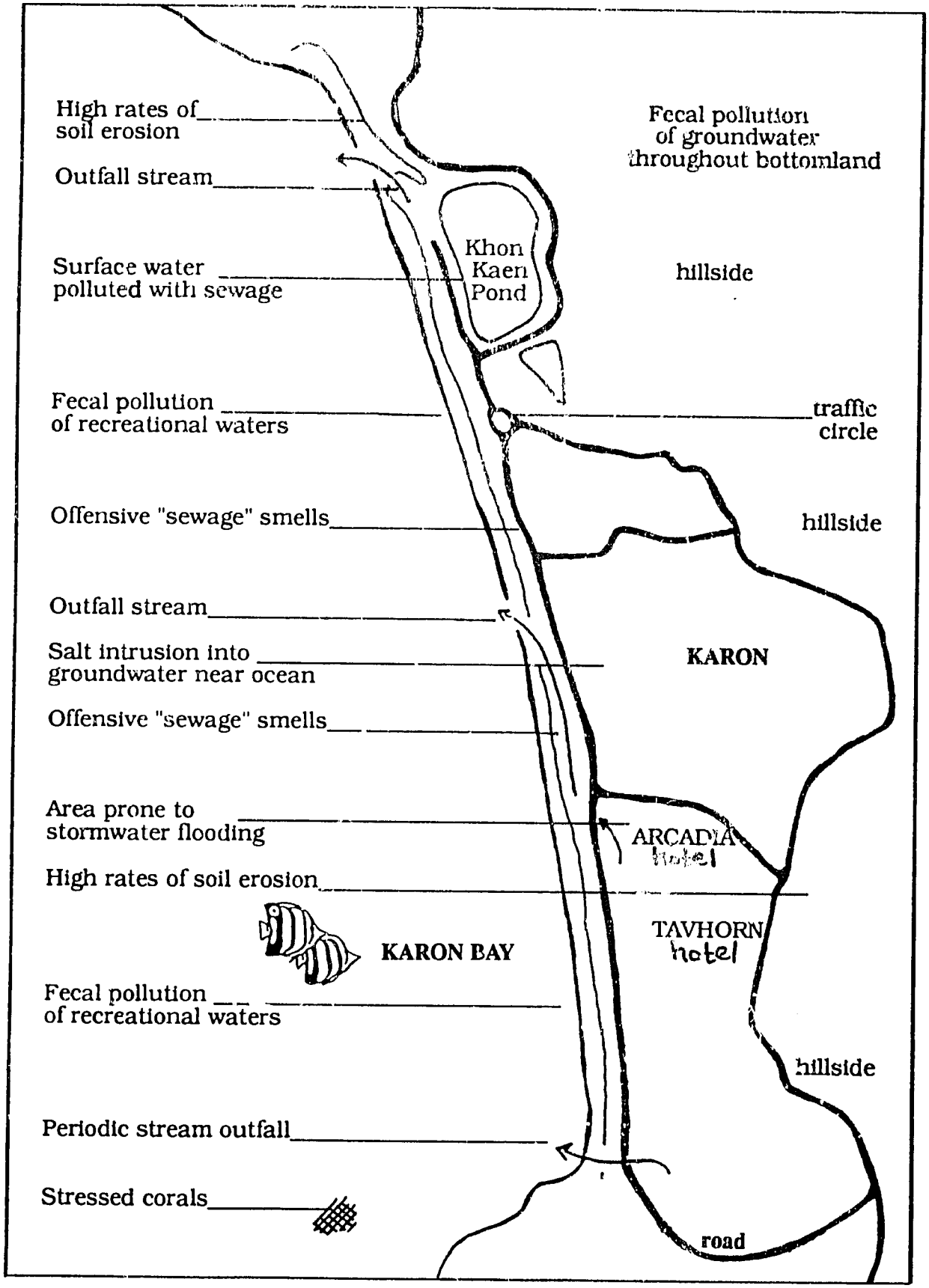


Figure 1.3. Illustrative Water Quality Problems In Karon Basin Bottomland.

1.1.3.1. Drinking Water

CRMP investigators found that:

(1) Near surface groundwater in both watersheds is contaminated with coliform bacteria, an indicator of the presence of probable human sewage; hence it requires boiling before it is safe to drink.

(2) Near-surface groundwater is not replenished adequately. Karon and Patong watersheds receive more than two meters of rainfall per year, but most is drained away. As a result, near-surface groundwater is not replenished adequately, saline water has intruded, and water shortages occur during the dry season.

(3) Existing deep wells may become contaminated. Several hotels rely on deep wells, which often are located near the base of the hillsides. Most of these deep wells currently provide safe and reliable water supplies, but are likely to become contaminated if development proceeds without proper wastewater treatment.

(4) Future water supplies may not meet demand. Patong already receives a growing portion of its water from nearby Bang Wad reservoir, which may soon supply a portion of Karon's fresh water as well. The Bang Wad reservoir is expected to be able to meet the anticipated water supply demands through the year 1993. A water shortage is expected during 1993-1995. While additional water supplies are being developed from other, more distant reservoirs, periodic shortages of water supplies must be considered, because of extended dry seasons and failures in the distribution system.

1.1.3.2. Wastewater

(1) Sewage contaminates surface waters. Sewage smells frequently offend visitors to both Karon and Patong, because of the high wastewater loading in streams and drainage ditches. In Patong, the smell is particularly noticeable in open drainage ditches along the second street. In Karon, the smell is noticeable in the central canal that flows by several hotels.

(2) Sewage contaminates marine waters. Though it is not apparent to most visitors, the recreational waters along Patong's entire shoreline occasionally fail ONEB's recommended recreational water quality standards. This is due to sewage contamination. Patong Bay is more sheltered from ocean currents than is Karon Bay--as a result, Patong has less ocean mixing and faces greater risk of water quality degradation from both wastewater and silt loading than Karon.

(3) Municipal wastewater treatment is not widely available. The Japan International Cooperative Agency (JICA) constructed a municipal wastewater collection and treatment plant in Patong, which opened in June 1989. The facility is sufficient to treat 2,000 cubic meters of wastewater per day (wastewater from approximately 8,000 people) and is now being expanded to 5,000 cubic meters per day (20,000 people) with collection pipes available throughout most of the bottomland (Figure 1.4). CRMP paid the cost of managing the treatment plant during its first year. The facility is operating well but most shops and houses are not yet connected. Several

were inadvertently connected to stormwater drains, and therefore their sewage receives no treatment. As a result, the facility probably serves less than a third of Patong's population. By year 2000, approximately two-thirds of Patong's wastewater may be treated by the municipal wastewater treatment plant. However, because of continued growth, the one-third of the population that does not receive municipal treatment may produce a net increase in the coliform and nutrients discharged to Patong's waters. Presently, the Public Works Department is committed to expand the plant's capacity, with completion expected in 1991.

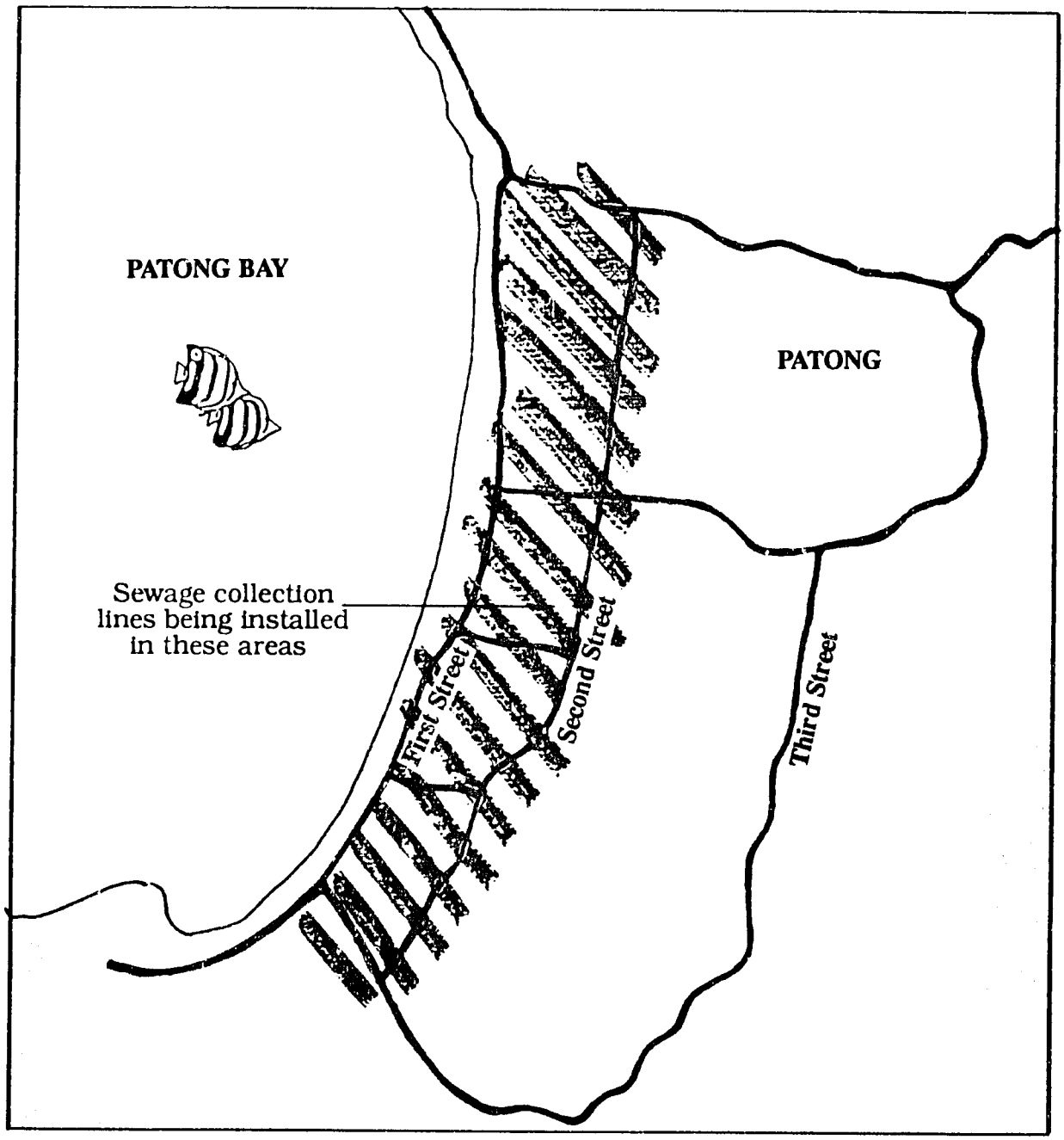


Figure 1.4. Municipal Wastewater Treatment Coverage Area in Patong.

1.1.3.3. Stormwater Flooding

Urban flooding has increased due to the earth-filling of wetlands and streams. Over the past few years, half of the rice paddies in both Patong and Karon have been covered with approximately a meter of soil to provide a dry foundation for shops, restaurants, and hotels. Also, several streams and drains have been covered over, plugged, or have become shallower and narrower due to siltation. The situation causes some streets in Patong and Karon to flood during heavy rainstorms. Flooding occurs most often in the wet season, but also during occasionally heavy rainstorms in the drier, tourist season.

Ironically, area-wide flooding has increased as individual landowners elevated their own land to prevent flooding of their property. In the long-run, although the covering of marshes and paddies with earth-fill temporarily creates dry land, chronic flooding again will occur once surrounding areas have been earth-filled to the same or a higher level, unless adequate sized stormwater detention ponds have been created to store temporarily excesses of stormwater. The problem will continue to get worse as more wetland and paddy areas are earth-filled, unless adequate drainages and water storage wetlands are maintained. At least 25 percent of the bottomlands should be retained in pond or wetland to avoid these problems.

1.1.3.4. Nearshore Water Quality

Good nearshore water quality is important to protect the health and pleasant experience of swimmers and waders. In Patong and Karon, the nearshore waters occasionally experience high levels of coliform pollution as seepage from cesspits move through groundwater and into the surf zone. Also, sewage often is carried into the surf zone by streams and stormwater runoff.

A lake, river, or bay can receive only a limited amount of nutrients, pathogenic organisms, BOD (biochemical oxygen demand), silt, etc., without becoming polluted. For most people, the first indicators of pollutant overloads are various offensive smells and occur regularly in some places in all three watersheds.

It is difficult to determine a water body's maximum ability to receive nutrients or pollutants without severe damage, because so many factors are involved (treatment levels, ocean mixing, temperature, vegetation, etc.). Computer models can help estimate the carrying capacity of specific bays. CRMP developed wastewater loading models for Karon and Patong Bays. Since Patong Bay is more enclosed (less mixed and diluted by ocean currents), its capacity to absorb wastewater discharges is smaller and it is already more degraded than either Karon or Kata bays. See Panswad, 1989, for a more complete discussion of wastewater loading models.

1.1.4. Sources of Sewage Contamination in Patong, Karon and Kata

(1) Many buildings lack appropriate wastewater treatment. Current law does not require wastewater treatment for hotels and other structures with less than 80 rooms. Thus more than a third of the homes, shops, and hotels in Karon, Kata, and Patong use cesspits, which are holes in the ground into which sewage is discharged. Cesspits provide no wastewater treatment but leech untreated sewage into groundwater. As a result, sewage contamination of both groundwater and the nearshore sea will continue to

increase in proportion to the number of toilets not connected to effective wastewater treatment systems.

(2) There are few suitable locations for on-site sewage disposal systems. Septic systems, which consist of one or more sealed treatment chambers, followed by a leech field, must be located on suitable soil at sufficiently low density to allow natural processes to properly treat wastes. In Patong and Karon watersheds, there are no locations with both suitable soils (moderate drainage) and low population densities (less than 1 family per rai), which would allow conventional septic systems to function adequately.

(3) Many hotel "package plants" are poorly managed. Package plants are used by the larger hotels in all three watersheds. Many are well designed, but ineffectively operated. Because of their relative complexity, package plants have a worldwide history of poor operation and frequent breakdowns. There currently is no regulatory program and no government agency with authority to enforce proper operation of package plants.

A 1987 survey of hotel package plants in Phuket, Bangkok, and elsewhere in Thailand (Panswad, et al. 1987) revealed overall, that hotels were often achieving only negligible treatment. In 1989, CRMP assessed operation and maintenance problems of 13 hotel package plants on Phuket, and found half failed to meet ONEB's recommended wastewater effluent standards.

(4) Stormwater flooding of cesspits pollutes both drinking and coastal waters. Drinking water wells become polluted, not only when groundwater is contaminated but also when heavy rains cause cesspits and septic tanks to overflow. Stormwater also washes oils, pesticides, and other chemicals from streets, and roadside dumps into wells, streams, and bays. The pollution potential of stormwater generally has been overlooked, but recent findings in other countries indicate that stormwater is often the leading source of stream and coastal pollution. In Patong and Karon, the amount of wastewater and other pollutants carried by stormwater has not been documented, but is probably considerable, especially in the more populated areas.

1.1.5. Sediment Contamination in Patong, Karon, and Kata

(1) Removal of vegetation causes erosion and property damage. More than 34,000 metric tons of soil erode from the Karon watershed each year, and a similar amount probably leaves Patong and Kata. Losses of soil during rainstorms occurs whenever unprotected soil is exposed to falling or flowing water. Major areas of exposed soil occur on hillsides that have been excavated for fill material, on bottomland sites that have been earth-filled but the soil is unprotected by vegetation, and along the Ring Road (both the slopes and the roadbed). Stormwater flowing across these areas has created ravines in several places. Mud slides, which can damages houses and property, have occurred on the ring road, between Patong and Karon, and south of Kata, forcing several closures of the inside (southbound) lanes. Also, stormwater has undercut the outside (northbound) lane, causing the pavement to subside or break away. The concrete waterways alongside the ring road continually crack or become blocked by sediments so that water is diverted across the road making for dangerous driving.

(2) Eroding sediments clog water bodies. Much of the eroded soil is carried by stormwater and into local ponds, streams, lagoons, and bays. Coarser particles settle out quickly, blocking streams and causing localized flooding.

(3) Suspended sediment interferes with plant and animal life. Finer particles (i.e., clay and silt), which may remain suspended in the water for several hours or days, reduce sunlight penetration. Aquatic plants help reduce nutrient loading, but siltation reduces the ability of plants to function--as a result, the combined effect of nutrient (sewage) loading and high siltation may increase the unpleasant odors at the mouth of the stream in Patong, or in the stream between Karon and Kata. The combined impact of silt and wastewater is especially harmful to fish and corals: Patong Bay's corals show signs of a stressed environment.

(4) Converting native hillside forests increases runoff. Native forests prevent flooding and siltation by infiltrating up to 90 percent of rainfall and loosing as little as 100 kilograms of sediment per rai per year. Little native forest remains in Patong, Karon, or Kata, as more than 75 percent of the hillsides have been converted to row crop rubber or coconut plantations. Such row crop forests may produce more stormwater runoff (increasing downstream flooding) and as much as five times the sediment loading (increasing stream clogging). Approximately three percent of the hillsides are being excavated to obtain earth-fill, which is used to elevate former rice paddys. Such excavation and construction sites may intercept as little as ten percent of rainfall but produce more than 200 times the sediment loading of native forests. Following the 1989 hillslides in Nakon Si Thanmarat, Thailand prohibited forest logging. However, the rule has not prevented clearcutting of native forest for conversion to rubber plantations, nor has it prevented hillside excavations in Patong, Karon, or Kata.

1.2. CRMP's Water Quality Initiatives in Patong and Karon

Several Thai consultants and American advisors assisted ONEB and CRMP to improve water quality in Patong and Karon.

1.2.1. Managing Patong's Wastewater Treatment Plant

Recognizing that the first year of operation can establish the long-term reputation and excellence of a wastewater treatment plant, CRMP provided funds to manage Patong's newly completed wastewater treatment plant, which had been build through a grant by JICA. As a result, the facility maintained effluent water quality well within ONEB's proposed standards. In addition, the firm advised the Sanitary District on how to assure proper hook-ups as the wastewater collection system was expanded.

1.2.2. Defining Wastewater Treatment Options

CRMP consultants and ONEB officials assisted the Patong Sanitary District in planning for expansion of the sewage collection and treatment system.

Chulalongkorn University developed preliminary plans and budget requirements to build a wastewater collection and treatment system sufficient to meet the needs of the Karon watershed as the community expands.

Chulalongkorn designed and tested several onsite wastewater treatment systems suitable for isolated dwellings in coastal areas. The units proved superior to conventional septic systems, because they do not rely on soil for final treatment: this allows their use by existing dwellings that lack adequate treatment systems. The three-chambered individual home treatment system uses an initial septic chamber followed by two specially designed tanks, which replace the soil treatment stage (see Panswad, 1989). CRMP's alternative three-chambered system is effective only when population densities are below eight people per rai, and only when pumped out every 3-5 years.

1.2.3. Evaluating Karon's Groundwater Quality

CRMP retained the engineering faculty of Chulalongkorn University to test the water found in Karon's near-surface community wells. Due to pollution by human sewage sources throughout the bottomlands, all tested wells failed the World Health Organization's (WHO) water quality standards. CRMP projects that the near-surface community wells in Patong, Kata, and other populated coastal communities will also fail WHO drinking water health standards (Panswad 1989).

1.2.4. Defining Karon's Stormwater Management Needs

CRMP retained the engineering faculty of Chulalongkorn University to recommend a strategy for stormwater management throughout the Karon watershed (Koontanakulvong and Weesakul, 1989). Their strategy calls for:

* repairing and maintaining the current stormwater drainage system in Karon.
* upgrading Karon's stormwater drainage system to handle increasing volumes of stormwater as the urban area expands.
* retaining sufficient bottomland ponds and wetland to reduce stormwater flooding.

1.2.5. Providing Training for Officials and Sewage Plant Managers

CRMP provided a week-long in-service training course for the managers of hotel sewage treatment plants in Patong, Karon, and Kata. The course workbook was subsequently updated and provided to managers unable to attend the course. Participants requested that the course become an annual event.

CRMP provided an on-site consultation for managers of seven hotel 'package' treatment plants in Patong, Karon, and Kata to evaluate these operations and recommend how to improve their performance.

CRMP took Patong's and Karon/Kata's officials to tour Pattaya's wastewater management system, meet with Pattaya officials, and consider how to effectively manage Phuket's sewage treatment systems.

1.3. Recommended Policies, Measures and Actions

POLICY 1. Develop water supply infrastructure to provide adequate supplies of safe water in Patong, Karon, and Kata.

Measure 1: MOI should adopt and enforce ONEB drinking water quality standards for all hotels and restaurants.

Measure 2: The Royal Irrigation Department should identify possible hillside reservoir sites in Patong, Karon, and Kata watersheds, including but not limited to Ban Thor Soong and Klong Pak Bang in Ampoe Kra Too, Jetra and Klong Bang Neo Dum in Ampoe Thalang, and Klong Bang La, Klong Yontr, and Klong Kra Ta in Ampoe Muang. Before any area is selected for reservoir development, an environmental impact assessment will be conducted by RFD and reviewed by ONEB, with the results of the EIA and review being made available to the media and the public.

Measure 3: RFD and MOI should prohibit land disturbances within watershed areas above these possible reservoir sites identified through Measure 2.

> Action 1: RFD and Patong Sanitary District should determine land ownership on the hillsides of Patong, Karon, and Kata.
>
> Action 2: RFD should curtail leases of hillside lands and prevent cutting of trees within the identified reservoir watersheds.

Measure 4: The Department of Minerals should identify and map possible municipal deep well sites at the base of hillsides in each watershed.

Measure 5: RFD and MOI should prohibit land disturbances within 50 meters of the deep well sites.

Measure 6: MOI should add water conservation standards to the BCA, such as a requirement that water saver toilets and showers be installed on all new construction to reduce the demand for additional water of drinking quality.

POLICY 2. Provide Adequate Wastewater Treatment in Karon, Kata, and Patong.

Measure 1: ONEB, with participation from the Sanitary Districts, MOI's Public Works Department, and the private sector, should adopt and implement a watershed wastewater treatment strategy that will eliminate cesspits and assure that all wastewaters meet ONEB wastewater effluent standards before they are discharged into the environment.

> Action 1: MOI DPW will accelerate land acquisition and construction of a municipal treatment plant to service Karon and Kata bottomlands with a goal of a treatment capacity of 1/5 cubic meter of wastewater per person per day that brings wastewater to ONEB effluent discharge standards.

Action 2: MOI DPW will accelerate expansion of Patong's Municipal Wastewater Treatment Plant to assure that all houses and buildings are serviced throughout the entire bottomland.

Action 3: MOI should amend the rules applied to Karon and Patong watershed through the Building Control Act to:

(1) require that all commercial establishments tie-in to the municipal wastewater collection system whenever collection pipes are within 100 meters of the business site.

(2) prohibit any direct discharges to either ground or surface waters, unless these meet ONEB effluent standards.

(3) require that 'Package plant' discharges meet ONEB effluent standards.

(4) require that any construction application demonstrate that its wastewater system will pass through a municipal treatment plant, or until such a municipal wastewater treatment plant is available, will treat effluent to meet ONEB wastewater discharge standards. Failure to meet ONEB standards will result in serious penalties as can be provided under the BCA.

Action 4: MOI DPW should provide sufficient funds, training and manpower to the Sanitary District to understand the wastewater management technology and effectively operate municipal treatment plants in Patong and Karon. The Sanitary Districts may choose to have a private contractor manage their wastewater treatment plants.

Action 5: ONEB should provide an annual training course for "package plant" operators.

Measure 2: ONEB and MOI should protect public health by assuring adequate ambient water quality.

Action 1: ONEB should establish ambient coastal water quality standards for Patong and Kata, and update (if necessary) its proposed standards for Karon.

Action 2: ONEB should post warnings at recreational beaches whenever ambient water quality standards are exceeded.

Action 3: MOI should require that all gasoline and chemical storage tanks be double walled so that if the inner tank develops a leak, no chemical will be leaked to the environment (the tanks should be inspected annually).

Measure 3: ONEB should provide the public with accurate and understandable information about water quality in Patong, Karon, and Kata.

Action 1: ONEB should formulate and implement a monitoring system of outfall effluents from municipal and package treatment plants in Patong and Karon.

Action 2: ONEB should establish an analytical laboratory in Phuket to evaluate its water samples.

Action 3: ONEB should report monitoring results to each "package plant" owner/operator, to the Sanitary District, and the public.

Action 4: ONEB should advise the public about the benefits of wastewater treatment and about available wastewater treatment options through a public awareness campaign.

POLICY 3. Mitigate flooding and siltation in Patong, Karon, and Kata.

Measure 1: Government and the private sector will cooperate to reduce stormwater flooding.

Action 1: MOI should fund drainage system improvements in Karon, as proposed in Koontanakulvong, Sucharit, and Sutat Weesakul, 1989.

Action 2: MOI should purchase remaining natural wetlands and abandoned paddys in Karon, Kata, and Patong to prevent flooding, recharge groundwater, and preserve open spaces. For Karon, approximately 100,000 cubic meters of community wetland will be needed in the central and southern portions of bottomland to buffer stormwater run-off from central and southern hillslopes. Similar amounts are needed in Patong and Kata. Key sites for wetland acquisition/protection in Karon and Patong are shown in Figure 1.5.

Action 3: MOI should protect r. ers, swamps, and permanent streams. These are sovereign lands, whose title cannot be conveyed into private ownership.

Action 4: RFD should prevent additional encroachment of hillside forests in each watershed.

Action 5: RFD should prohibit clearcutting of any slope greater than 17 degrees.

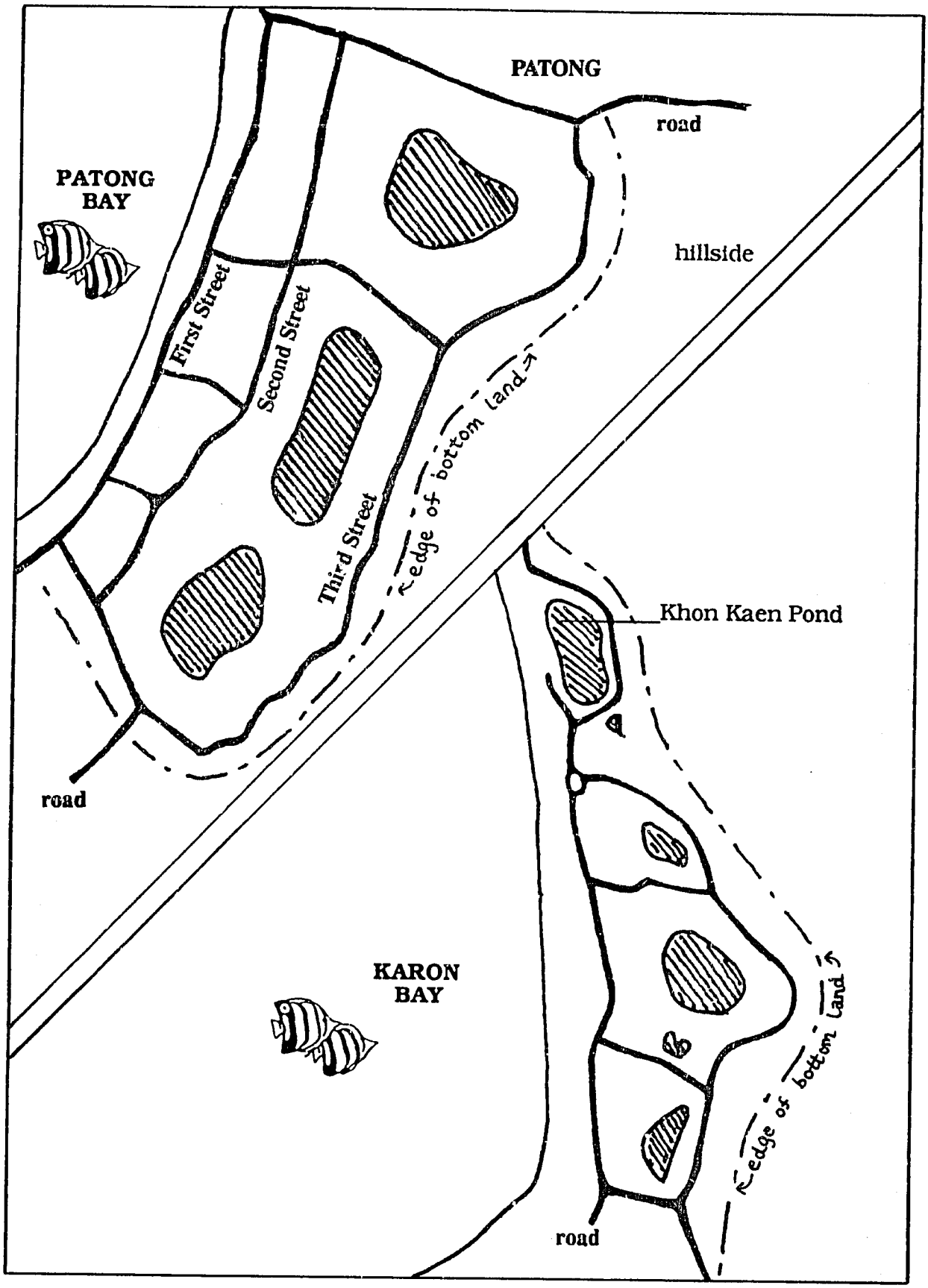


Figure 1.5. Needed Stormwater Buffering Wetlands in Karon and Patong.

Measure 2: MOI should add flood and erosion/siltation mitigation regulations to the BCA (Building Control Act). Examples of standards that should be included follow:

(1) All new commercial construction provide stormwater detention and retention to limit stormwater discharge to the site's pre-development rate of stormwater discharge. When modifying existing developments, the landowner must add adequate stormwater detention basins, or help pay the costs for maintenance of community owned and managed wetland areas. Such impact fees must be high enough to discourage developers from simply draining stormwater off their own property, and must cover the cost of maintaining the community wetland.

(2) Developers protect streambanks. A minimum construction setback of 5 meters from temporary stream channels, and 10 meters from the banks of permanent streams and rivers is necessary. Vegetation inside the buffer zone must be protected and not mown.

(3) Additional fill not be placed in bottomlands. When elevated areas are needed (i.e., private parking lots and roadbeds above the 10-year floodplain), the fill be obtained onsite by constructing a pond. This prevents further loss of flood buffering, whereas bringing fill into the bottomlands only transfers flood problems to neighboring properties.

(4) Pilings, not fill, must be used to elevate structures above the original ground level, to retain flood buffering capacity, and the first floors of all dwellings should be above the 100-year flood level.

(5) No land disturbances be allowed on land that cannot be stabilized against future erosion, including existing hillside excavations. This usually includes hillslopes steeper than 35 percent.

(6) New parking or driveway paving must be porous, to encourage infiltration.

(7) Disturbed lands must be restabilized with grass or permanent vegetation within 30 days after the end of excavation or construction, and before the establishment opens for business.

(8) At construction or mining site, a settling basins sufficient to detain all stormwater for 72 hours, as well as sediment barriers to prevent any siltation from escaping the site, must be provided.

(9) After construction or excavation, no highwalls may remain taller than 1 meter (a highwall is any slope greater than 45 degrees). This regulation prevents continual soil erosion from permanent excavation scars.

(10) Construction operators must deposit performance assurance bonds with the regulatory agency. CRMP suggests a performance bond of 10,000 Baht/rai. The bond will be returned to the contractor after final inspection and verification that erosion has been corrected, or will be used to correct onsite stormwater management problems.

1.4 Implications for National Policy

Government has few tools to protect water quality. Although local actions are essential to preventing further degradation to Patong, Karon, and other watersheds in Phuket, only the national government can take the difficult steps that are needed to adequately protect water quality in Thailand.

(1) Thailand lacks national water-quality standards. Although ONEB has proposed quality standards for drinking and recreational waters, as well as effluent standards for wastewater, no agency with regulatory power has adopted these standards and is committed to enforce them. In addition, ONEB's ambient water standards, which have been proposed for specific bays such as Karon, do not affect how development proceeds. Thailand faces a major challenge in both adopting standards (effluent and ambient) and in changing how development is regulated in order to meet such standards.

(2) Monitoring for compliance to water quality standards must be strengthened. Although ONEB has monitoring expertise, it lacks funds to adequately monitor ground, surface, and marine waters to determine if they meet drinking, recreational, or other protection and use criteria. When monitoring is conducted, the results are not distributed widely, nor are regulatory actions taken where water quality problems are shown to be present.

(3) Enforcement is essential to assure that waters can be maintained within national quality standards. For example, whenever recreational waters are found in violation of their standards, the public must be advised through the media and visible signs that the waters are not in compliance. Likewise, untreated or inadequately treated sewage discharges must be linked to severe fines or closure of the hotel or other facilities in question.

(4) Most local districts and Sanitary Districts lack the technical expertise and authority to operate wastewater treatment plants, monitor water quality, and take action against violations of standards. ONEB and MoI need to work with Provincial Districts and Sanitary Districts to develop a process for formulating wastewater treatment plans and MoI needs to provide funding, technical assistance, and the political support so that local government can enforce water quality standards. At the same time, ONEB and MoI should provide the oversight to assure that local governments are in compliance with national standards.

2. Protecting Coral Reefs

2.1. Findings of Fact

2.1.1. Importance of Healthy Coral Reefs to Phuket's Economy

Phuket's coral reefs are of great value to the island and its residents. Values range from the protection of the western coast from the monsoon to the support of both new and traditional activities. Healthy coral reefs are providing the following benefits:

(1) Recreational and scenic values. Phuket's reefs are used year-round by thousands of foreign and domestic tourists for snorkeling, diving, and sightseeing.

(2) Tourism promotion and revenues. The Tourism Authority of Thailand and local businesses, including tour companies and tour boat operators, use Phuket's coral reefs to attract tourists to the island. The underwater scenery serves as a symbol of the beauty of Phuket's natural environment. The revenues generated by offshore excursions and souvenir sales exceed one hundred million baht every year.

(3) Maintenance of traditional lifestyles and culture. Phuket's reefs have always been used by coastal villagers for small-scale fisheries, providing food for subsistence, as well as ornamental fish and shells for trade. These traditional activities continue to provide sources of income and food to local people.

(4) Conservation and educational. Phuket's coral reefs are included in Thailand's national system of marine national parks and fisheries sanctuaries. As such, they play an important conservation and educational role. In addition, the reefs have served as natural outdoor laboratories, contributing to research in Thailand and Southeast Asia.

The degradation of healthy reefs is a significant loss to local residents and businesses. If the decline in the scenic and recreational values of coral reefs continues, it will eventually affect the viability of small businesses dependent on coastal tourism. Losses in reef productivity also will lead to losses in sources of food and changes in traditional lifestyles.

2.1.2. Coral Reefs in Phuket

Coral reefs are present in the western and southern bays of Phuket, and on several nearshore islands (Figure 2.1). Reef distribution and condition in Patong, Karon and Kata Bays are shown in Figure 2.2.

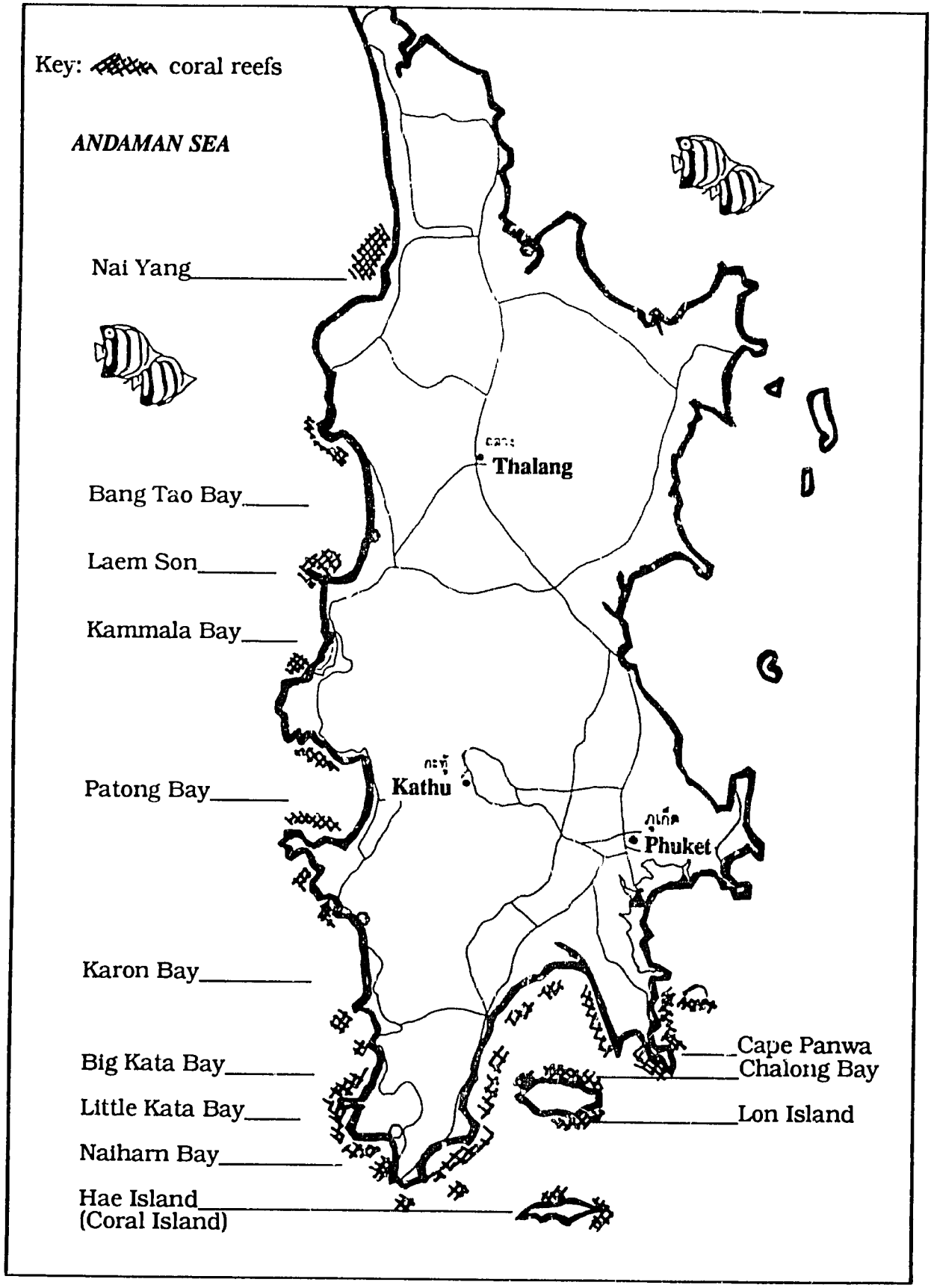


Figure 2.1. Coral Reefs of Phuket.

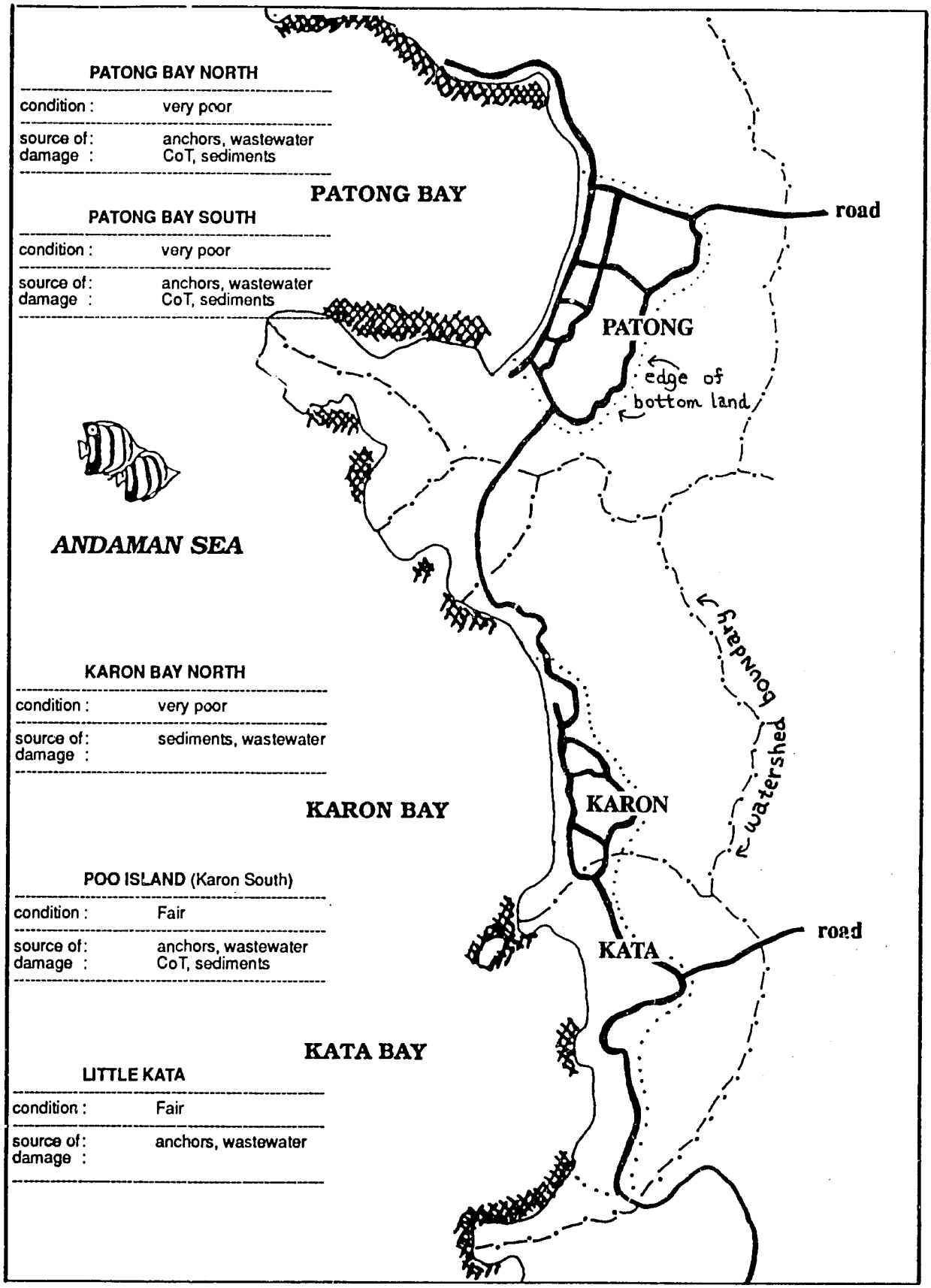


Figure 2.2. Coral Reef Condition in Patong, Karon, and Kata Bays.

The major causes of coral reef degradation in Phuket are related to tourism, pollution, fisheries, and natural events.

(1) Tourism-related impacts: These include anchor damage and groundings caused by tour boats, littering, trampling and the casual collection of corals by tourists. Examples of reefs where recreational activities are the predominant cause of damage include Ko Hae and North Patong Bay.

(2) Pollution-related impacts: The major pollution threats for Phuket's coral reefs are sedimentation associated with the development of coastal watersheds, eutrophication (overfertilization) brought by sewage outflows from hotels and coastal settlements, and sedimentation produced by offshore tin mining. Examples of reefs where water pollution is the predominant cause of damage include Patong Bay South, Karon, Ko Hae, and Ao Bang Tao.

(3) Fisheries-related impacts: Dynamite fishing and trawling over reefs can cause substantial long-term damage to the structure of a reef. With the expansion of tourism activities around Phuket, these illegal activities have been declining as a major source of reef damage in this area. Nonetheless, reef blasting and trawling over shallow reefs are still reported at some of the offshore reefs, including Ko Racha Yai, Ko Dok Mai, and Nai Yang. Overharvesting of lobster, grouper and other valuable species of fish and invertebrates is also threatening the long-term fishery yields of Phuket's reefs.

(4) Natural events: Reef conditions are affected by exposure to storms and extreme low tides, and crown-of-thorn infestations.

The geographic extent and significance of these problems were documented during the CRMP (see Lemay and Chansang, 1989: *A Coral Reef Strategy for Phuket and Surrounding Islands*. ONEB/USAID). Even within Phuket Province, the problems and their underlying socio-economic dimensions vary considerably from one reef location to another.

2.2. CRMP's Coral Reef Management Initiatives on Phuket

During the early stages of the Phuket demonstration project in 1987, the CRMP team worked with local residents to identify practical management actions that could help resolve such relatively simple problems such as anchor damage and littering. Many suggestions and offers of help came from local people, including teachers, hotel operators, divers and tour boat operators. The assessment of issues and practical solutions were presented at a workshop in Phuket in March 1988, where a group of community projects were selected for implementation. CRMP's participants implemented the following community-based activities:

(1) Mooring buoy installation -- Twenty permanent mooring buoys were installed as a demonstration at Patong and nearby Hae Island, both popular diving and snorkeling sites. Installation followed a training workshop for local divers who had volunteered to assist ONEB, the Department of Fisheries, the National Park Division and the Harbor Department in installing buoys. The objective of the workshop was to train local groups in procedures for selection of appropriate sites, equipment operation, and buoy installation procedures.

(2) Signs -- Thirteen wayside signs promoting the wise use and conservation coral reefs were installed in Patong, Phuket town, Hae Island, Rawai, Chalong Bay, the airport and the bus terminals. The construction of the signs was sponsored by Kodak, Thailand, Ltd., and their installation involved the cooperation of several local organizations. This action was successful in demonstrating how the private sector can work with government to achieve habitat management objectives.

(3) Community events -- Several community events that drew attention to Patong's coral reefs were sponsored and hosted by CRMP, the Phuket Governor's Office, Phuket Aquarium, and others. These included a "Crown-of-Thorns" day in November 1988 and the second "Coral Reef Day" in April 1989.

(4) Promotional activities -- These included the production of a coral reef poster, T.V. spots, interviews with local citizens, and extensive newspaper and magazine coverage.

(5) Coral reef curriculum -- A coral reef curriculum was produced by the Phuket Teachers' College in cooperation with local primary grade schools. It incorporates information and classroom activities on Phuket's reefs into the standard science curriculum for grades 4 to 6. This curriculum, the first environmental education packet produced in Phuket by a local group, was tested in several urban and rural schools and has been revised to incorporate the suggestions of local teachers.

(6) Coral reef protection diorama at Phuket Aquarium -- CRMP provided design advice and funding for the construction of a permanent coral reef exhibit at the Phuket Aquarium. The exhibit will be seen by several thousand foreign and Thai tourists that visit the aquarium every year.

(7) Coral reef protection brochures -- CRMP and the American Woman's Club of Thailand produced a brochure entitled "Thailand's Underwater Gardens", which describes Thailand's coral reefs and what citizens can do to protect them. CRMP and Kodak, Thailand, Ltd., produced a brochure on the use of mooring buoys.

(8) Other local training activities -- Several Training workshops were conducted in Phuket for tour boat operators and guides; coastal management volunteers, mainly local business owners in the tourism industry; and the local Youth Club.

From March 1988 to May 1989, the Phuket coral reef project evolved from a small initiative to an extensive community program involving many members of the public and business sector (Table 2.1). By May 1989, many of the techniques and lessons learned were being transferred to other parts of Thailand including Krabi and Surathani provinces.

Table 2.1. Private Sector Participation in Phuket's Coral Reef Protection Program.

Corporation / local group	Activity / Material	Estimated Value (Baht)
Kodak (Thailand) Ltd.	13 signs 4,000 posters 10,000 brochures	300,000
Karon-Kata Diving Group	5 mooring buoy systems plus installation	15,850
Phuket Rotary Club	3 mooring buoy systems	7,200
Phuket Island Resort (at Hae Island)	5 mooring buoy systems 10 small buoy systems food and lodging	20,000
Phuket Island Diving Shop	6 mooring buoy systems 12 small buoy systems buoy installation	24,000
Phuket Diving Association	installation of mooring buoys at Shark point, Big Racha, and Patong Bay	
Matlang Resort	4 mooring buoy systems	8,800
Thai Airways International Diving Club	4 mooring buoy systems	8,800
WET Diving Group	4 mooring buoy systems	8,800
DUGONG Group	mooring buoy installation	
Mr. Ashley J. Boyd	100 slides	200,000
Promotion Diving Center 20 slides	diver training 20 slides	47,500
Holiday Diving Club, LTD	20 slides	40,000
	TOTAL	700,950

2.3. Recommended Policies, Measures and Actions

POLICY 1: Maintain and Promote the Multiple Uses of Phuket's reefs.

Measure 1: ONEB, the Department of Fisheries, the Royal Forestry Department, and the Provincial Government will zone the reefs surrounding Phuket using existing laws.

Action 1: Reefs will be assigned to three zones based on: coral condition, existing use, local socio-economic conditions, and the existing laws, and regulations. The zones will be mapped by the ONEB regional office (Figure 2.4), and are:

(1) Restricted/Conservation Zone: Reefs of Nai Yang Beach. This zone is set aside for conservation and scientific research. All types of fishing and anchoring are prohibited. This zone corresponds to Phuket coastal water quality standards for coral reef conservation.

(2) Recreational Zone: Reefs of Patong Beach, Poo Island, Kata Noi Beach, Hae Island, Racha Noi Island, Dok Mai Island and Hin Moo Sang. This zone provides for an intermediate level of protection and includes reefs set aside for recreational purposes. All fishing is prohibited, and anchoring is restricted to mooring buoys. Water quality must be maintained within ONEB's recreational water quality standards.

(3) General Use Zone: Reefs of Bang Tao, Laem Son (Surin Beach), Karon Noi Beach, Sen Bay, Man Island (Nai Harn Beach), and Racha Yai Island. Here, all legal uses of coral reefs, including research, recreation, fishing, and anchoring are permitted.

Action 2: Provincial Government and the Tourism Authority of Thailand (TAT) will undertake a public promotion campaign of the coral reef zoning plan. Brochures, posters, and the zoning map will be produced and circulated to inform reef users and the private sector.

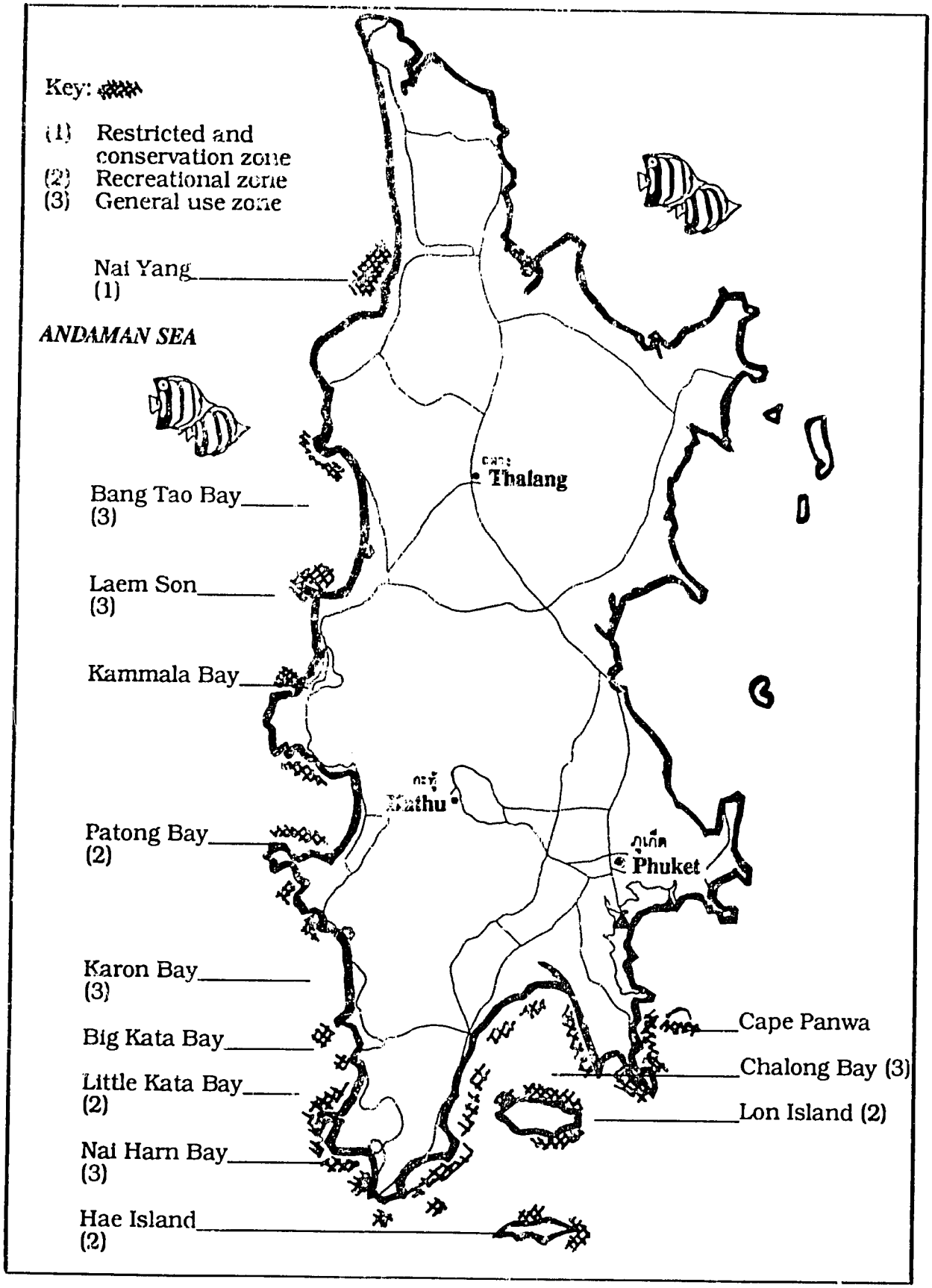


Figure 2.4. Proposed Zoning of Phuket's Coral Reefs.

POLICY 2: Promote the Recovery and Enhancement of Coral Reef Habitat.

Measure 1: ONEB and the Provincial Government will strengthen pollution control measures for coastal waters near reefs.

Action 1: ONEB should apply coastal water quality standards to areas other than Karon in accordance with the coral reef zoning plan. Water quality at all reefs zoned for "Conservation" must meet ONEB standards for coral reef conservation. Water quality for all reefs zoned "Recreation" must meet ONEB standards for swimming.

Action 2: ONEB regional office should undertake a cooperative water quality surveillance and compliance program with the Department of Fisheries, PMBC, and Provincial Government. A local unit will be trained to sample water quality over coral reefs and record any violations to the standards. This activity will be coordinated with other monitoring actions presented in the "Water Quality" chapter.

Action 3: ONEB should modify its EIA procedures when considering new development in Karon, Kata, and Patong to address the possible impacts of proposed developments on coral reefs. EIA reviews and approvals of coastal developments will take coral reef zoning into consideration.

Measure 2: ONEB, Provincial Government, and other agencies should cooperate to reduce degradation associated with tourism and fisheries on coral reefs.

Action 1: The Department of Fisheries (DOF), the Marine Police, the Navy, and the Department of Harbor should prepare a coordinated offshore surveillance and enforcement program. High priority will be assigned to coral reefs zoned for "Conservation" and "Recreation."

Action 2: DOF should establish a traditional fisheries extension program along the west coast of Phuket to enhance awareness and support for coral reef conservation among local fishermen. A fisheries officer will be trained to promote the use of more appropriate or improved fishing practices and gear, particularly among traditional fishermen involved in shell and ornamental fish collection or small-scale operators involved in bottom-trawling.

Action 3: Provincial Government and ONEB in cooperation with the private sector should continue to install mooring buoys in the General Use and Recreational Zones as designated in the zoning plan.

Action 4: Provincial Government, TAT, and the Department of Harbors should undertake a campaign to encourage tour boat operators to navigate appropriately near coral reefs. The campaign should include seasonal workshops to train boat operators in the use and maintenance of mooring buoys, distribution of information to escort guides and tour company officials on how to promote appropriate conduct among passengers and to discourage coral collection and littering.

Measure 3: DOF should establish a stock monitoring and recovery program for lobster and other depleted reef species.

Action 1: DOF should make stock assessments of spiny lobster and giant clam populations along the west coast and offshore reefs. These studies will estimate population size, age and sex distribution, recruitment rates and estimate harvesting pressure. This information will provide the basis for an experimental reef fishery management scheme in the Phuket area.

Action 2: DOF should formulate and implement experimental lobster fishery regulations with the cooperation of local fishermen.

Measure 4: DOF, the Royal Forestry Department (RFD), and the private sector should conduct a crown-of-thorns (COT) eradication program.

Action 1: DOF and the private sector should undertake a COT eradication campaign designed to raise diver awareness of COT and its effects on reefs.

Action 2: DOF should train volunteer divers in the eradication techniques and organize regular COT eradication events.

Action 3: DOF, RFD, and the private sector should establish a voluntary COT reporting pr , encourage recreational divers to report COT sightings using a s rdized post-card.

Measure 5 DOF, RFD, and ONEB should implement a cooperative coral reef monitoring program.

Action 1: DOF, RFD, and ONEB should establish a coordinated coral reef monitoring program in the Phuket vicinity. This will require the selection of long-term monitoring sites, standard sampling methodologies for key parameters, and data base management. The program should be simple and low-cost to ensure its sustainability. Key parameters for the program will be: temperature, salinity, nutrients, transparency, live/dead coral cover, and evidence of disease, breakage, or algal overgrowth.

Action 2: DOF, RDF, and ONEB should train a local unit of government officials and volunteer divers in simple coral monitoring techniques.

POLICY 3: Enhance Local Commitment to Coral Reef Management.

Measure 1: Provincial government, ONEB, and TAT, in cooperation with the private sector, should continue the local promotion campaign for coral reef protection.

Action 1: ONEB should initiate a new public information campaign that links coastal water quality to coral reef health.

2.4. Implications for National Policy

CRMP's coral reef management project in Phuket provided the Royal Thai Government with valuable experience on how a community-based approach to coral reef habitat management can be approached successfully. A National Coral Reef Management Strategy is now being formulated based in part on the important lessons learned in Phuket. These included the following:

2.4.1. Focus on priority problems

The success of the first "planning" phase involved sorting immediate, visible and relatively simple reef management issues from more complex problems. Care was also taken in evaluating the socio-economic aspects of each problem, understanding reef users, and identifying target groups for community action.

The Phuket demonstration project strengthened island-wide and national interest in a national coral reef management strategy. Having gained practical experience in community-based approaches, it now is appropriate to address the more difficult coral reef degradation issues, including:

(1) Limiting the development of tourism and recreational activities to the carrying capacity of coral reefs;

(2) Resolving conflicts between coral reef protection and coastal land use, particularly coastal development that reduces nearshore water quality; and

(3) Reducing and mitigating the social and economic impacts of declining fisheries and reef productivity.

All of Thailand's coral reefs should be assigned to the four management categories, with management objectives and a process for allocating uses and reducing damage at each reef. A national-provincial reef management partnership must consider the need to control offsite impacts on coral reefs, including controls over sedimentation and water pollution. Because most offsite problems are generated on land, the national coral reef management strategy must be one element of a national land use strategy. Specifically:

* Thailand's EIA process, when applied to land development or mining, must consider the impacts of land-generated pollution and sedimentation upon coral reef communities;

* Water quality standards for coral reef communities must be linked to mechanisms for preventing problems at their source; and

* ONEB should coordinate a national coral reef management strategy, but management and enforcement must be the responsibility of the Departments of Fisheries and National Parks.

2.4.2. Select simple, cost-effective solutions

Both the coral reef signs and the mooring buoy installation were selected as an initial focus because they relied upon simple, known technical solutions to clear and easily understood problems. Both activities offered clear benefits to the

private sector. The measures were perceived as tangible actions and their installation and maintenance provided opportunities for citizen involvement. This same approach should be adapted when similar programs are initiated in other parts of Thailand.

2.4.3. Provide opportunities for local testing of techniques

While encouraging local participation in coral reef management, central government also:

(1) Provided public information to local users about the value of the reefs and the causes of their degradation;

(2) Offered specialized training for volunteer divers and other local residents who wanted to participate in reef protection;

(3) Demonstrated the on-site feasibility of simple technical measures at two trial sites prior to undertaking and island-wide program; and

(4) Identified and endorsed local arrangements for continuing habitat management.

2.4.4. Consider the incentives and constraints to local participation

A key to securing local involvement in coral reef protection was knowing what to ask of different groups. Each local target group had its own incentives and constraints. For example, local dive shops and tour boat operators were more available before and after the peak of the tourist season, and were most likely to assist if they saw a benefit to themselves or their businesses.

3. Promoting Efficient Land Use

3.1. Findings of Fact

3.1.1. Importance of Planned, Efficient Land Use

Planned land use is essential for development and maintenance of coastal tourist resorts where scenic land areas, beautiful beaches with clear water, and pleasant villages, are essential values. Water quality, coastal habitats and virtually all other environmental values are affected by land use and development patterns.

In Patong and Karon/Kata, for example:

* The unregulated development of the bottomland has resulted in near-urban environments characterized by incompatible adjacent land uses, increasing congestion, lack of open space, and a loss of scenic and aesthetic values.

* On the hillsides, excavations continue to be enlarged to obtain earth-fill. Visible throughout the watershed, these unvegetated quarry slopes greatly degrade the appearance of the entire community, and they release tremendous quantities of sediments, which clog streams and bays.

* Soil from hillside excavations is being used to cover remaining paddies and wetlands to make elevated (less flood prone) building sites. However, this increases the flooding in surrounding areas as the overall water storage capacity of the bottomlands is reduced.

3.1.2. Land Use in Phuket

Phuket Island, which measures 49 by 19 kilometers, is Thailand's largest island. It remains principally agricultural, with over half its land area in rubber and coconut plantations (Figure 3.1). Primary changes in land use over the past two decades have included a resurgence and expansion of rubber plantations, loss of native forests, rapid tourism development of west coast beaches, expansion of mariculture along the north-east coastline, abandonment of most land based tin mines, as well as earth-filling of mangroves and other wetlands to create new land around Phuket town. Phuket has no island-wide land use plan, except for roadway routes.

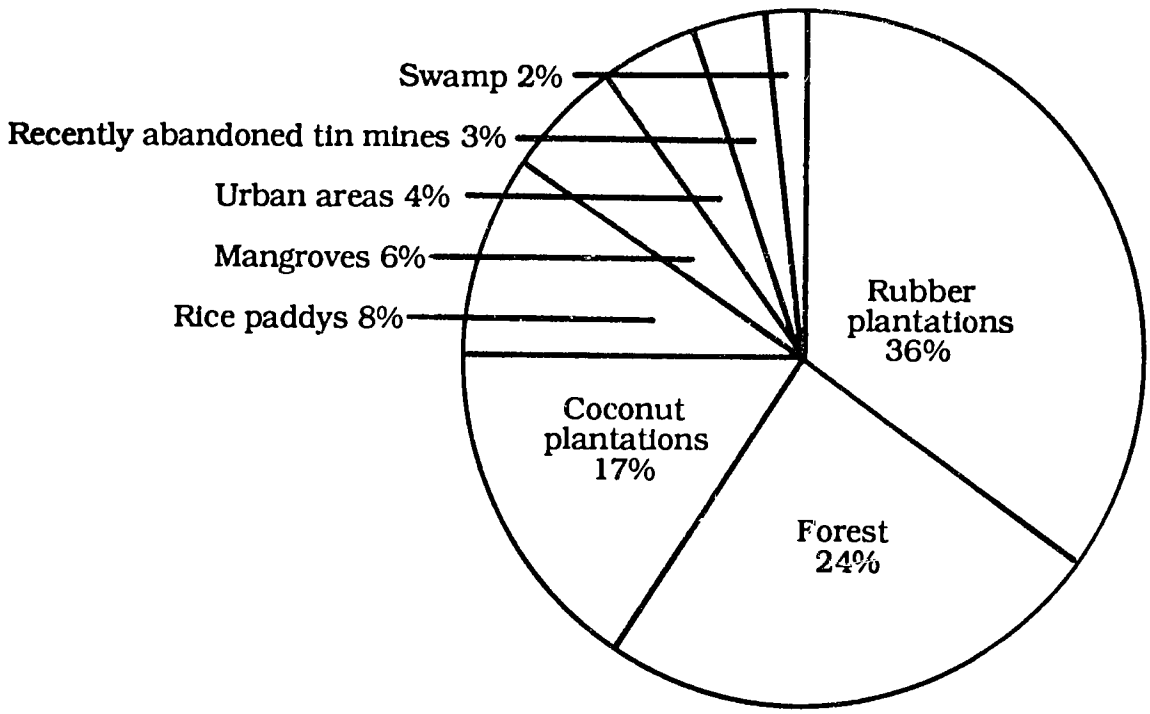


Figure 3.1. Overall land use on Phuket Island, in 1989.
Note that 12 percent of Phuket Island has been mined.

3.1.3. Land use In Patong and Karon

The following observations are apparent in Patong and Karon:

(1) The bottomlands of both watersheds have tourism-dominated economies that have exploded within the last ten years. Hotels, restaurants, and shops now occur throughout both bottomlands, which are becoming urbanized, so that little bottomland open space is expected to remain. Rice is no longer grown in either watershed because the paddies can no longer be flooded or drained as needed.

Land use problems are increasing in Patong, Karon, and Kata. Thailand's sudden tourist boom caught most Phuket communities unprepared, so that local land-use planning and infrastructure development for roads, public buildings, parks, open spaces, solid waste management, and municipal services have fallen behind development and land use control. Regulations to protect environmental quality and control land-use were not put in place. Once major land use changes occurred in the absence of regulations, so that the environmental quality in each watershed has suffered, as evidenced by hillside mining scars, trash-filled drains, periodic urban flooding, loss of open spaces, automobile-jammed streets, insufficient parking, and so on. Land use problems found in both watersheds are illustrated in Figures 3.3 and 3.4.

(2) On the hillsides, rubber has largely replaced native hillside forests. The ownership of plantation cultivated hillsides is not clear: many areas, previously believed to be protected as forest preserves, are now privately cultivated rubber plantations.

(3) Current jurisdiction of the Sanitary Districts covers only the community area, thus there is no local authority to manage wastewater treatment, solid waste and other common services outside the Sanitary District area.

(4) Patong's dune is unrecognizable. The front road has been paved onto its flattened crest. On the part that remains seaward of the roadway, vendors and tourists have eliminated about 80% of its former vegetation, by parking rental cars and motorcycles. Several buildings occur seaward of the road.

(5) Karon's dune remains for most of its length, but its stabilizing vegetation has been severely trampled by passing beach-goers. Vendors are becoming established on the seaward side of the dune, while taxis park on the landward side. At the southern end, one hotel and many vendors have occupied the dune's crest.

(6) Land price speculation is intense due to the widespread expectation that almost unbelievable profits can be generated from resort developments. Many landowners apply for development permits in order to drive up the price of their land.

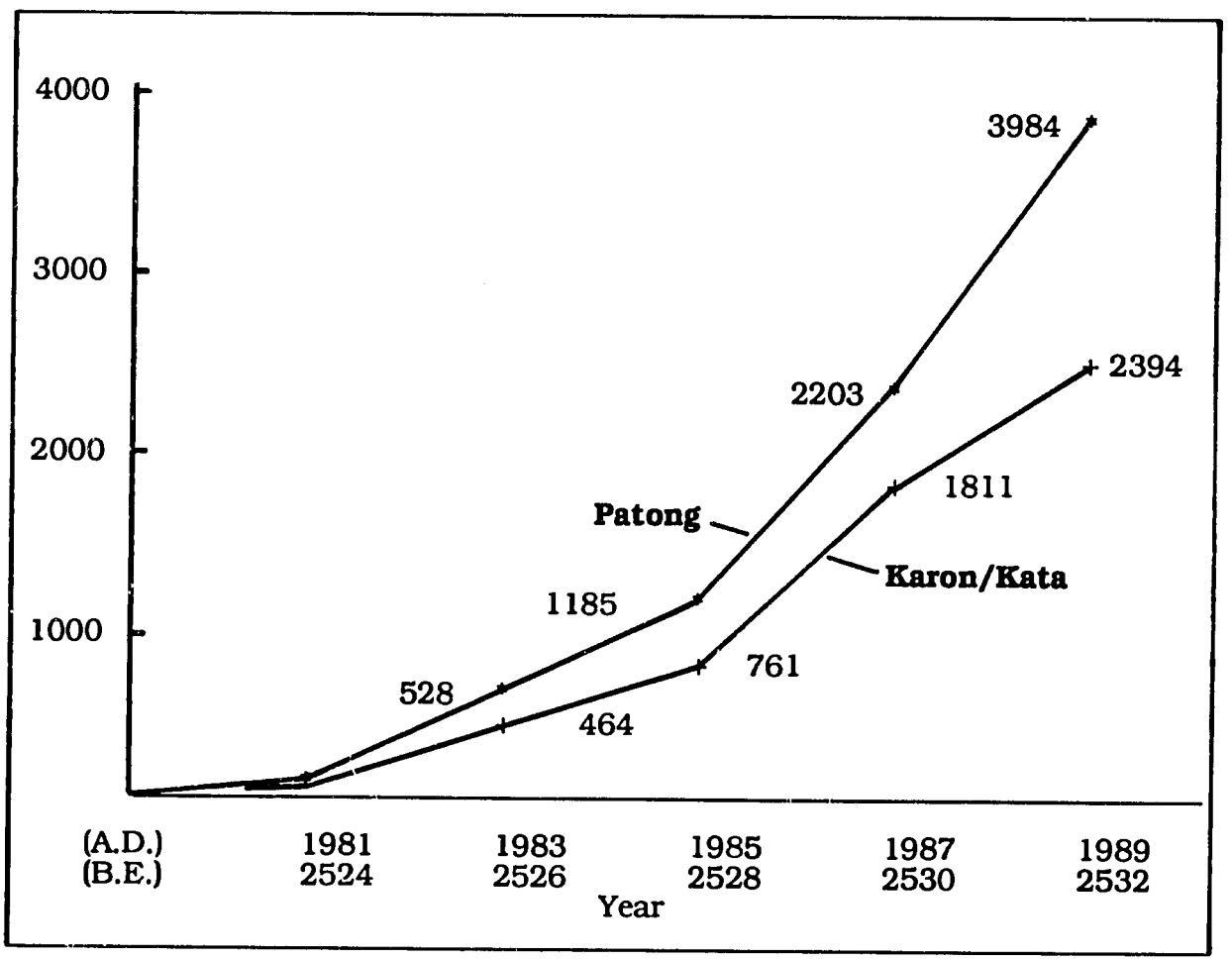


Figure 3.2. Numbers of Hotel Rooms in Patong and Karon/Kata, 1981 through 1989. From TAT Statistics and Research Division.

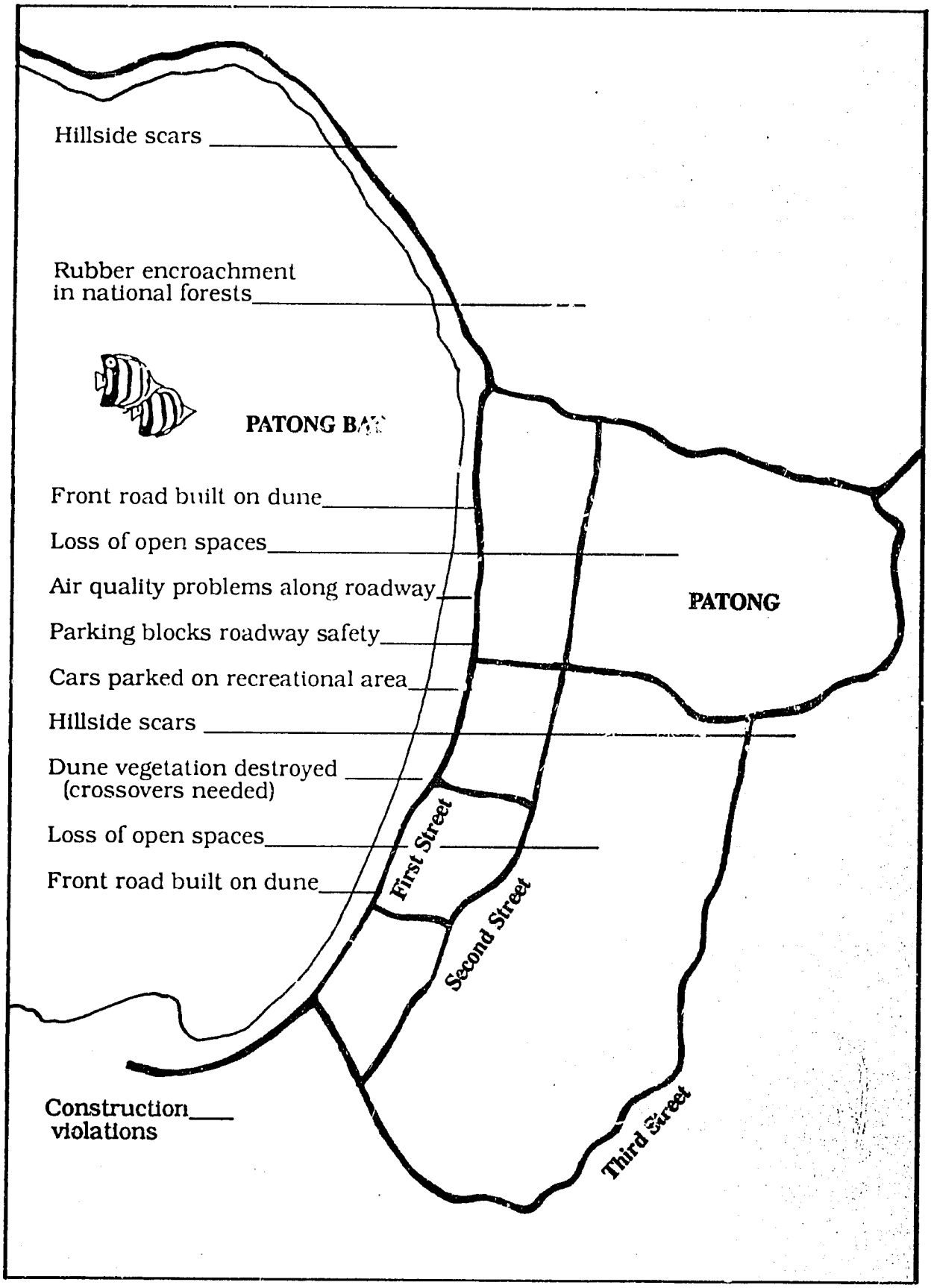


Figure 3.3. Illustrative Land use Problems in Patong Basin.

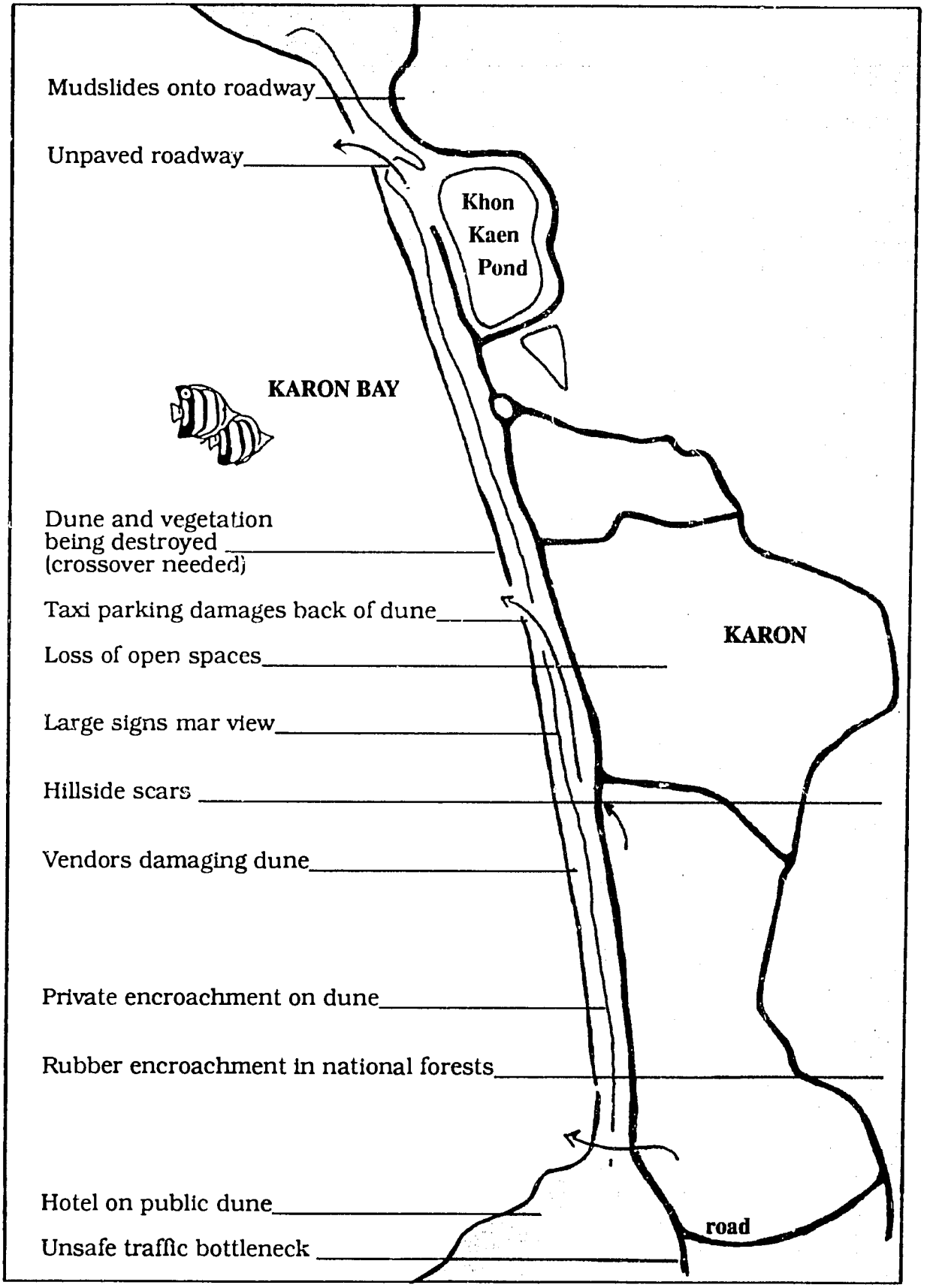


Figure 3.4. Illustrative Land use Problems in Karon Basin.

3.1.4. Land Use Planning in Patong and Karon

CRMP investigated land use in Patong and Karon watersheds and found:

(1) Despite numerous planning efforts, land development in Patong and Karon remains unregulated.

Little development had occurred in Patong or any west coast watershed in 1970. JICA (Japan International Cooperative Agency) developed a community plan for Patong in the mid-1970s. The Plan called for enclaves of tourism development (with adequate infrastructure) surrounded by green spaces. This rational plan was never adopted by any government authority nor implemented.

By the mid-1980s, Phuket, especially Patong, was beginning to grow rapidly. In July, 1984, Cabinet adopted policy guidelines recommended by the National Environment Board to control land based activities along Phuket's shorelines to minimize their impacts on coastal areas. Specific measures were taken, including:

* Enactment of a Royal Decree that applied the Building Control Act to the beach areas of Phuket;

* Promulgation of Ministerial regulations (through the BCA) that prohibited certain types of construction along the beach; and

* A directive to the Ministry of Interior's Town and Country Planning Division to prepare a Master Land Use Plan for the West Coast of Phuket.

Preparation of the Master Plan occurred primarily in Bangkok with little consultation between the planners and Phuket officials and residents. In 1990, the plans, which provided guidelines for land use in specific areas (Figures 3.5 and 3.6), were finally adopted by Ministerial Decree as authorized by the Town and Country Planning Act of B.E. 2518. However, during the almost six-year planning period that lasted from 1984 to 1990, the Patong and Karon watersheds changed dramatically.

Many hotels and shops were built within zones that would have excluded shops or hotels, in both Patong and Karon Master Plans. The incompatibility is more noticeable in Patong, due to its more rapid growth rate and fragmented land ownership pattern.

In spite of the many incompatible land use changes that occurred prior to their adoption, these plans still offer useful land use zoning guidelines to help establish areas of low, moderate, and high density residential and commercial development. Unfortunately, the plans do not specify such things as:

* minimum lot sizes within each zone;

* community parks, playgrounds, wetlands, and other open spaces;

* sites for future municipal service facilities; and

* regulations for site development.

Despite the existence of a number of technically adequate plans for land use control in Patong and Karon Watersheds, and the overwhelming evidence that such plans are needed, there has been no concerted effort to implement them.

(2) Hillside development remains unregulated. The hillsides of Patong and Karon watersheds are designated as forest reserves and are under the management control of the Royal Forestry Department, Ministry of Interior. In both watersheds, the natural forests have been cut and rubber plantations established. Such conversions have impacts on environmental quality, especially water quality, and are also a first step in converting public forest lands to private ownership. The current status of land tenure for the Patong and Karon watersheds remains unclear. This makes it virtually impossible to carry out meaningful planning or regulation of these lands.

3.1.5. Current Land Use Management Tools

Although Thailand possesses the necessary legal and institutional framework to control land development, the government has not done so. The laws that do exist have not been effectively utilized. Regulations for key laws, such as the Town and Country Planning Act, have never been written or adopted, so their utility remains untested. Tasneeyanond and Rubthong (1991), in their report for CRMP on *Legal and Institutional Issues Affecting the Management of Thailand's Coastal Region*, set forth the framework and constraints to effective implementation of land use controls in detail. The following is a summary of their findings.

3.1.5.1. Development Planning

(1) Environmental Impact (EIA) Provision of National Environmental Quality Act -- The EIA process in its current form can only, under the most extreme conditions, prevent development activities that would harm the environment. For example, proposed tin mining of several of Phuket's west coast beaches and near shore waters was not allowed as a result of an ONEB-prepared EIA. There are other weaknesses in the EIA procedure. Only large-scale developments require an EIA. For example, hotels with less than 80 rooms do not required an EIA, and are not required to provide wastewater treatment or other environmental mitigation measures. Also, EIAs do not produce binding mitigation measures. No regulatory agency currently is required to take any actions based on the outcome of the EIA process. EIAs only consider physical impacts on or near the proposed development. They do not consider how certain developments -- like the ring road or airport expansion -- will further fuel development and environmental degradation of Phuket.

3.1.5.2. Zoning Regulations

Zoning is used to regulate the patterns and density of development. The primary zoning tools in Thailand are Master and Specific Town Plans. Master Plans, when adopted, only offer guidelines; Specific Plans are binding.

(1) Master Town Plans -- The Town and Country Planning Act (TCPA) provides the Ministry of Interior's Town and Country Planning Commission with a mechanism to establish guidelines for land-use zones in a designated community or planning area. MoI promulgates and publishes a Master Town Plan in the Government Gazette for its implementation. However, Master Town Plans only offer guidelines and there are no set penalties for noncompliance.

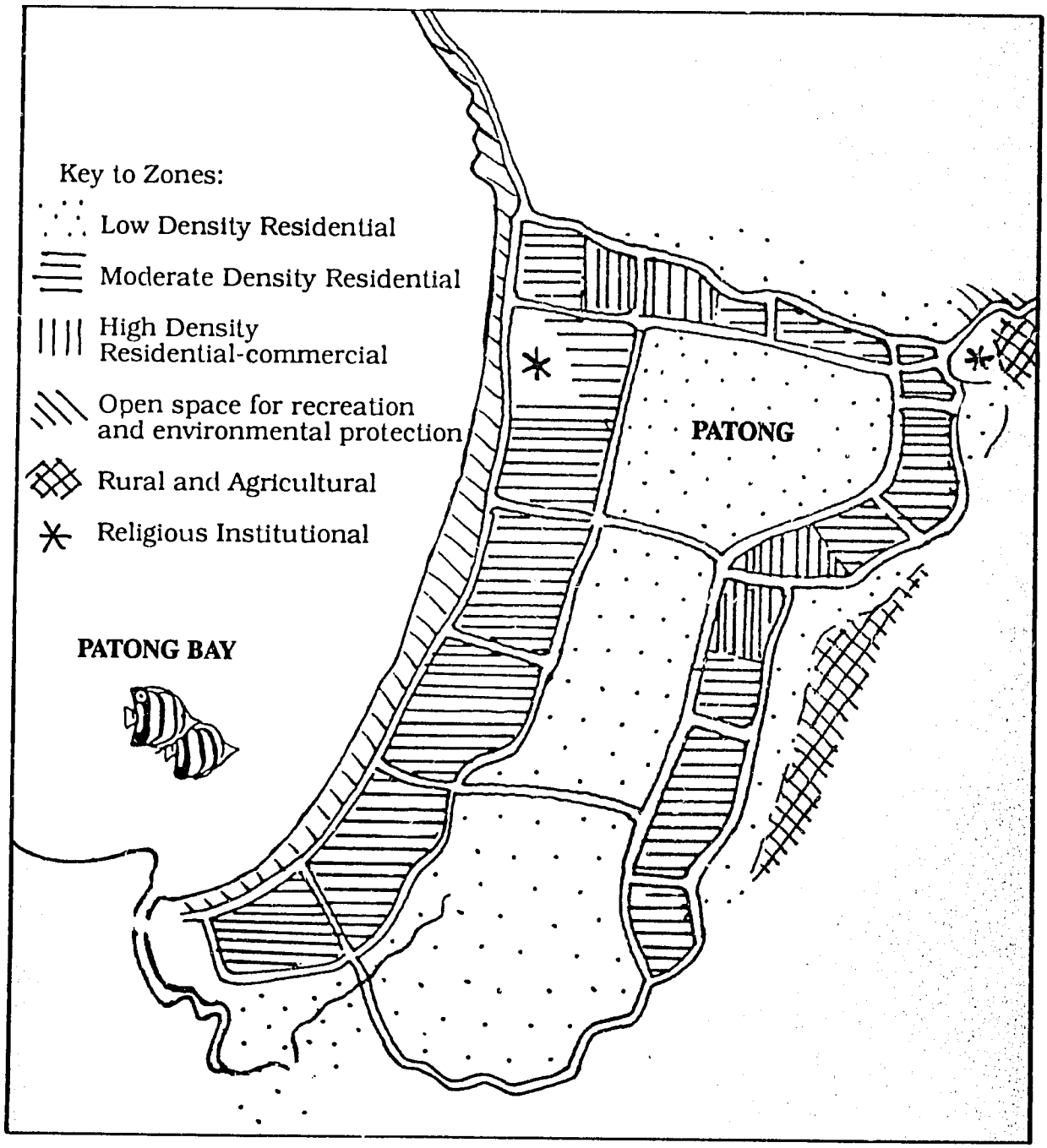


Figure 3.5. Master Town Plan Land use Zones for Patong, as prepared by the Ministry of Interior Town and Country Planning Division.

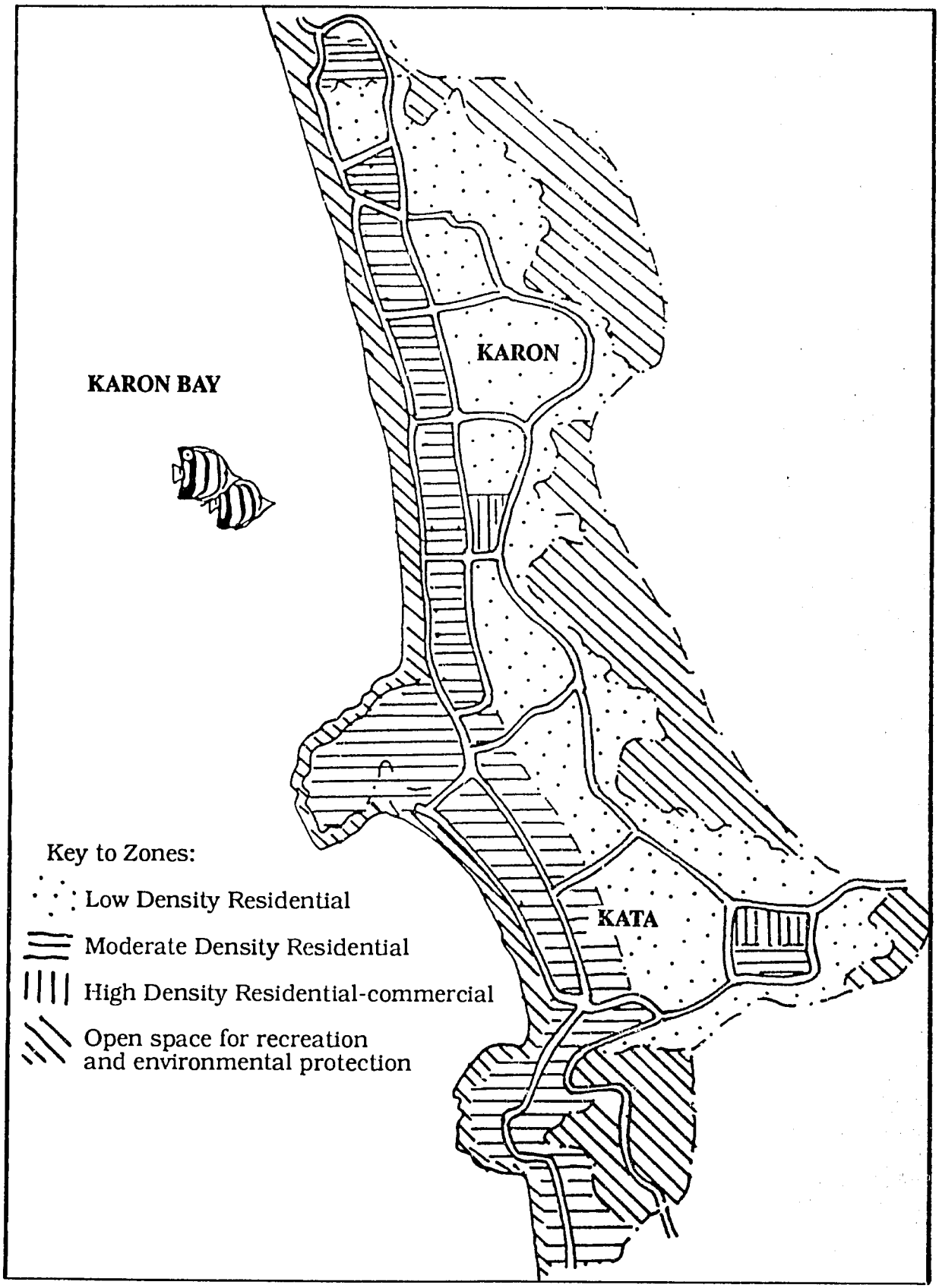


Figure 3.6. Master Town Plan Land use Zones for Karon/Kata, as prepared by the Ministry of Interior Town and Country Planning Division.

(2) Specific Town Plans -- The TCPA also includes provision for a detailed and stringent program to govern land use -- the Specific Town Plan. These require approval by Parliament prior to their implementation. A Specific Town Plan has never been formulated or adopted, reflecting the prevailing public attitude that favors unlimited land use freedom for development.

3.1.5.3. Site-specific Regulations

(1) Building Control Act (BCA) -- The BCA addresses both zoning and site development considerations. The BCA regulates some aspects of land use and site development in Patong and Karon within 200 meters landward of the mean high tide mark. Aspects of development currently regulated by the BCA include building height and the percent of a lot that can be covered. The BCA currently does not include regulatory standards for aspects of development that affect the environment such as wastewater treatment, fresh water conservation, or stormwater management. There is no legal barrier to making such needed additions to the BCA.

3.1.6. Implementation of Land Use Controls

The lack of implementation of land use controls rests not with Thailand's existing legal and institutional structures, but rather with their inadequate administration. Key problems include:

* Lack of clear ministerial guidelines that would allow the denial of development permits, based on environmental considerations;
* Failure to designate BCA zones or adopt enforceable land use plans in a timely manner;
* Political and financial limits placed on local authorities to fill gaps in the BCA through local ordinances; and
* Lack of effective enforcement actions.

3.2. CRMP's Land Use Assistance To Patong and Karon

Patong and Karon Sanitary Districts, volunteer citizens, local businesses, ONEB, and CRMP cooperated to improve land use management in Patong and Karon:

3.2.1. Beachfront Designs

Working with each Sanitary District, CRMP provided landscape engineering to develop model beach-front protection and enhancement designs for Patong and Karon.

3.2.2. Litter and Solid Waste Management for Patong

Patong's Sanitary District, local hotels, ONEB, and CRMP initiated a litter prevention campaign, in Patong, that included:

* 100 litter receptacles near the beach and other key areas.
* weekly, remove litter from all receptacles.
* weekly, pick up any litter from the beach.
* beach cleanliness zones, in which hotels and other businesses compete to maintain the cleanest areas.

3.2.3. Land Use Planning Guidelines for Patong, and Karon/Kata.

CRMP assisted Karon and Patong Sanitary Districts in the preliminary design of a watershed-wide land use plan (Chulalongkorn University Environmental Research Institute, 1990: *Landuse Planning Guidelines Project for Patong and Karon-Kata Communities and Western Loop Road Area in Phuket Province*). The recommendations provide background information, current trends, and suggested land use densities in all zones within each watershed.

3.2.4. Resources Profile of Phuket Island

ONEB and URI provided indexed maps and descriptions of the physical, biological and human resources of Phuket Island, in *Phuket: A Resource Profile.*

3.2.5. Phuket Coastal Issues Profile

ONEB provided a review of the resource issues affecting Phuket Island, along with companion reports for all 22 coastal provinces in Thailand.

3.2.6. Management Plans for Phi Phi National Marine Park

The Phi Phi Islands form one of Thailand's most visited national marine parks, and lie within a two hour ship passage from Phuket Island. CRMP assisted the National Park Department to prepare a management plan for the park (*Hat Nopharatthara - Mu Ko Phi Phi National Park Management Plan* 1990-1994).

3.2.7. Analysis of the Legal and Institutional Framework for Land use Management.

CRMP commissioned a detailed analysis of the legal and institutional framework for land use management in Phuket (Tasneeyanoid and Rubthong, 1991). The study provided essential background for the formulation of the Action Plan.

3.3. Recommended Policies, Measures, and Actions

Policy 1: Effectively manage new development in Patong, Karon and Kata

Measure 1: MOI should expand the BCA zone to cover the entire watershed, from the mean high-water mark to the top of the hillsides. While reserve forest lands will continue to be administered by the Royal Forestry Department, inholdings and development on leased areas must also meet BCA construction regulations.

Measure 2: MOI should expand the Sanitary Districts to cover the entire watershed, concurrent with the expanded BCA area coverage.

Measure 3: MOI should empower the Sanitary Districts with BCA enforcement authority. MOI will provide financial assistance to the Sanitary Districts and require them to enforce the BCA locally.

Measure 4: In Patong and Karon, the Town and Country Planning Division should work with the Sanitary Districts to develop implementable Specific Town Plans.

> Action 1: The Sanitary Districts should use the Master Plans developed by MOI's Town and Country Planning Division as their zoning plans until Specific Plans are developed.
>
> Action 2: The Karon Sanitary Districts, with technical support from MOI and ONEB, should agree to a process and timetable for preparing and adopting a Specific Town Plan. The process should include informal and formal mechanisms for consultation among planners, agency officials, local government, businesses, and local citizens.
>
> Action 3: When completed, the land use plans should be attached with a specific request that Cabinet order MoI to implement the Specific Town Plan consisting of all necessary land use control measures. The Specific Town Plan also must be approved by Parliament to be binding.

Measure 5: Patong's and Karon's Sanitary Districts, should work with MOI to establish maximum development densities for land areas, in which the BCA should apply.

Measure 6: Future roadways, parks, and open spaces should be designated within each watershed.

Policy 2: Conserve hillside lands and vegetation in Patong, Karon, and Kata watersheds.

Measure 1: RFD and the Department of Land Development, should reassert authority over public lands. Many rai on the hillsides have been illegally taken from the public and their native forests have been converted to coconut or rubber plantations. Using historical aerial photographs, these encroachment violations should be identified, for assertion of public ownership.

Measure 2: RFD should prohibit hillside quarrying, construction, or site modifications that cannot be stabilized against erosion. Implementation measures could include requiring excavators to develop an approved excavation and reclamation plan, and provide substantial performance bonds to assure that

siltation is not permitted to leave the site and that the completed area is properly reclaimed. The plan and bond should require sedimentation ponds and should leave no unvegetated areas for five years after reclamation (when the performance bond would be returned to the excavator). For existing hillside excavations, which currently do not trap sediments on site, bonded excavation and reclamation plans should be formulated to provide realistic sediment controls for future excavation as well as to correct existing erosion problems.

Policy 3: Discourage Speculation of Building Permits

Measure 1: MOI should prohibit development permits from being transferred with land ownership title transfers. Construction permits are often sought as a method to increase the speculative price of land. By prohibiting the transfer of development permits, land speculation would become less intense, and the local Sanitary Districts would have a greater opportunity to acquire sites for community ponds, open spaces, sewage treatment sites, and so on.

Measure 2: MOI should routinely cancel any construction permit that has remained inactive for one and a half years, so that after one and a half years, a new construction permit application must be submitted and reviewed according to current permit requirements.

3.4. Implications for National Policy

The legal and institutional framework for controlling land use management in Thailand currently exists. What is lacking is both the political will and administrative mechanisms to make this framework effective. Key issues that must be addressed include:

(1) ONEB environmental standards and outcomes of the EIA process are advisory only. To be effective they must be adopted and implemented by the appropriate implementing agency.

(2) ONEB's EIA procedure, which has not been used as originally intended, is not a substitute for environmental management regulations. For example, the Ring Road and the Airport expansion were constructed without EIA consideration of their impacts on the west coast beach watersheds. Both EIAs only looked at the physical impacts on-site and in the immediate vicinity of the Airport and Ring Road construction projects. Instead, future EIAs must effectively anticipate and evaluate the region-wide impacts of major projects that trigger the "boom" development cycle. The findings and recommendations must then be incorporated in development planning and implementation

(3) Thailand must find an effective mechanism to control the density and type of development that occurs on private property. The existing legal tool for effective land use control (the Town and Country Planning Act's Specific Town Plan) has never been used. Either sufficient political will must be built to use this tool, or other, more politically acceptable but effective tools must be developed.

(4) The Building Control Act, which is the only site development control mechanism in Thailand, lacks sufficient environmental standards. Currently, it addresses building height and area coverage. It must be amended to include environmental considerations such as water conservation, waste disposal, stormwater management, and so on.

(5) Thailand needs to build an institutional mechanism to address small scale watershed planning. There is no linkage between the management of hillsides, which is managed by the Ministry of Agriculture, and urbanized or rapidly developing areas, managed by Ministry of Interior.

(6) Land use management is most effective when carried out at the local level. Because most Sanitary Districts lack the expertise, authority, and financial resources to plan for and enforce management regulations in their areas, MoI needs a mechanism to strengthen and assist Sanitary Districts to carry out their responsibilities.

(7) All effective land use management ultimately rests on the ability of government to place some restrictions on how private property is used. Private property rights in Thailand are protected as a constitutional right of the Thai people and there is little political support for limiting such rights. Yet if Thailand is to protect the *public good* it must find a workable balance between the rights of private property owners and the maintenance of environmental quality. This is a major challenge.

4. Building Citizen Participation in CRM Decision-Making

4.1. Importance of Public Awareness and Participation.

Resource management programs can succeed only if they are perceived as necessary and fair by a large segment of affected populations. Therefore, public awareness and participation are essential aspects of the Phuket coastal management strategy. These programs create the conditions necessary to implement effective CRM policies and measures through:

(1) Increased public appreciation -- Public awareness programs help promote an appreciation of Phuket's natural environment, including clean water, healthy coral reefs, and the link between such resources and the local economy. When an environmental promotion campaign is effective, the community begins to place higher value on its coastal resources.

(2) Informed local residents and resource users -- The dissemination of information leads to better understanding of coastal resources and potential sources of damage, such as pollution, erosion, and habitat destruction. When the information is given to resource users, such as land owners, tourists, or fishermen, the information can bring about lasting changes in behavior and an interest in avoiding further resource damage. The result can be voluntary compliance to regulations.

(3) Increased public involvement and support -- Appreciation and understanding among local residents can lead to support for management measures and a willingness to participate in resource management decisions, particularly where there are strong local incentives for getting involved.

(4) Fair balance of public and private interests -- Active community participation in coastal management increases the stake that residents have in their environment. Since a wider range of interest groups are represented in the CRM process, this helps government balance all private sector interests.

4.2. CRMP's Public Awareness and Participation Activities on Phuket

The Phuket Demonstration Project has featured (1) an emphasis on building public awareness of resource management issues and support for their solution; and (2) numerous attempts to define a workable and meaningful consultative process to formulate coastal resource management strategies that address and balance the interests and needs of national and local government and the private sector. Used in combination, both elements -- awareness and participation -- were instrumental to the success of the coral reef protection activities described in Chapter 2 and the formulation of this Action Plan.

4.2.1. Public Awareness Campaigns

During the early stages of CRMP, local awareness and understanding of coastal resources and issues were low. Public attention was focused on the remarkable growth of Phuket's tourism sector, but there was limited understanding of how that growth was linked to the degradation of environmental amenities. Relevant information about the status of coastal resources such as water quality, coral reefs, and land use were contained in official government reports that were not locally available.

Simultaneously, resource users, particularly tourists and local businesses serving them, were increasing rapidly. The new land owners and foreign visitors were largely unaware of deteriorating coastal conditions, particularly where these were not visible. Conflicts between changing land uses and traditional uses were also increasing but there were no mechanisms to resolve these conflicts.

In undertaking a public awareness campaign in Phuket, the CRMP team took considerable care to identify appropriate target groups. Many individuals, businesses, and local associations on the west coast of Phuket benefit from coastal resources and, consequently have an incentive to support and get involved in CRM activities. Targeting these users was a priority.

Coral reefs were selected as the initial theme for the public awareness campaign because their protection was relevant to a cross-section of tourism-related businesses and groups; the issues associated with their management were known and could be easily communicated; and solutions to problems -- such as site damage -- were technically simple but required participation of local government and citizens to implement. From 1987 to 1990, CRMP embarked on a campaign carefully tailored to local issues that:

* Built consensus that a set of reef management problems required special attention;
* Increased understanding among key target groups of the nature and causes of the problems affecting reefs and their particular interest in solving problems;
* Focused on issues and not on promotion of a particular agency or program;
* Defined and publicized tangible actions that individuals could take to solve problems; and
* Utilized local resources, including the local media and experts, the Phuket Teacher's College, the Phuket Aquarium, to prepare and distribute information.

Relevant technical information on the status of coral reefs, the extent of anchor damage and the use of mooring buoys was incorporated into attractive brochures, posters, signs, and short videos. These materials were used in combination with community events such as a Coral Reef Day and specialized seminars on coral reef conservation for tour boat operators, hotel operators, and CRM volunteers. These efforts helped to motivate citizens to take action to protect coral reefs and insist that their government also take action to solve the problems affecting reefs.

During the latter stages of CRMP, the public awareness campaign was broadened to include other CRM issues. Technical findings on water quality, solid waste disposal, and land use were disseminated in simple and appealing CRMP fact sheets. In the end, CRMP's public awareness campaign succeeded in reaching a broad range of major resource users, including hotel operators, local land owners, tour companies, escort guides, tour boat operators, tourists, divers, dive clubs, local scientists, experts, small-scale fishermen, local government officials, the Phuket Action Committee, local schools, and local media.

4.2.2. Public Participation and Formulation of the Action Plan

CRMP relied on several vehicles to encourage local involvement in the formulation of this Action Plan. A local Action Committee was formed by the Governor to represent varied interests in the community. Local consultants worked with national experts and the CRMP team to analyze technical issues and prepare findings for presentation to the Committee and at several public meetings. Three workshops were held during 1988 through 1990 to solicit opinions and suggestions:

(1) CRM Workshop, Phuket, March 1988 -- Thai experts presented findings from preliminary investigations of issues and recommendations for corrective actions to key problems. Phuket officials and citizens evaluated the reports and recommended additional studies and actions during discussion sessions.

(2) CRM Workshop, Bangkok, October 1989 -- Thai experts presented preliminary results of resource management studies on water quality, coral reefs, soils mapping, and land-use, as well as the legal tools available for resource protection and management. Local, provincial, and national officials as well as concerned citizens provided comments and suggestions to guide pending recommendations.

(3) CRM Workshop, Bangkok, March, 1990 -- Thai legal experts presented final results of resource management studies and law to Phuket citizens and officials, allowing considerable discussion after each presentation. Participants were provided initial **Patong, Karon/Kata Action Plans** for review and comment. Refinement of these preliminary action plans led to this current **Action Plan** document.

(4) What Future for Phuket Workshop, Phuket, April 1991 -- ONEB presented a draft version of this **Action Plan** to Phuket officials and residents, and representatives of central government. Based on workshop discussions and endorsement, the measures included in this document are being forwarded to Cabinet.

Through these workshops and meetings, the ideas included in this plan were discussed among citizens, consultants, and local, provincial, and national officials. This process was useful even though it was ad hoc and voluntary, and participants did not always understand clearly how their input would be used. Even today, the commitment to seek public input on future land use decisions rests on individual initiative and informal procedures, but public participation and consultation is not a requirement of Thai environmental management law.

4.3. Recommended Policies, Measures, and Actions

Policy 1: Phuket residents and resource users will have access to accurate, current, and relevant information about coastal issues and the state of their coasts.

Measure 1: ONEB and Provincial Government will establish a cooperative monitoring program for key coastal resources and habitats, in cooperation with other resource management agencies.

Action 1: ONEB, with input and cooperation from DOF, RFD, and Provincial Government will develop a cooperative monitoring plan that will track selected indicators of development and environmental quality along the west coast of Phuket.

Action 2: ONEB's Regional Unit will train provincial staff, the regional staff of central agencies and, as appropriate, local groups in Phuket (colleges, schools, dive clubs, etc.), to carry out the monitoring program.

Action 3: ONEB Regional Unit will establish a provincial coastal data base.

Measure 2: ONEB will assist Provincial Government in disseminating understandable state-of-the-coast information to Sanitary Districts, municipalities, the media, local organizations, and citizens.

Action 1: ONEB will prepare and distribute understandable information on the state of the coast, through a variety of communication techniques.

Action 2: ONEB will provide specialized training for local officials and citizens to increase their capability in interpreting information about the environment.

Measure 3: ONEB and Provincial Government will develop agreements with TAT and local businesses for funding local environmental awareness campaigns.

Measure 4: Resource Management Agencies with a presence in Phuket will establish education and extension programs to reach local schools, community organizations, business associations, and other resource users.

Action 1: ONEB will train provincial staff and members of Sanitary Districts involved in development decisions about basic environmental management concepts.

Action 2: ONEB will provide funding and technical assistance for the development of water pollution control and environmental planning courses at the community college.

Action 3: ONEB will provide funding and technical assistance for the development of a "Coastal Environments" curriculum by the Teacher's College for use in primary and secondary schools.

Action 4: RFD will develop a coastal environmental education program for Nai Yang National Marine Park that targets both tourists and local residents.

Action 5: DOF will expand its education and extension activities associated with the Phuket Marine Biological Station and Aquarium.

Policy 2: Phuket residents will be able to participate in the development decision-making process.

Measure 1: ONEB and provincial government will support the creation of forums and organizations that will allow public participation in decision-making.

Action 1: The Governor will continue the Phuket Action Committee as a government/private sector forum to promote discussion of initiatives and developments that affect coastal resources. ONEB Regional Office will assist the Governor in the secretariat function for the committee.

Action 2: Sanitary Districts will establish local consultative committees that will be available to meet regularly with provincial and national government representatives to discuss developments that affect them. Each committee may develop a broad set of long-range management alternative solutions for their target issue, estimating the cost, potential funding source, and benefit of each alternative and presenting this information to the public to develop consensus.

Action 3: Government will promote opportunities for volunteer participation in CRM.

Measure 2: Provincial government will encourage the private sector and local groups to develop fund-raising programs for environmental protection and coastal resources management.

4.4. Implications for National Policy

In formulating a national approach to coastal resources management both public awareness and public participation must play prominent roles. From the Phuket experience the following lessons emerge as helpful guidelines in launching a national program.

4.4.1. Public Awareness Campaigns Play an Essential Role Throughout the CRM Process.

The heightened local awareness that has followed the coral reef campaigns is a foundation on which to build greater understanding and appreciation of other crucial CRM issues in Phuket and the Kingdom, such as the linkages among coastal land use, degradation of coastal habitats, and water quality degradation.

While government agencies have an important role to play, an effective public awareness program on coastal issues must reach beyond government agencies and include Universities and Teachers' Colleges, Non-government organizations and the media. These latter organizations are best able to reach key target groups and motivate people to take action at the community level. For such groups to be effective, they must have access to timely, accurate information about coastal

resources and issues. To encourage such efforts, central government can provide technical assistance, logistical support, and recognition of their activities.

4.4.2. Public participation is essential to effective Coastal Resources Management.

Experience has shown repeatedly that if resource management schemes are to succeed they must be accepted by the people who will be affected by them. Acceptance and endorsement are much more likely if people have been consulted during the formulation of the resource management scheme. For consultation and public participation to be productive, participants must have information; they must clearly understand their role in the planning process; and they must know how their input will be used in decision-making.

Currently, Thailand has no established formal mechanism to encourage citizens to participate in the resource allocation and management decisions that affect their lives and livelihoods. This can result in a lack of understanding and support for major developments and give rise to controversy and intense land use conflicts. A national CRM Program must directly address this situation by including a predictable, formal consultative process for CRM plan formulation and an open, predictable decision-making process for development decisions. Government must commit to early notification of coastal development proposals, public review of plans and proposals, and formal responses to community input.

4.4.3. The Benefits of Public Awareness and Participation Efforts are Great.

Effective public awareness and participation efforts greatly enhance the probability of successful implementation of resource management strategies. They can lead to:

* Much higher levels of voluntary compliance with the often restrictive measures required to maintain environmental quality;
* Increased political support for resource management efforts; and
* An attitude of "volunteerism" by the private sector that makes government's task easier. For example, NGOs may carry out their own education programs; businesses may donate time, money, and sometimes land to community efforts; and individuals may participate in special events, clean-ups, and work days.

5. IMPLEMENTATION SCHEDULE BY POLICY, MEASURE, AND ACTION

5.1. WATER QUALITY Policies, Measures and Actions

Measure/Action	Workplan 91 92 93 94 95	Budget (Thousands of Baht)	Lead Agency
POLICY 1: Develop water supply infrastructure in Karon, Kata, and Patong.			
Measure 1: Adopt/enforce ONEB drinking water standards for hotels & restaurants	continuously	50/yr	MOI
Measure 2: Identify possible hillside reservoirs	91	10	DOI
Measure 3: Prohibit disturbances above possible reservoir sites			
Act 1: Map hillside ownerships	91	150	RFD
Act 2: Curtail leases of hillsides prevent cutting in watersheds	continuously	50/yr	RFD
Measure 4: Identify municipal well sites	91	200	DOM
Measure 5: Prohibit land disturbances within 50 meters of well sites	continuously	10/yr	MOI
Measure 6: Add water conservation to BCA	91		MOI
POLICY 2. Provide Adequate Wastewater Treatment in Karon, Kata, and Patong.			
Measure 1: Adopt/implement sewage treatment strategies			
Act 1: Acquire land & build municipal sewage plant in Karon and Kata	91	100 million	MOI
Act 2: Expand Patong's Municipal sewage treatment plant	91 92		MOI
Act 3: Amend BCA	91		Cabinet
Act 4: Operate municipal treatment plants in Patong and Karon	continuously	250/yr	MOI
Act 5: Provide annual training for "package plant" operators	continuously	100/yr	ONEB
Measure 2: Assure ambient water quality			
Act 1: Establish ambient standards	91		
Act 2: Post warnings as necessary	continuously	10/yr	ONEB
Act 3: Double-wall chemical tanks	continuously		ONEB
Measure 3: Provide public information			
Act 1: Implement monitoring	continuously	100/yr	ONEB
Act 2: Analytical lab in Phuket	91	250	ONEB
Act 3: Report monitoring results	continuously		
Act 4: Advise public on wastewater treatment benefits & options	continuously	100/yr	ONEB/SD

POLICY 3. Mitigate flooding and siltation in Patong, Karon, and Kata.

Measure 1: Reduce stormwater flooding.			
Act 1: Improve Karon drainage system	91	12 million	MOI
Act 2: Buy key wetland areas	91 via bond	2.5 billion	MOI
Act 3: Protect sovereign wetlands	continuously	100/yr	MOI
Act 4: Prevent hillside encroachment	continuously	50/yr	RFD
Act 5: Prohibit clearcutting of steep slopes.	continuously	50/yr	RFD
Measure 2: Add stormwater measures to BCA	91		MOI

5.2. CORAL REEF Policies, Measures and Actions

Measure/Action	Workplan 91 92 93 94 95	Budget (Thousands of Baht)	Lead Agency
POLICY 1: Maintain and Promote the Multiple Uses of Phuket's Reefs			
Measure 1: Implement reef zoning plan			
Act 1: Assign reefs to zones	91		ONEB
Act 2: Public promotion campaign	91	100	ONEB
POLICY 2. Promote Recovery and Enhancement of Reefs			
Measure 1: Strengthen pollution control			
Act 1: Apply water quality standards	91		ONEB
Act 2: Water quality surveillance	continuously	100/yr	ONEB
Act 3: Modify EIA procedures	91	100	ONEB
Measure 2: Reduce reef degradation			
Act 1: Offshore surveillance	continuously	100/yr	DOF
Act 2: Fisherman extension program	continuously	100/yr	DOF
Act 3: Install mooring buoys	continuously	100/yr	ONEB
Act 4: Encourage good navigation	continuously	50/yr	DOH
Measure 3: Stock monitoring/recovery program			
Act 1: Stock assessment studies	91 92 93	100/yr	DOF
Act 2: Lobster regulations	92	50	DOF
Measure 4: Crown-of-thorns eradication			
Act 1: COT eradication campaign	91 92 93		DOF
Act 2: Train volunteer divers	yearly	50/yr	DOF
Act 3: COT reporting program	continuously	50/yr	DOF
Measure 5: Interagency Reef monitoring			
Act 1: Monitor local reefs	continuously	100/yr	DOF
Act 2: Train local monitors	annually	100/yr	DOF
POLICY 3: Enhance Local Commitment to Coral Reef Management			
Measure 1: Promotion campaign			
Act 1: Initiate campaign	91		ONEB

5.3. LAND USE Policies, Measures and Actions

Measure/Action	Workplan 91 92 93 94 95	Budget (Thousands of Baht)	Lead Agency
POLICY 1: Effectively manage new development in Patong, Karon and Kata			
Measure 1: Expand BCA to entire watershed	91		MOI
Measure 2: Expand SDs to entire watershed	91		MOI
Measure 3: Empower SDs with BCA authority	91	300/yr	MOI
Measure 4: Patong: Use MOI T & C plan	91		
Measure 5: Karon: identify land use zones densities	91	100	MOI
POLICY 2: Effectively manage hillside lands in Patong, Karon, and Kata.			
Measure 1: Expropriate hillside lands	91 92 93	100/yr	RFD
Measure 2: Prohibit unstable excavations	91	100	RFD
POLICY 3. Discourage Speculation of Building Permits			
Measure 1: Prohibit development permits from transfer with land title	91		Cabinet
Measure 2: Cancel inactive permits	continuously		Cabinet
POLICY 3. Formulate and Implement Watershed-wide Land Use Plans			
Measure 1. Prohibit construction that does not meet Patong master town plan	91		Cabinet
Measure 2: Karon: agree to process & timetable for specific land use plan	91	100	MOI

5.4. PUBLIC AWARENESS AND PARTICIPATION Policies, Measures and Actions

Measure/Action	Workplan 91 92 93 94 95	Budget (Thousands of Baht)	Lead Agency
Policy 1. Citizens will have access to accurate, current, relevant information			
Measure 1. Environmental quality monitoring			
Act 1: Develop cooperative monitoring plan	continually	100/yr	ONEB
Act 2: Train provincial staff	annually	100/yr	ONEB
Act 3: Provincial coastal data base	91	50	ONEB
Measure 2. Disseminate state-of-coast information			
Act 1: Distribute understandable information	continually	50/yr	ONEB
Act 2: Train local officials & citizens	annually	100/yr	ONEB
Measure 3. Local awareness campaigns	annually	50/yr	TAT
Measure 4. Establish extension programs			
Act 1: Train provincial staff	annually	100/yr	TAT
Act 2: Technical assistance	continually	200/yr	ONEB
Act 3: "Coastal environments" curriculum	91	50	ONEB
Act 4: Nai Yang educational program	continually	100/yr	RFD
Act 5: PMBC extension activities	continually	100/yr	DOF
Policy 2. Phuket residents will be able to participate in development decision-making.			
Measure 1. Forums and organizations			
Act 1: Phuket Action Committee	continually	75/yr	Province
Act 2: Local consultative committees	continually	75/yr	SD
Act 3: Opportunities for volunteer participation	continually		all

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