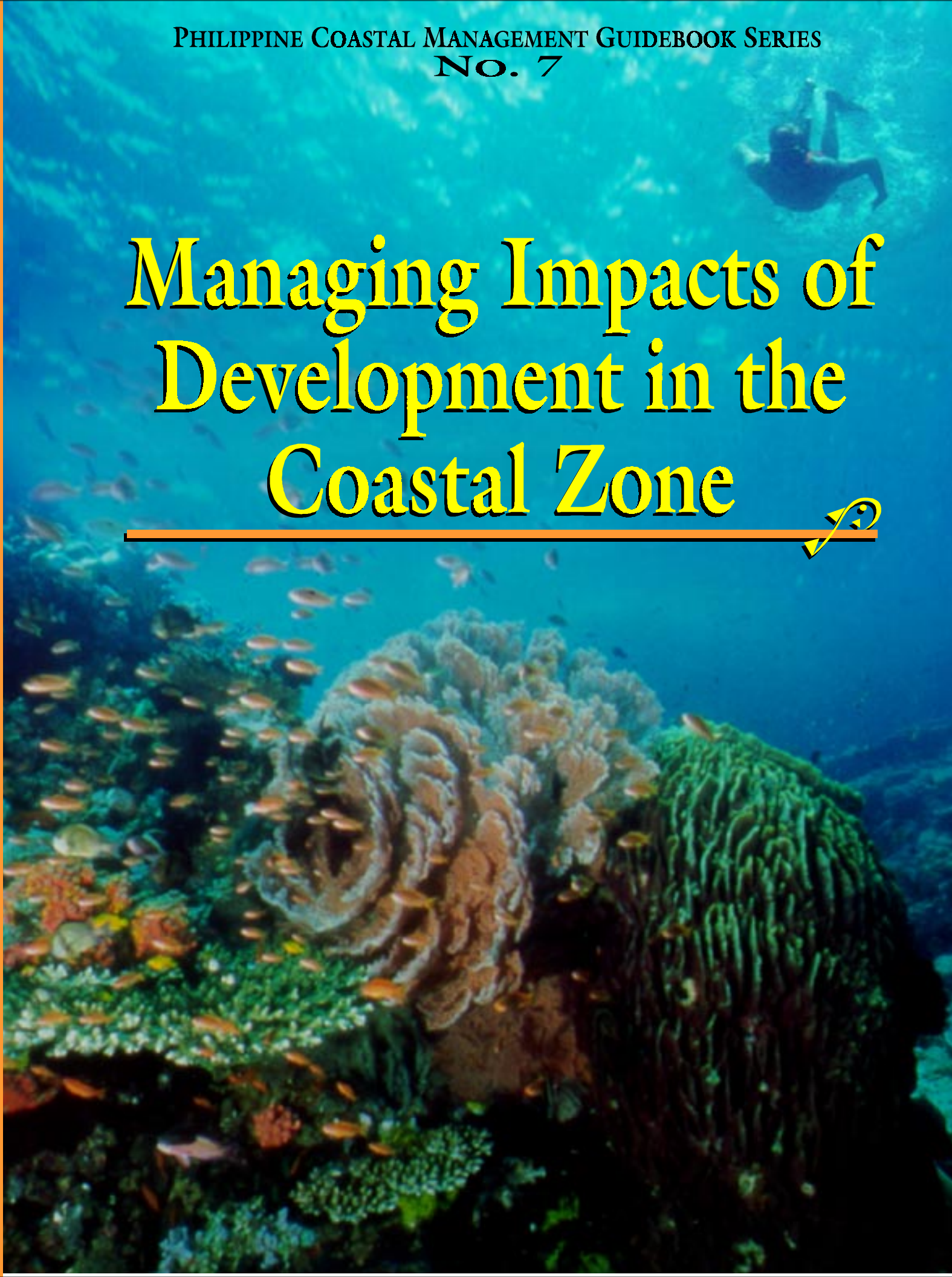
PHILIPPINE COASTAL MANAGEMENT GUIDEBOOK SERIES
NO. 7

Managing Impacts of Development in the Coastal Zone



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NO. 7:

MANAGING IMPACTS OF DEVELOPMENT IN THE COASTAL ZONE

By:

Department of Environment and Natural Resources

Bureau of Fisheries and Aquatic Resources
of the
Department of Agriculture

Department of the Interior and Local Government

and

Coastal Resource Management Project
of the
Department of Environment and Natural Resources
supported by the
United States Agency for International Development

Philippines

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by

Department of Environment and Natural Resources (DENR)
Bureau of Fisheries and Aquatic Resources of the Department of Agriculture (DA-BFAR)
Department of the Interior and Local Government (DILG)
and
Coastal Resource Management Project (CRMP)

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List of acronyms and abbreviations

AC	authority to construct
BFAR	Bureau of Fisheries and Aquatic Resources
BOD	biochemical oxygen demand
CBBE	countryside businesses and barangay entities
CCO	chemical control order
CDO	cease-and-desist order
COD	chemical oxygen demand
CRM	coastal resource management
CRMP	Coastal Resource Management Project
DA	Department of Agriculture
DAO	Department Administrative Order
DENR	Department of Environment and Natural Resources
DDT	dichloro-diphenyl-trichloroethane
DILG	Department of the Interior and Local Government
DND	Department of National Defense
DOE	Department of Energy
DOTC	Department of Transportation and Communications
DPWH	Department of Public Works and Highways
ECA	environmentally critical area
ECC	environmental compliance certificate
ECP	environmentally critical project
EGF	environmental guarantee fund
EIA	environmental impact assessment
EIARC	Environmental Impact Assessment Review Committee
EIS	environmental impact statement
EMB	Environmental Management Bureau
EMF	environmental monitoring fund
EMP	environmental management plan
EMPAS	Environmental Management and Protected Areas Sector
ERA	environmental risk assessment
FPA	Fertilizer and Pesticide Authority
ICM	integrated coastal management
IDA	industrial development area
IEE	Initial Environmental Examination
IEMP	Industrial Environmental Management Project
LGC	Local Government Code

LGU	local government unit
MBAS	methylene blue active substances
MPP-EAS	Marine Pollution Prevention for the East Asian Seas
MOA	memorandum of agreement
NAMRIA	National Mapping and Resource Information Authority
NEDA	National Economic and Development Authority
NGO	nongovernment organization
NIPAS	National Integrated Protected Areas System
NOCOP	National Operations Center for Oil Pollution
NPSP	non-point source pollution
PAB	Pollution Adjudication Board
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCG	Philippine Coast Guard
PD	Presidential Decree
PICCS	Philippine Inventory of Chemicals and Chemical Substances
PO	permit to operate
PPA	Philippine Ports Authority
RA	Republic Act
RED	Regional Executive Director
RGC	Regional Agro-Industrial Growth Center
SAMP	Special Area Management Plan

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This book represents the composite work of many individuals and organizations. The authors are:

Mary Gleason, Ph.D., Coastal Resource Management Project
James Maragos, Ph.D., United States Fish and Wildlife Service, Hawaii
Lloly de Jesus, Tetra Tech EM, Inc.

The following Departments have endorsed, reviewed, and made contributions to this book:
Department of Environment and Natural Resources
Department of Agriculture
Department of the Interior and Local Government

The technical editors include:
Catherine Courtney, Ph.D., Chief of Party, Coastal Resource Management Project
Alan White, Ph.D., Deputy Chief of Party, Coastal Resource Management Project
R. Steven Nakashima, M.P.A., M.S.P.H., Environmental Specialist, New Rochelle, New York
Annabelle Cruz-Trinidad, M.A., Policy Advisor, Coastal Resource Management Project

The reviewers include:
Reynaldo Alcances, Chief, Environmental Impact Assessment Divison, Department of Environment and Natural Resources
Sandra Arcamo, Chief, Fisheries Resource Management Division, Bureau of Fisheries and Aquatic Resources Central Office
Zoraida Aquende, Division Chief, Department of the Interior and Local Government - Bureau of Local Government Development
Florendo Barangan, Director III, Department of Environment and Natural Resources-CEPCO
Ephraim Batungbacal, Research Officer, Tambuyog
Ruby Buen, Policy and Planning, Department of Environment and Natural Resources
Romelo Cabangon, Project Development Officer IV, Department of Environment and Natural Resources
Leonard Faller, Tetra Tech EM Inc.
Efren Flores, Ph.D., Bureau of Fisheries and Aquatic Resources-Fisheries Resource Management Project
Flordeliz Guarin, Ph.D., Vice President, Pirnie/Australian Power and Water

Rudolf Hermes, Research Fellow, Philippine Council for Aquatic and Marine Research and Development
Esmeralda Manalang, Bureau of Fisheries and Aquatic Resources Region 4
Teresita Mistal, Director, Department of Interior and Local Government - Bureau of Local Government Development
Roy Olsen de Leon, Silliman University Center of Excellence for Coastal Resource Management
Rolando Pablo, Engineer, Land Management Bureau
Michael Pido, Technical Officer, International Maritime Office
Manuel Tacorda, Assistant Chief, Legal, Land Management Bureau
Mayette Rodriguez, Project Development Office, City Environment and Natural Resource Office
Engr. Samuel Serna, Local Government Unit, Polillo

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Foreword

Department technical personnel have reviewed and fully endorse the *Philippine Coastal Management Guidebook Series* as an essential information guide to assist in improving the status of Philippine coastal resources and their management. This series of guidebooks strengthens our capacity to enhance coastal management efforts in the country. It clearly identifies roles and responsibilities for all concerned departments, agencies, and organizations in this collaborative coastal environmental management effort.

Let us enjoin all users of these guidebooks to collectively work for sustainable management of our coastal resources for the economic and environmental well-being of our country!

Department of Environment and Natural Resources

Department of Agriculture - Bureau of Fisheries and Aquatic Resources

Department of the Interior and Local Government

Preface and orientation to this guidebook series

This book is the seventh in a series of eight guidebooks on coastal management in the Philippines. The titles and basic content of these eight books are shown next page. The series covers major topics concerning all aspects of coastal management in the Philippines and follows a theme of local government perspective, while highlighting the role of various stakeholders and other factors that affect coastal environments.

This seventh book, *Managing Impacts of Development in the Coastal Zone*, addresses the important role of planning and assessment of impacts of development activities as a component of coastal resource management. Essential steps in assessing environmental impacts under the Philippine Environmental Impact Statement System administered by the Department of Environment and Natural Resources are described with an emphasis on the role of local government and communities. Other important management tools such as spatial planning, economic evaluation, and environmental risk assessment are also described, as well as the impacts of ten important categories of development activities and mitigation measures. Sources and types of pollution in the coastal environment are identified and local level management strategies to minimize pollution impacts are emphasized.

Coastal management is the theme of these books because of the urgent need to manage and protect the coastal resources of the Philippines. These resources are known to be incredibly valuable and important to the country's security. If the management problems are not addressed using integrated approaches, the environmental and food security of the country will be further threatened. These guidebooks lay out a process to address deteriorating coastal environments, loss of resources, increasing poverty, and to reverse current trends. They are holistic in approach while offering many specific solutions that are easy to implement. Read, comprehend, and make use of these guidebooks!

Philippine Coastal Management Guidebook Series—Titles and contents

1. Coastal Management Orientation and Overview	◆ Definitions and trends in coastal management ◆ Issues, resources, and impacts of concern in the Philippines ◆ Introduction to the coastal management process in the Philippines ◆ Guidebook series and how to use it
2. Legal and Jurisdictional Framework for Coastal Management	◆ All laws pertaining to coastal management ◆ All jurisdictions affecting coastal areas and resources ◆ The roles and mandates of government agencies
3. Coastal Resource Management Planning	◆ Coastal management planning process from local government perspective ◆ Key steps and procedures in the process ◆ How to develop the coastal management plan
4. Involving Communities in Coastal Management	◆ Importance of involving coastal communities ◆ Community organization process and participatory approaches ◆ Information, education, and communication techniques ◆ Sustainability of community-based coastal management
5. Managing Coastal Habitats and Marine Protected Areas	◆ The coastal marine ecosystem and how it functions ◆ Management considerations of critical coastal habitats ◆ Creating and managing marine protected areas
6. Managing Municipal Fisheries	◆ Municipal waters and legal jurisdiction for fisheries management ◆ Planning for fisheries management ◆ Management interventions and how to apply them
7. Managing Impacts of Development in the Coastal Zone	◆ Roles of planning and environmental impact assessment ◆ Environmental guidelines for coastal development ◆ Government role and mandate to prevent development impacts ◆ Managing coastal and marine pollution
8. Coastal Law Enforcement	◆ Major issues in effective law enforcement in coastal management ◆ Roles and responsibilities of major law enforcement groups ◆ Initiatives to improve fishery law enforcement

chapter 1

Introduction

The coastal ecosystems of the Philippines are very productive and represent a huge natural and economic resource for the country. Coastal resources provide food and livelihood for the Philippine people and make a large contribution to the national economy. Clean coastal waters and healthy coastal habitats provide sustained economic benefits to the Philippines.

Due to the archipelagic nature of the Philippines and the interconnectedness of the land and sea, most development activities have the potential to cause negative impacts on the coastal environment. Planning, environmental assessment, and pollution management are the best strategies for minimizing adverse effects of development in the coastal zone. All development activities should be evaluated to ensure consistency with existing land use and coastal resource management (CRM) plans, subject to the environmental impact assessment (EIA) process, and implemented using best management practices. Although the government has the primary responsibility for controlling coastal development activities and managing pollution, non-government organizations (NGOs) and local communities can play an important role as stakeholders and protectors of local culture, economic opportunities, and the coastal environment.

This guidebook describes the role of planning, EIA, and pollution management strategies to minimize adverse impacts on the environment and human health from development activities. The focus is on local level management, primarily through the local government units (LGUs) supported by national agencies and the community. The target audience of the guidebook is the LGU. Other guidebooks in this series provide additional information to support the management of impacts of development; these other guidebooks describe the legal basis for coastal management (*Guidebook 2: Legal and Jurisdictional Framework for Coastal Management*), coastal management planning at the local level (*Guidebook 3: Coastal Resource Management Planning*), tools for improving community participation in the coastal planning process (*Guidebook 4: Involving Communities in Coastal Management*), and habitat management (*Guidebook 5: Managing Coastal Habitats and Marine Protected Areas*).

WHY IS IT IMPORTANT TO MANAGE IMPACTS IN THE COASTAL ZONE?

Development projects in the coastal zone and in upland areas can have widespread impacts on coastal habitats such as beaches, mangroves, and coral reefs, as well as on fishery resources that feed the nation. Some of the major impacts of development include habitat destruction, alteration of natural ecosystem processes, and pollution. Because it is difficult to reverse development impacts and

restore damaged ecosystems, unplanned development, without proper environmental guidelines and mitigation, results in the net loss of resources and future development options. Planning development with a full evaluation of potential environmental impacts and full participation of the local communities minimizes adverse impacts.

Beginning in the 1970s, the government of the Philippines enacted strong environmental and conservation policies, with the support of the people, local governments, NGOs, and international aid organizations. Laws, regulations, ordinances, certifications, and permit requirements were passed to protect a variety of natural resources and to control the effects of pollution and increasing industrialization and urbanization. Among these was a mandatory EIA process, established with the creation of the Environmental Impact Statement (EIS) System administered by the Department of Environment and Natural Resources (DENR) through Presidential Decree (PD) 1586. The EIS System is initiated during the planning and implementation stages of proposed development activities with the potential to cause severe environmental harm or those occurring in environmentally sensitive areas. Other legislation and regulations were developed to set aside and protect conservation areas, protect fishery resources from overexploitation, discourage destructive fishing techniques, manage pollution and waste, promote sustainable forest management practices, and encourage long-term multisectoral land use planning.

Many of these accomplishments provided tangible benefits to coastal zone resources, but have been insufficient to stem the tide of massive resource depletion and habitat destruction, particularly to coastal zone resources such as beaches, mangrove forests, and coral reefs. Although there is a national legal framework for EIA, land use planning and pollution management, laws are often poorly enforced or ineffective and improvements are needed to encourage greater participation by the LGU and local communities.

Protection of Resources and Sustainable Development Options

Development projects that are unplanned or poorly sited can foreclose other options to develop, use, or rely on coastal resources. Often alternative developments that are more beneficial to local communities are not considered. For example, a bridge over a narrow bay may result in greater benefits to fisheries and small boat navigation compared to a fill road or causeway. The economic benefits of coastal disposal of mine tailings may be far outweighed by the cost of poisoned, destroyed, and lost fisheries and medical treatment and relocation of sick squatters living on the tailings. Local communities and local governments need to evaluate the threat proposed development options pose to future resource use. This guidebook provides the procedures and guidelines to ensure adequate treatment and evaluation of development alternatives.

Local Level Support of Development Activities

National and provincial governments have limited staff and capability to review proposed developments and lack local knowledge of the sites. In contrast, local government staff, *barangay* officials, and community members spend most of their lives near proposed development sites and

have better knowledge of the environment and history of the area. If a site, scale, or design for a proposal is not suitable, they are in the best position to know what better alternatives are available. Local communities are also in the best position to monitor and enforce the environmental conditions imposed on development projects.

More often than not, developments designed, approved, and implemented by "outsiders" are not in the best interest of local communities. LGUs need to be involved from the beginning to insure that the location, scale, design, and operation of development projects will benefit the community. What kind of pollution will be generated and how can it be avoided? What are the environmental and economic consequences, and who will pay to clean up pollution and waste? Will construction cause air, noise, and water pollution, and will fishery resources be degraded? Will the new development overload educational, medical, power, water, trash removal, or sewage treatment services? The LGU should determine the tangible costs and benefits to established communities, and what needs to be done for the proposal to gain the support of local communities.

Development Decisions Need to be Made Carefully

If official decisions on proposed developments are made before local communities are consulted, it is very difficult to compel the decision-makers to back out or change their minds. Often financial loan commitments need to be made quickly to fund construction. Politically-based commitments (e.g. "deals") are often tied to development projects and are difficult to renege on. Although existing EIA procedures require development proponents to consult with local communities, the latter need to be assertive to ensure that they truly participate in decision-making. Local communities need to be involved to advance other development alternatives, mitigation, monitoring, and compensation that need to be covered in the proposal as part of the EIS.

If a poorly conceived development project does not work out, the developer will most likely abandon the site or project rather than commit additional funds for dismantling and cleaning up structures and restoring the site to pre-development conditions. Lending institutions will not throw "good money after bad", and the developer will simply walk away and leave the local community "holding the bag". Witness the many hectares of failed and abandoned shrimp ponds lining many Philippine shores, for example. Thus, there is great value in good advance planning, technical advice, and evaluation of a full range of options as part of any development proposal in the coastal zone.

Once ecosystems are damaged, ecosystem restoration is costly and technically difficult. For example, large-scale restoration of a coral reef ecosystem has only been successfully accomplished once in world history (Kaneohe Bay, Hawaii) but at a cost of many millions of dollars. The initial damage was caused by the improper decision to place sewer outfalls inside the bay rather than outside where pollution would not damage the reefs. Because a government agency was at fault and was successful in budgeting more tax funds to finance the new outfall, the restoration project

went forward. But typically a government or private developer cannot afford to make a similar mistake and double project funding to implement corrective measures. Exercising common sense, good judgement, and consulting the advice of experienced professionals before development activities are approved are essential.

THE PHILIPPINE COASTAL ZONE

What is the coastal zone? A simple definition for the coastal zone is *that part of the land influenced by the sea together with the adjacent part of the sea influenced by the land.* From an ecological perspective, there should be no fixed boundary since the influencing factors will have varying strengths depending on location or season. In the Philippines, the outermost boundary of the coastal zone is officially defined as *the extent to which land-based activities have measurable influence on the chemistry of the water or on the ecology or biota.* The innermost boundary is defined as *one kilometer from the shoreline except at places where measurable indicators for marine influences exist like mangroves, nipa swamp, beach vegetation, sand dunes, salt beds, marshlands, bayous, recent marine deposits, beach and sand deposits, and deltaic deposits in which case the one-kilometer distance shall be reckoned from the edges of such features.*

Coastal zone boundaries are difficult to fix. For example, the coastal zone modified by the urban environment off Manila would be much wider due to runoff and pollutants from land and the extensive shipping and fishery activity, compared to a remote uninhabited coast off northern Palawan Island. Another example is that during the wet season the land influence extends further offshore due to increased runoff, and during tropical cyclones the ocean influence extends further landward due to high waves, salt spray, and storm surges. In some locations or during some seasons a rigidly defined coastal zone would be too wide for some circumstances and too narrow for others. For municipal planning efforts, the municipal waters are defined as extending from the shoreline to 15 km out to sea. However, due to the archipelagic nature of the Philippines, many land-based activities further inland than the 1 km coastal zone boundary can affect coastal resources and need to be considered in the planning process, especially if rivers or other waterways carry pollutants to the sea.

IMPORTANT IMPACTS OF DEVELOPMENT IN THE COASTAL ZONE

The coastal zone is subject to impacts from a wide variety of land-based and marine-based development activities (Figure 1). All development, from housing to large-scale industrial sites, have some environmental and socioeconomic impact and should be subject to some type of EIA or environmental review. The major types of impacts resulting from development and associated pollution are described below.

Habitat Loss or Degradation

Complete destruction of habitat and loss of associated values result from some types of development activities such as reclamation projects, conversion of mangroves to fishponds, clear-

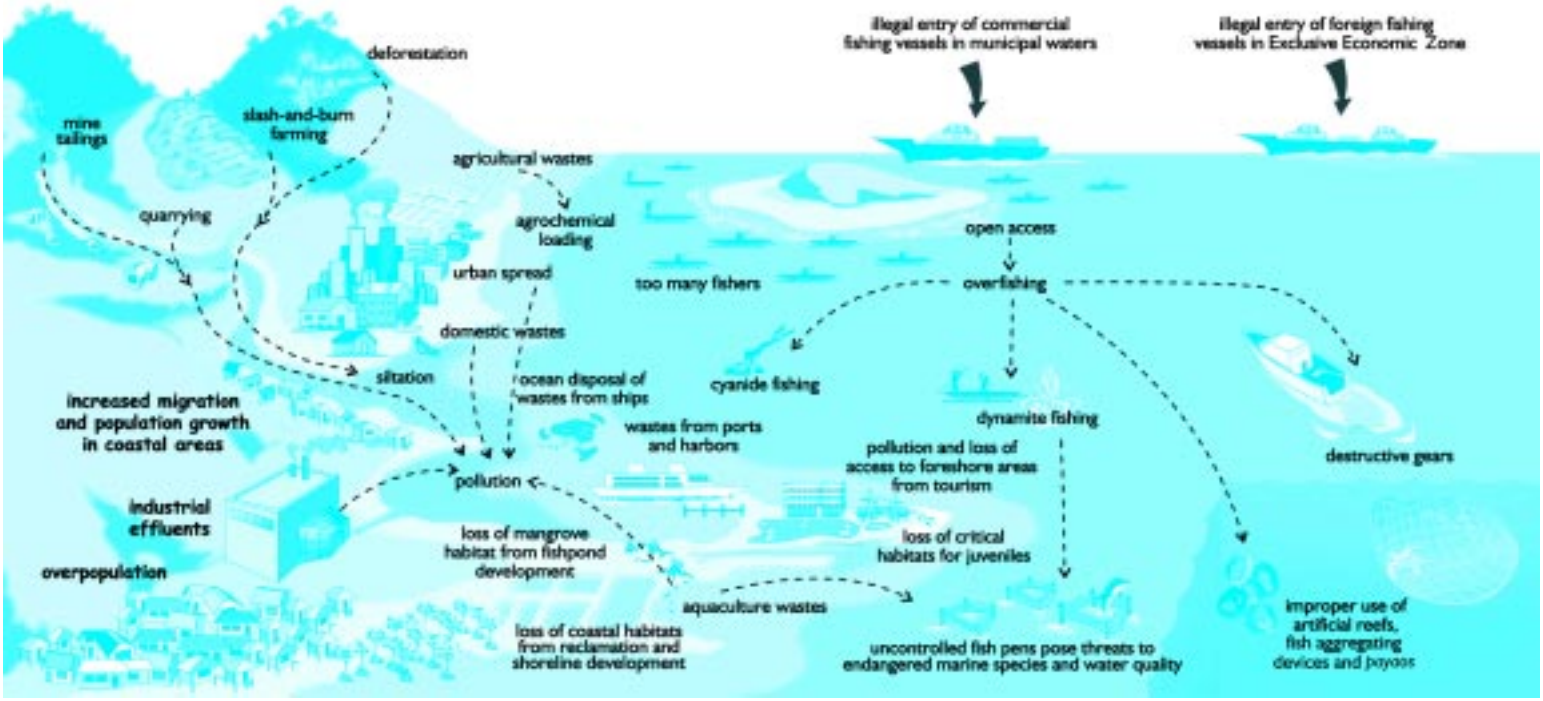


Figure 1. Various economic activities and their impacts on the coastal environment.

cutting forested areas, and large-scale industrial and urban development. These types of development activities thus warrant special attention because of the severity of the environmental impact. Most other types of development cause some degradation of habitat and loss of value. Building roads, for example, allows access to areas that will subsequently be further developed or settled by squatters. Housing settlements and industrial development result in waste streams that will eventually reach the sea and cause degradation of coastal habitats.

Declines in Biodiversity and Disruption of Ecosystem Function

Development that causes habitat loss or degradation will ultimately cause declines in species diversity and abundance in coastal habitats. This decline in biodiversity represents a net loss of future economic values that could have been gained from these resources. Many types of development disrupt ecosystem functions and reduce productivity of natural systems. Conversion of mangroves to fishponds results in a loss of nursery habitat for fish and can cause declines in productivity of fisheries. Shoreline development disrupts the ability of coastal habitats (reefs and mangroves) to absorb storm energy and can result in extensive erosion and loss of property.

Coastal and Marine Pollution

Chemical wastes, sediment, and nutrients cause adverse impacts to human health and the environment. All industries generate waste streams that contribute to pollution when not properly managed. Housing settlements and hotels/resorts not equipped with septic tanks or sewage treatment plants result in runoff of nutrients and pathogens to the sea that severely degrade coral reefs and seagrass habitats and endanger human health. Runoff of surface water

from agricultural areas results in fertilizers and pesticides being carried to the sea and polluting coastal waters. Transport of mine tailings or mining wastes to coastal waters causes fish kills and human health impacts. Wastewater from intensive aquaculture is a significant source of pollution.

Erosion, Accretion, and Hydrological Impacts

Resort and port development and construction of seawalls and groins along the coastline causes erosion of the shoreline as sediment transport pathways are altered or blocked. Urban development affects the hydrologic cycle, including groundwater recharge and surface runoff, by creating non-porous surfaces that stop infiltration of rainwater. Upland forestry development and mining activities that remove forest cover result in extensive erosion and surface runoff of sediments that ultimately smother and kill coral reefs and seagrass along the coast.

Adverse Impacts on Human Health and Welfare

Finally, many types of development activities adversely affect local coastal communities. Polluting industries cause human health impacts from contaminated air, food, and water and can also cause reductions in productivity or health of the food supply (crops, fish, etc.). Resort development often excludes local fisherfolk from foreshore areas and access to fishery resources. Large infrastructure projects force resettlement of people, often with socioeconomic impacts.

DEVELOPMENT PLANNING, ENVIRONMENTAL ASSESSMENT, AND POLLUTION MANAGEMENT

The most important approaches for managing impacts of development include planning, environmental assessment, and pollution management. The LGU has a key role in managing impacts of development, with support from national agencies and others (Table 1). An excellent compilation of local government environmental responsibilities is *A Guide in Local Environment Code Formulation* (Local Government Development Foundation and Konrad Adenaeur Stiftung 1996).

Development Planning

Development planning provides the framework for management in the form of land use plans, development plans, and CRM plans that describe the desired goals and objectives for the area and provide specific strategies, such as zoning and environmental guidelines, to guide development activities. A proposed development project should first be reviewed in the context of its consistency with existing plans; projects at odds with existing plans should not be approved. Reconciliation of national, provincial, and municipal plans is a prerequisite since inconsistent overlapping plans make it difficult for decision-makers to determine the appropriateness of a project being evaluated. At the local level, municipal development plans, municipal land use plans, and CRM plans provide the local framework for the review of development projects and potential impacts (Figure 2).

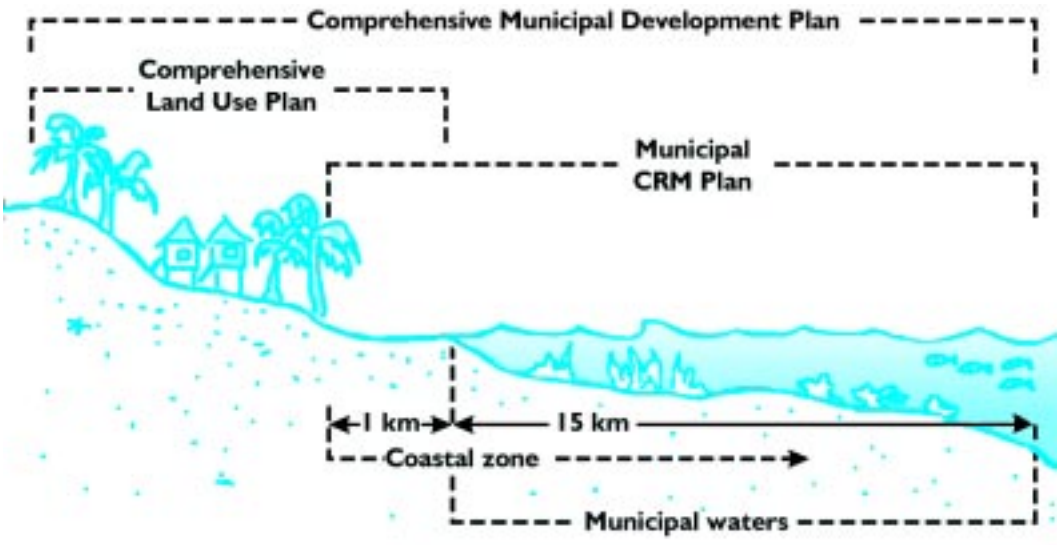


Figure 2. Spatial extent of municipal planning necessary to address impacts in the coastal zone.

Table 1. Key roles and reponsibilities in managing impacts of development and pollution.

Department of Environment and Natural Resources

- Environmental protection for marine and terrestrial habitats and resources and maintenance of environmental quality
- Regulate development such as mining and other resource extractive enterprises
- Implement the national EIS System, through EMB and Regional Offices, and review EIS and IEE documents
- Issue environmental compliance certificates (ECCs) for approved projects
- Provide technical assistance to LGUs
- Formulate environmental quality standards for water, air, land, noise, and radiation
- Formulate rules and regulations for use and disposal of toxic and hazardous wastes
- Issue authority to construct and permit to operate for pollution-generating industries
- Enforce pollution control laws and penalize violators

Local Government Units

- Manage development impacts in jurisdictional area and participate in national EIS System
- Prepare development plans, land use plans, and CRM plans
- Provide overall coordination and facilitation for planning and environmental assessment
- Manage municipal waters and fisheries
- Manage solid waste and enforce pollution control laws at the local level

(continued)

Table 1. (continued)

- Approve local pollution control ordinances
- Enforce cease-and-desist orders of the Pollution Adjudication Board
- Support local enforcement agencies
- Provinces and cities may conduct reclamation projects, subject to oversight by the national Public Estates Authority and subject to review under the EIS System
- Provinces and municipalities may establish tourism facilities subject to coordination with the Philippine Tourism Authority and subject to review under the EIS System

Department of Agriculture (DA) and Bureau of Fisheries and Aquatic Resources (BFAR)

- DA responsible for regulating agriculture and fisheries development
- BFAR responsible for the development, management, and conservation of fisheries and aquaculture resources

Department of the Interior and Local Government (DILG)

- Assist to formulate local policies and standards and models in accordance with RA 7160
- Support LGUs

Philippine Ports Authority (PPA)

- Responsible for government-funded commercial port development and private port development that is subject to EIS requirements

Department of Public Works and Highways (DPWH)

- Develop and regulate the construction of roads, bridges, reclamation, sewage treatment, dams, and other infrastructure projects that are subject to EIS requirements

Department of Energy (DOE)

- Develop and regulate energy resources including power plants, petroleum and petrochemical industries, offshore oil and gas, and hydroelectric dams that are subject to EIS requirements

Department of National Defense (DND)

- Development of military infrastructure that is subject to EIS requirements

Department of Transportation and Communications (DOTC) and the Philippine Coast Guard (PCG)

- Monitor, investigate, and enforce water pollution violations (PCG)
- Monitor offshore oil and gas development
- Respond to oil spills or other pollution incidences

Department of Tourism (DOT) and Philippine Tourism Authority (PTA)

- Develop and regulate tourism projects, including supporting infrastructure projects and golf course development that are subject to EIS requirements

(continued)

Table 1. (continued)

Department of Science and Technology (DOST) - Philippine Council for Aquatic and Marine Research and Development (PCAMRD)

- Coordinate, plan, monitor, and evaluate research development activities with the country's aquatic resources

Metropolitan Waterworks and Sewerage System (MWSS) - Local Water Utilities Administration Authority (LWUA)

- Ensure compliance to accepted water quality standards
- Provide water quality monitoring laboratories nationwide

National Mapping and Resource Information Authority (NAMRIA)

- Provide maps and resources for development planning and EIS studies

National Economic and Development Authority (NEDA)

- Plan and arrange financing for development projects
- Facilitate research
- Strenghten science and technology capacity

Nongovernment Organizations

- Provide facilitation and technical assistance to communities and LGUs
- Review EIS and IEE documents
- Provide information and education at the community level
- Provide legal service for environmental law enforcement
- Assist with monitoring of compliance with environmental regulations

Community and People's Organizations

- Participate in public hearings and voice community concerns
- Assist in scoping and review of EIS and IEE documents
- Assist in local monitoring and enforcement activities

Academe and Technical Experts

- Provide technical expertise and data for planning, EIS, and pollution monitoring
- Assist in data collection and analysis
- Provide assistance in information management

Environmental Assessment

All development activities cause some type of environmental impact and therefore all development projects should go through an environmental review process. EIA, resource valuation, and environmental risk assessment (ERA) are important tools that are used, usually at the project level, to evaluate the impacts of development and to identify ways in which those impacts can be avoided or minimized. The goals of EIA are to describe the need for a proposed

project, identify environmental and socioeconomic impacts, identify feasible alternatives to the proposed project, and suggest mitigation measures that could reduce impacts if the project is implemented. The goals of ERA are to identify and evaluate the hazards associated with certain types of proposed projects (such as large infrastructure projects or projects involving hazardous waste) and the risk of significant adverse impacts.

Pollution Management

Managing impacts of pollution resulting from existing development and ensuring that proposed future development will not cause significant pollution is of critical importance in protecting the environment and human health. Careful environmental review of projects, enforcement of existing pollution regulations, and controlling the volume of pollution through source reduction are management strategies that can help to reduce the impact on the coastal zone. DENR, the LGUs, and local communities have key roles in managing pollution and enforcing existing regulations.

In summary, due to the archipelagic nature of the Philippines, most development activities have the potential to cause some adverse impacts on the coastal zone. Coastal waters and coastal resources need to be protected from adverse impacts to ensure continued economic and ecological benefits to the people. Important types of impacts include habitat loss or degradation, declines in biodiversity and ecosystem health, pollution, and adverse effects on human health and welfare. Development decisions need to be made carefully so that development does not cause unnecessary impacts. The LGU has a key role in land use planning, environmental review of development projects, and pollution management. The next chapter provides a framework for development planning and the assessment of potential impacts of development projects.

chapter 2
Development planning and environmental assessment

Due to decentralization, the LGU has been given more control over local development and is mandated to protect coastal resources from adverse impacts that might result from development activities. The LGU, therefore, has a critical role to play in development planning and environmental review of local development projects. Stakeholder involvement in the development process is also very important to ensure that local interests and concerns are addressed. The LGU is uniquely positioned to implement local level planning using a consultative process with the objective of minimizing adverse environmental impacts. *Guidebook 4: Involving Communities in Coastal Management* provides more information on stakeholder involvement in planning and coastal protection.

Decisions on coastal development activities need to be made wisely because they can result in irreversible impacts on natural resources and foreclose a variety of economic, social, cultural, and environmental benefits, functions, and opportunities. Development that has not been subject to environmental review has the greatest chance for failure because no effort was committed to estimating the future consequences of the development or committing sufficient resources for fixing failures should they arise. This chapter describes development planning and project evaluation procedures for managing impacts of coastal development activities and emphasizes the appropriate actions that should be taken by local government and communities to insure that development decisions reflect their inputs and interests.

PLANNING FRAMEWORK

Each LGU is responsible for developing plans for areas under its jurisdiction. Municipal level plans should be harmonized and consistent with plans at higher levels, such as provincial, regional, or national plans. LGUs should prepare development plans, land use plans, and CRM plans as a critical first step to provide the framework for managing impacts of specific development projects (Figure 2).

Development Plans

Municipalities are required to prepare Comprehensive Municipal Development Plans that would provide a guide to future development and a framework for the evaluation of proposed and existing projects in their area. Development plans identify appropriate and attainable development goals, fiscal policies related to planning, institutional mission and structure, and administrative relationships, collaboration, and linkages. These plans focus on population, basic services, education, health, labor, economy, social services, and housing. These plans should be

integrated and harmonized with development plans and goals of the next higher Local Development Council, based on a participatory process, and operationalized with local budgets (DILG *et al*. 1994a).

Land Use Plans

Each LGU is also required to prepare its Municipal Comprehensive Land Use Plan. Land use plans first describe existing land uses, topography, geology, resource distribution, and other features of the landscape, and then propose spatial plans and zoning for appropriate land use alternatives in the area. Land area is allocated into functional classes of land use such as settlement, industry, tourism, agriculture, and conservation and preservation areas that are appropriate given the physical features, existing land use, policies, and development plans (DILG *et al*. 1994b).

Coastal Resource Management Plans

Managing impacts of development in the coastal zone must also be addressed within the framework of local level CRM planning. The development of CRM plans as a basic service of local government is described in detail in *Guidebook 3: Coastal Resource Management Planning*. Specific strategies to promote careful planning of coastal development are required to ensure that development activities are evaluated and implemented according to legal requirements and are consistent with the local level CRM plans. A municipality may also have a collaborative agreement with another municipality in the form of an integrated coastal management plan that addresses a larger spatial area, such as a watershed or bay. Proposed development activities should also be evaluated for consistency with these inter-LGU collaborative planning efforts.

Other Existing Plans

Proposed development activities must also be evaluated for consistency with other existing plans and with consideration of whether a special area management plan (SAMP) may be appropriate. Such planning is encouraged through national legislation for the Agriculture and Fisheries Modernization Act (AFMA), through RA 8435 and DAO 83 on the management and development of small islands. Coastal zone development activities that may have *cumulative adverse impacts* on the environment or are incompatible with other types of land use are a class of activities warranting SAMP procedures. Many activities that are small in scope and which individually cause minor environmental effects may collectively cause great environmental harm. For example, individual shrimp ponds carved out of former mangrove forests might individually be considered minor. However, shrimp pond development has now destroyed thousands of hectares of mangroves throughout the Philippines, and roughly half of the mangroves in the country have been lost. In this case, many similar pond projects of small individual scope have now resulted in major impact on coastal resources. Applying a regulatory regime and EIA process that treats such projects only on an individual basis may miss the “big picture” of the cumulative effects of these developments on mangroves and coastal fisheries throughout an island or archipelago. Special area planning procedures would be ideally suited for this dilemma because the scope of the analysis could be increased to address all similar fishpond development along an entire coast or around an entire island.

A municipality may contain areas with special management needs such as Marine Protected Areas under the National Integrated Protected Areas System (NIPAS) and their associated Integrated Protected Area Plans or a local level marine reserve with a marine reserve management plan. Special economic zones such as Industrial Development Areas (IDAs), which may include industrial estates or Regional Agro-Industrial Growth Centers (RGCs), may have requirements that should be considered in the review of proposed development.

PROJECT EVALUATION

Project evaluation involves a careful appraisal of the suitability of a proposed development project within the planning framework, the alternative ways it can be implemented, a prediction of the consequences of each option, and selection of the best approach that will minimize the adverse environmental consequences of the proposed project. In short, project evaluation involves making predictions on the future with and without the development and making informed decisions before any action is taken. Figure 3 provides an overview of the evaluation of proposed development projects.

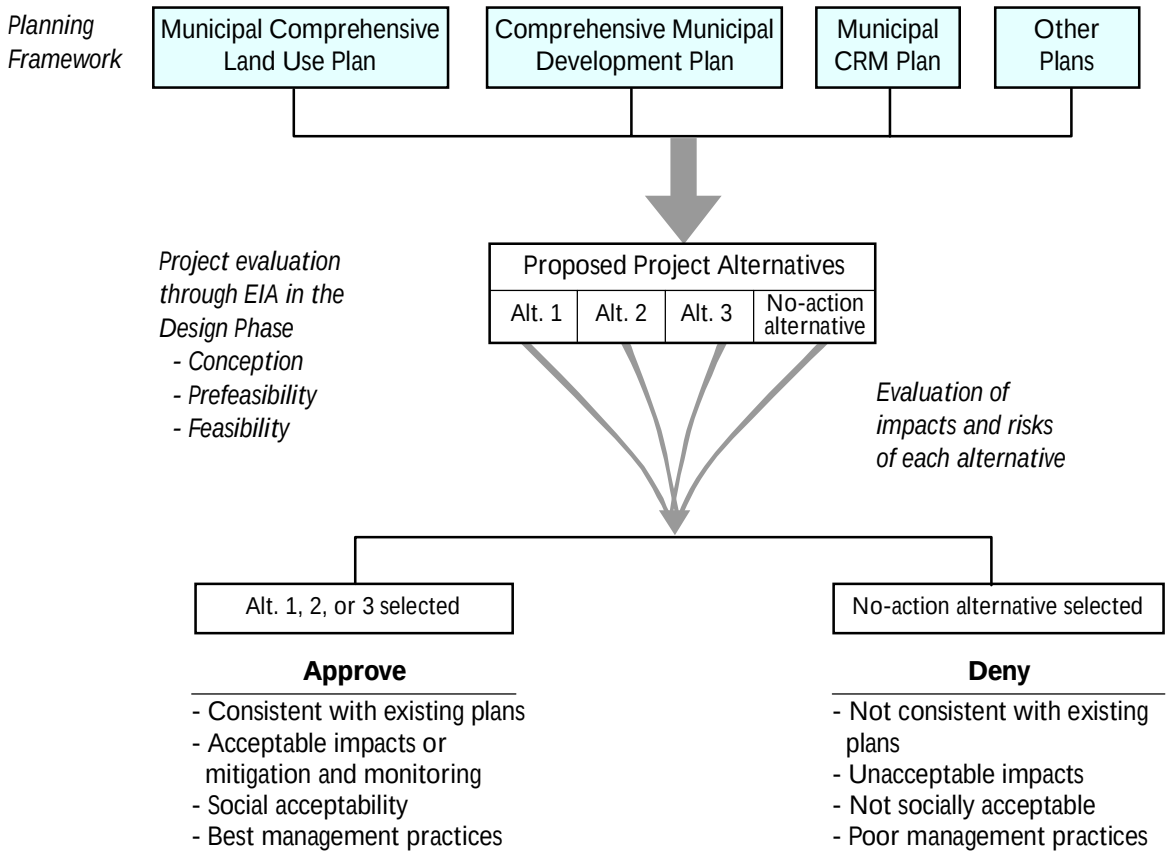


Figure 3. Local level planning framework for evaluation of proposed development projects.

Consistency with Existing Plans

Projects should first be evaluated within the framework of existing plans such as the Municipal Comprehensive Land Use Plan, the Comprehensive Municipal Development Plan, the Municipal CRM Plan, and any other existing plans that are relevant. The LGU should ensure that the proposed development project is consistent with the plans based on both the type and siting of the project.

Evaluation of Alternatives

More than one project design alternative should be evaluated and a no-action alternative should always be included as one of the alternatives. A no-action alternative is one where the proposed development project is not implemented. In addition, mitigation measures can also be evaluated that might reduce the adverse impacts of different alternatives. Alternatives can be organized into several categories (Sorensen and West 1992):

- **Location Alternatives**: Alternative sites that could be considered for the proposed development;
- **Demand Alternatives**: Alternative demands for the area such as residential versus tourism development;
- **Activity Alternatives**: Different activities which would meet the same goal such as impoundments versus levees for flood control; and
- **Process Alternatives**: Alternative designs that would change the level of impact, such as industrial process changes or pollution control measures.

Environmental Review within the Project Cycle

Environmental review of impacts of proposed development projects should take place *early* in the project cycle, before the project is begun. At the project conception and prefeasibility phases, initial environmental review should be conducted to determine if more detailed EIA is warranted and should follow the guidelines of the national EIS System (PD 1586). The national EIS System requires an EIS for certain kinds of projects that are expected to have impacts and is described below. The LGU should actively participate in a scoping process to identify significant issues that should be addressed in the EIA. The EIA should be completed during the feasibility stage, *before* any design or engineering work is initiated (Figure 4) and should fully evaluate all development alternatives, including the no-action alternative. Monitoring and auditing are conducted during and after project implementation.

The LGU should strive to ensure that all proposed development projects are evaluated with respect to their consistency with existing plans and compliance with the EIS System

Those responsible for reviewing environmental impacts of proposed development projects should also consider whether the design and operation employ best management practices for that type of development. For example, there are now best management practices available for resort and golf course development and operations that

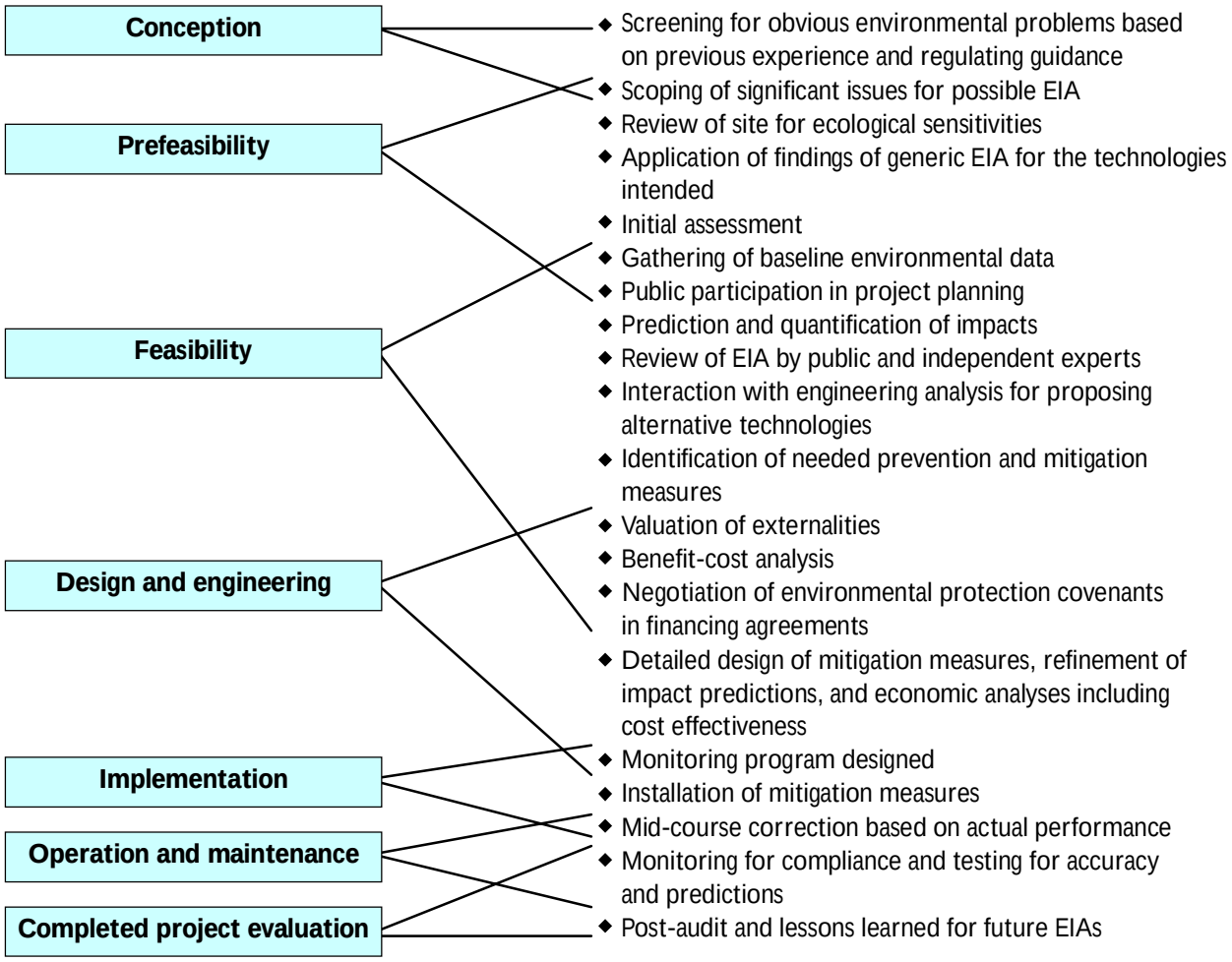


Figure 4. EIA in the project cycle *(adapted from Carpenter and Maragos 1989)***.**

seek to reduce volumes of waste and chemical pollution. Best management practices for coastal construction and dredging may include using silt screens to minimize transport of suspended sediments from the project site and other mitigation measures. Best management practices for industries include waste reduction, recycling, and waste treatment.

ENVIRONMENTAL IMPACT ASSESSMENT

EIAs in the Philippines are conducted under the Environmental Impact Statement (EIS) System administered by DENR. The EIS System will be described in detail in the following section; this section describes general components of EIA. A useful resource on the Philippine EIS System is *Our Stake in the Future: A Primer on the EIS System and DENR Administrative Order No. 96-37*. Another resource on environmental impact assessment is *How to Assess Environmental Impacts on Tropical Islands and Coastal Areas* (Carpenter and Maragos 1989).

EIA is conducted to evaluate environmental and social impacts that should be addressed before an individual project is implemented. The objectives of EIA are to:

- Evaluate the consequences of new projects or activities on the environment and local community;
- Identify alternatives and measures that can minimize these consequences; and
- Provide data, choices, and options for informed decision-making.

EIA is synonymous with E=early, I=integrated, and A=always *(Carpenter and Maragos 1989):*
Early - *EIA begins at the inception of development planning in order to identify opportunities and strengths and to guide the design of the project.*
Integrated - *EIA is linked to engineering and economic studies, not performed separately or at a later date.*
Always - *EIA proceeds through the project cycle and includes the monitoring of environmental protection measures and allows for mid-course corrections to improve management*.

EIA provides decision-makers with a range of alternatives for a proposed development project that have different environmental consequences and tradeoffs. EIA also provides an objective basis for weighing choices and making informed decisions before projects are initiated or approved. A no-action alternative is *always* included in the range of options. The EIA process includes provisions for public input; the LGU is uniquely positioned to facilitate stakeholder involvement in the decision-making process.

Evaluation and comparison of all feasible development alternatives, including the no-action alternative, before a decision is made in favor of any, is the heart of the EIA process and the key to efficient and successful development projects in the coastal zone.

EIA predicts the future state of the environment as a consequence of a proposed development activity compared to the state of the environment without the proposed development. EIA evaluates the potential for damage to the environment, adverse impacts to human health, and addresses the sustainability of the proposed development. EIA aims to identify the appropriate location and design for a project, suggest ways to reduce the unacceptable impacts, and evaluate the most cost-effective measures to reduce or eliminate impacts. Definitions of key terms in EIA are provided in Table 2 and suggested contents of an EIA report are provided in Table 3.

Table 2. Definition of EIA terms *(after Carpenter and Maragos 1989; Gilpin 1995)**.***

Alternatives: The evaluation of alternative locations, methods, and techniques including the alternative of not proceeding (no-action alternative).
Cumulative Effects: Progressive environmental degradation over time resulting from the additive effects of a range of activities causing impacts in an area or region.
Environmental Auditing: Periodic evaluations of a project or development activity to assess compliance with regulatory or EIS requirements.
Environmental Impact Assessment: The process of predicting the likely environmental consequences of implementing a project, and designing appropriate preventative and mitigating measures.

(continued)

Table 2. (continued)

Environmental Impact Statement: A document prepared by the development proponent or their consultant, based on the EIA, describing a proposed development project and its environmental impacts, alternatives to the proposal, and measures to be taken to protect the environment.

Impacts: The effect of one thing on another. In EIA, it reflects the effects of the proposed development activity on the environment and human welfare.

Mitigation Measures: Actions taken to prevent, avoid, or minimize the actual or potential adverse effects of a plan or project.

Monitoring: Observation and measurement of the performance of a project and its compliance with requirements. May include environmental monitoring of physical and ecological parameters and socioeconomic monitoring of effects on the community.

Scoping: An activity carried out early in the EIA process to ensure that the assessment focuses on key environmental issues associated with a proposed development activity. The result of scoping meetings is an agreement of the scope and depth of the EIA or EIS.

Table 3. Typical contents of an EIS report *(adapted from Carpenter and Maragos 1989)***.**

- **Title, abstract, executive summary;**
- **Description of the purpose and scope of the proposed development activity:** *location, underlying need, benefits expected, infrastructure, and inputs required;*
- **Alternatives, including the proposed action, no action, and mitigation measures for the proposed development activity***: reasonable alternatives that might reduce environmental impacts, site and design options, mitigation measures, compensatory measures to overcome damages, comparison among alternatives;*
- **Existing condition and trends in the environment***: activities in the area that could lead to cumulative impact, land use or zoning, population density and location, economic activities, sociocultural characteristics, baseline survey, and inventory of natural resources;*
- **Prediction of changes in natural resources and environmental quality attributed to the project if implemented:** *sequence diagram linking development to changes in the environment to impacts on human welfare and the ecosystem;*
- **Prediction of direct impacts on human health and welfare:** *adverse effects and exposure pathways, cumulative effects;*
- **Reasonably foreseeable indirect impacts or secondary effects:** *socioeconomic changes resulting from environmental impacts, subsequent environmental consequences of socioeconomic changes;*
- **Sustainability:** *tradeoffs between short-term impacts (positive and negative) and long-term condition of resource base, options maintained and options foreclosed by the project, irreversible commitments of natural resources;*
- **Benefit-cost analysis***: present value of all benefits and costs compared in a benefit-cost ratio, net present value, non-monetary or unquantifiable effects, cost-effectiveness of mitigation measures;*
- **Risk assessment:** *identification of risk from hazards to human health and the environment, likelihood and severity of adverse impacts, uncertainty, risk reduction opportunities;*
- **Public involvement:** *summary of scoping and public meetings, compliance with coordination and regulatory requirements, public hearings, and public notifications;* and
- **Findings and recommendations:** *prudent course of action in the face of uncertainty, preferred alternative to implement the proposed development activity, mitigation, and monitoring requirements.*

What are Impacts?

The types of impacts that should be considered in an EIA include biophysical, ecological, geophysical, socioeconomic, cultural, and human health impacts (Figure 5). A development activity, such as agricultural development in a watershed, requires a modification of the physical environment (removal of vegetation) that is the causal factor for a change in conditions in the environment such as increased erosion and turbidity in coastal waters. These changes in

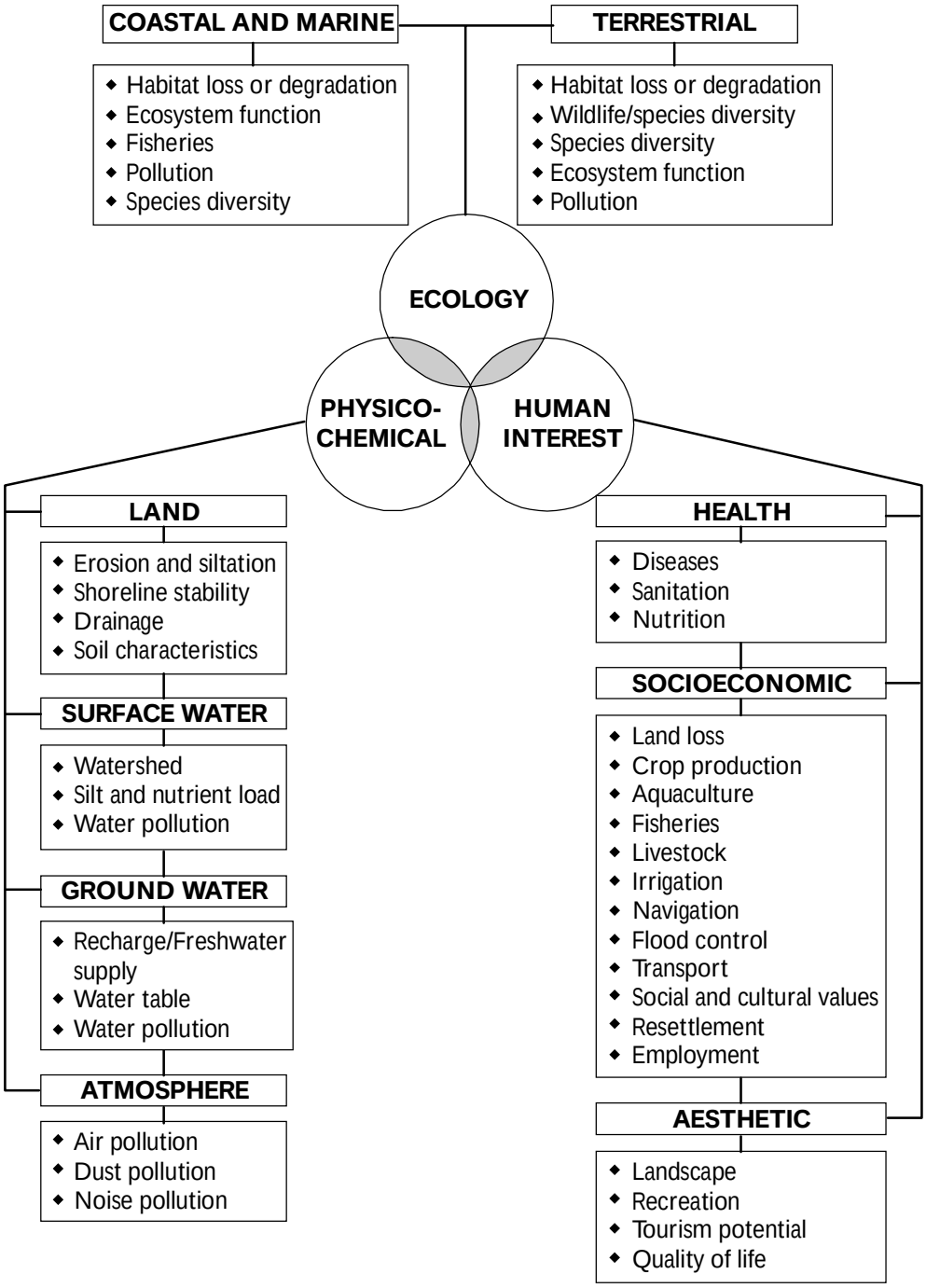


Figure 5. Types of impacts that should be considered in the EIA *(modified from Clark 1996)*.

conditions, or effects, in turn result in impacts to the environment or human health that are important to society. Thus, impacts are values that society places on the effects of development activities.

Impacts can be direct (first order) or indirect (second order). An impact network is a series of links between causes, condition changes, and impacts. For example, a multitude of impacts can result from the development of agriculture in a watershed (Figure 6). This type of development causes increased erosion due to removal of vegetation and exposure of bare soil. The resulting erosion causes changes in coastal waters including increased sedimentation and turbidity. These changes result in direct negative impacts to coral reefs, seagrass beds, coastal water quality, beaches, and navigation channels. These direct impacts cause other indirect impacts such as loss of fisheries, shipping, and employment that are experienced by the coastal community.

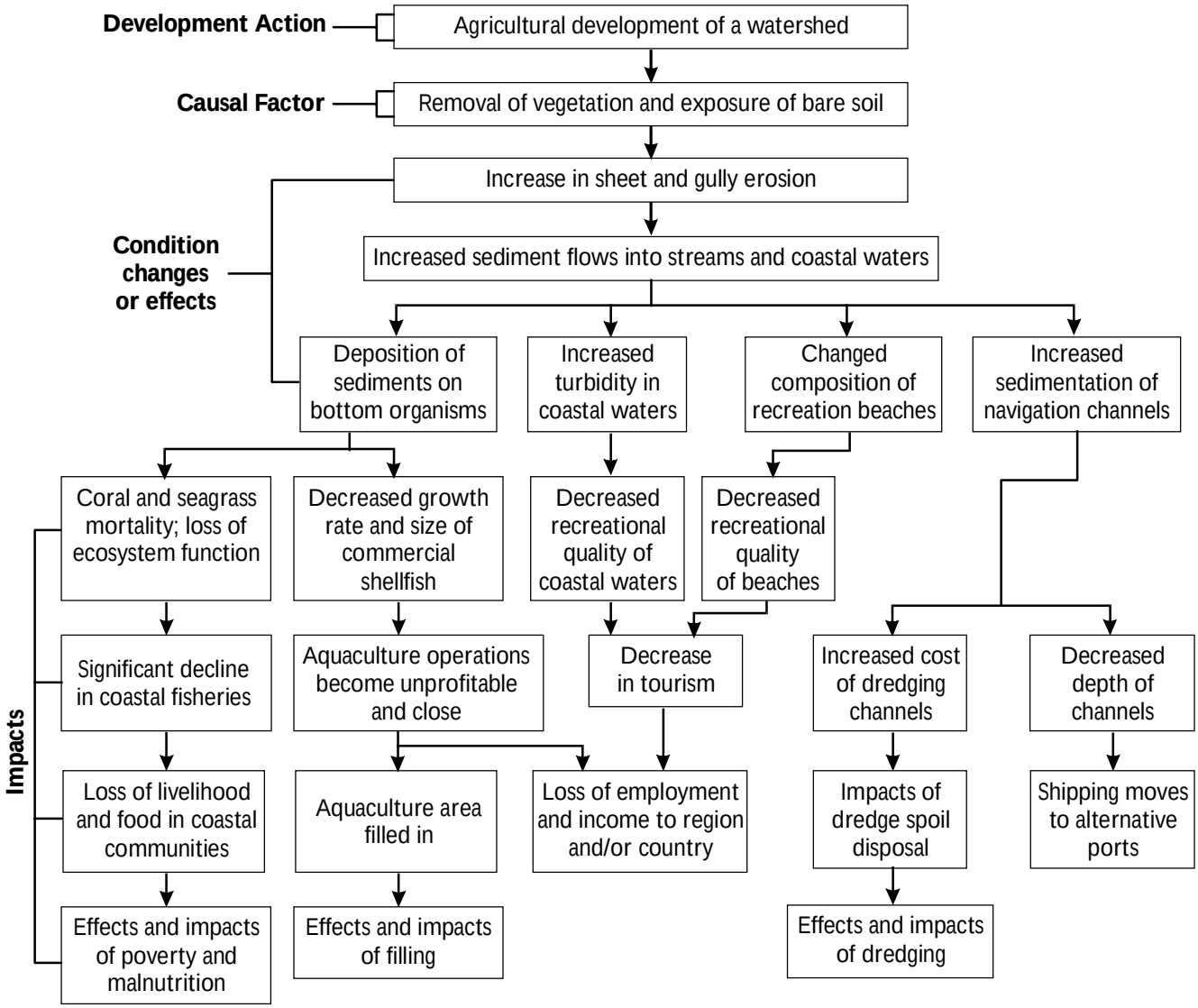


Figure 6. An impact network with direct and indirect impacts *(adapted from Sorensen and West 1992).*

Figure 7 provides another type of systems approach that can be used to identify direct and indirect effects of development activities and potential mitigation measures. Table 4 summarizes potential impacts of concern to coastal habitats discussed in more detail in *Guidebook 5: Managing Coastal Habitats and Marine Protected Areas* and in Chapter 4.

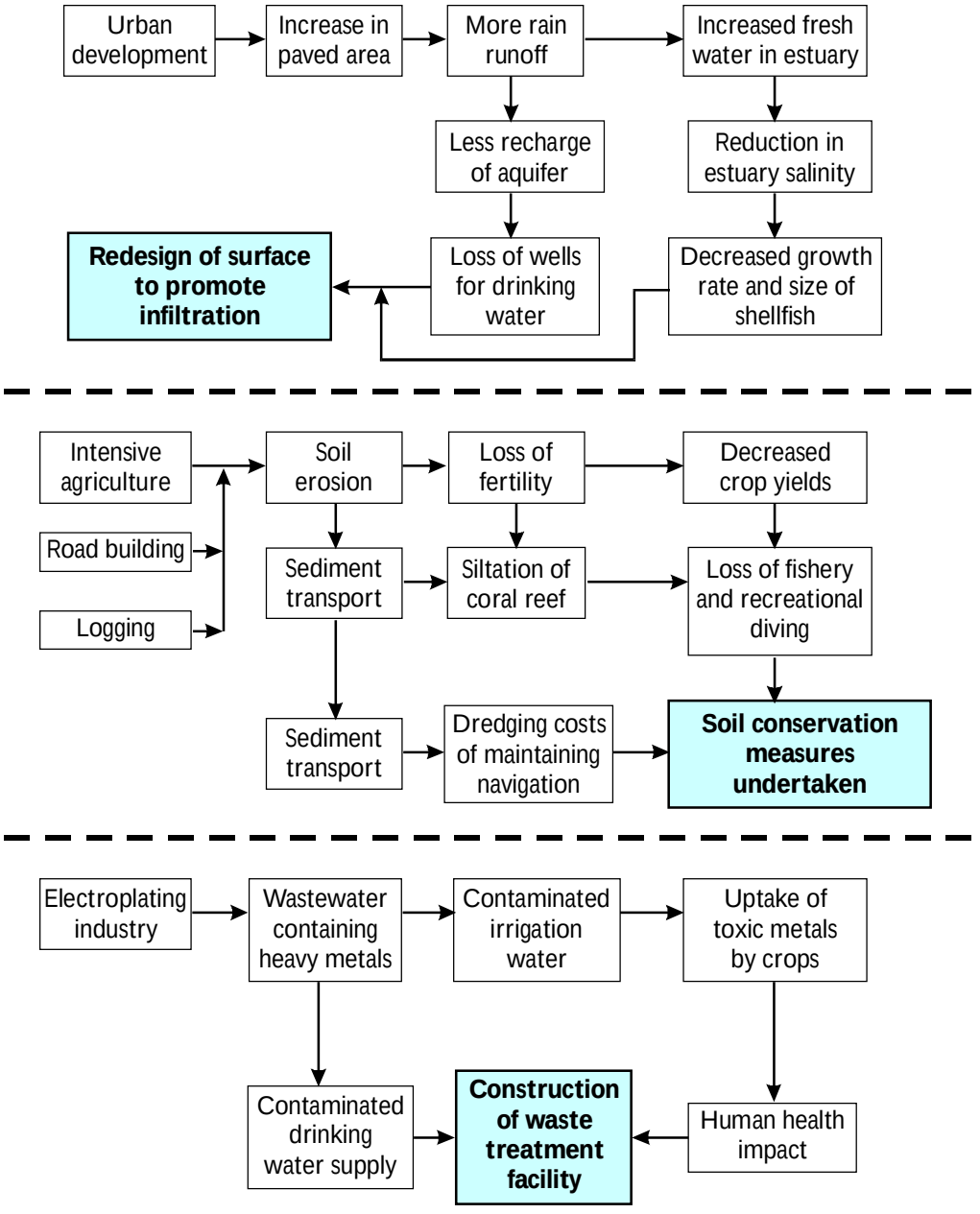


Figure 7. Systems approach to identifying direct and indirect impacts of development activities and possible mitigation measures (in shaded boxes) *(adapted from Carpenter and Maragos 1989)*.

Table 4. Potential impacts of concern in coastal habitats *(adapted from Coast Conservation Department 1990)***.**

Coastal habitat	Impacts of concern
Coral Reefs	Physical damage to coral reefs and collection of organisms beyond sustainable limits Increases in freshwater runoff and sedimentation Excessive input of nutrients Introduction of pollutants
Estuaries/Lagoons	Encroachment Changes in sedimentation patterns Changes to the salinity regime Introduction of pollutants Destruction of submerged and fringing vegetation Inlet modification Loss of fishery habitat
Mangroves	Changes in freshwater runoff, salinity regime, and tidal flow patterns Excessive siltation Introduction of pollutants Conversion of mangrove habitat and overharvesting of resources
Seagrass beds	Physical alterations Excessive sedimentation Introduction of pollutants Excessive input of nutrients
Salt marshes/Tidal flats	Degradation of bird habitat or larval fish habitat Obstruction of stormwater runoff
Barrier beaches, sand dunes, spits	Sand mining Erosion Dune migration

Mitigation

Mitigation measures are actions that can be taken to eliminate or reduce the level of impact from a proposed project (Table 5). Mitigation can take many forms (Clark 1996):

- Enhancement: improve or restore ecosystem being impacted;
- Minimization: reduce adverse impacts to the minimum level;
- Compensation: tradeoff of an unavoidable ecological impact for an ecological improvement in another area or of another type;
- Replacement: exchange a lost resource for another of the same type; or
- Indemnification: monetary recompensation for loss of ecological resources.

Minimization, or reducing the impacts at the site, is often the simplest approach. The preferred location of mitigation should be the project site itself; offsite mitigation should be considered secondarily (Clark 1996). Some mitigation measures are technological while others

may involve habitat protection. For sustainable development, every hectare of sensitive habitat lost to development should be mitigated with the complete protection of a hectare or more of similar habitat. Impacts of and mitigation measures for specific types of development activities are described in Chapter 3.

Table 5. Examples of mitigation measures.

- Relocate development to alternative site with fewer impacts;
- Compensate for the impacts by providing complete protection to similar habitat at another site or by restoring the same type of habitat;
- Limit the magnitude of the development action;
- Reduce impacts, such as pollution discharges, through changes in design, processes, or technologies;
- Reduce or eliminate other sources of pollutants or impacts in the area to reduce cumulative effects; and
- Provide compensation to the affected community to ensure that community receives fair share of the project benefits (such as job training or community infrastructure).

Monitoring Impacts from Development Activities

EIAs are predictive in nature and actual impacts may differ from predicted impacts. To measure impacts from development activities, a monitoring program is necessary. Monitoring may be necessary to ensure that the developer has complied with conditions of project approval and that actual impacts are no more serious than predicted impacts. It is important to realize that environmental systems are dynamic and changes can be difficult to distinguish from underlying dynamic patterns. A good understanding of how baseline conditions vary before the project is implemented is necessary to measure impacts (Figure 8). Replicated control sites, without the development activity, are also needed to measure impacts.

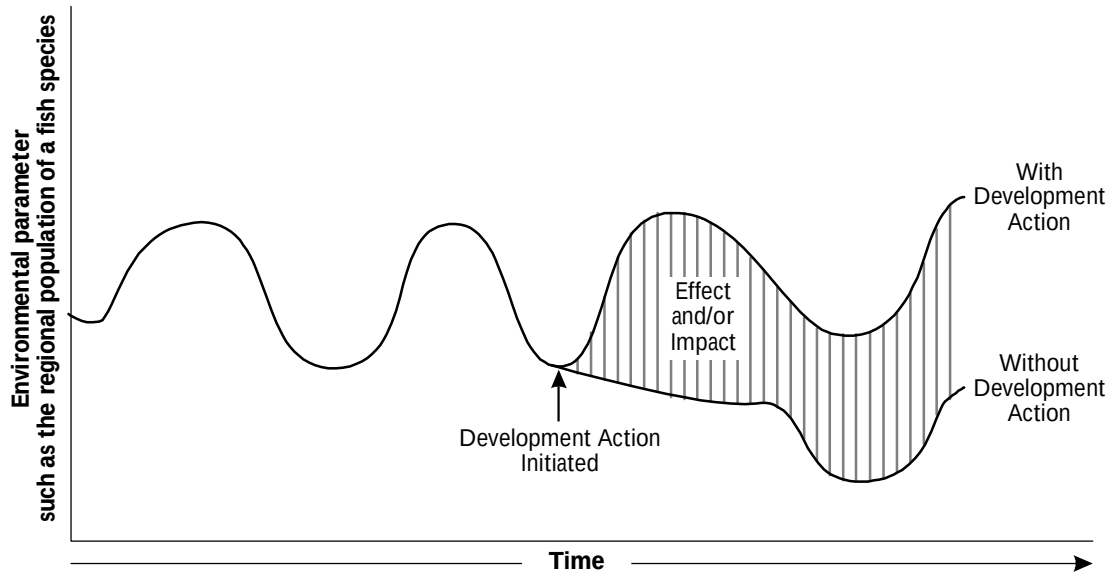


Figure 8. Distinguishing impacts from dynamic baseline conditions.

Environmental Impact Statement System Administered by EMB-DENR

The Philippine EIS System provides the legal and procedural framework for conducting EIAs for projects likely to have significant environmental impact. The Philippines formally established the EIS System in 1978 through Presidential Decree (PD) 1586 that designated DENR's Environmental Management Bureau (EMB) and DENR Regional Offices as implementing agencies. The EIS System was designed to safeguard the Philippine environment and natural resources in the face of growing industrialization and urbanization. Through DENR Administrative Order 96-37, DENR upgraded the EIS System and revised the implementing rules and regulations. DENR recently issued DAO 2000-05 that highlights the importance of public participation and social acceptability in the environmental review process.

The EIS System requires completion of an EIA and preparation of an EIS report for any environmentally critical project (ECP) or any project located in an environmentally critical area (ECA) as described in Tables 6 and 7. DENR determines whether a proposal is an ECP or will be implemented in an ECA; if either or both of these conditions apply, then the proposal is required to secure an environmental compliance certificate (ECC). For ECPs, the EIS System requires preparation of an EIS because these projects will most likely have high risk or negative environmental impact. ECPs include major resource extractive projects, major infrastructure projects, fishpond development, golf course resort development, and major industrial development projects. ECAs are areas that are ecologically, socially, or geologically sensitive; many coastal habitats such as mangroves, coral reefs, and municipal waters are classified as ECAs. For projects in ECAs, the EIS System requires an initial environmental examination (IEE) that includes a project description, and may require an EIS. After a thorough review of the project plans and EIA documents submitted by the project proponent, the project will be issued an ECC by DENR.

Table 6. Environmentally critical projects.

- **Heavy Industries**: including non-ferrous metal industries, iron and steel mills, smelting plants, and petroleum and petrochemical industries, including oil and gas;
- **Resource Extractive Industries**: including major mining and quarrying projects, forestry projects (logging, major wood processing, introduction of exotic animals in public or private forests, forest occupancy, extraction of mangrove products, grazing), and fishery projects (dikes for/and fishpond development projects);
- **Infrastructure Projects**: including major dams, major roads and bridges, major power plants (fossil-fuelled, nuclear, coal-fired, hydroelectric, geothermal), and major reclamation projects; and
- **Golf Course Projects:** golf courses and golf resorts are now subject to EIS requirements
- **Other**: Many other types of coastal projects not explicitly listed above may, at the discretion of DENR, require an EIS if they are considered ECPs. Some likely examples include major resorts or hotels, airports, ports, shoreline fortifications, fish processing plants, and major military development.

Table 7. Environmentally critical areas.

- National parks, watershed reserves, wildlife preserves, and sanctuaries declared by law;
- Areas set aside as potential tourist spots;
- Habitats of endangered or threatened species indigenous to the Philippines;
- Areas of unique historic, archaeological, or scientific interest;
- Areas traditionally occupied by indigenous people and cultural communities;
- Areas frequently hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.);
- Areas with critical (steep) slopes;
- Areas classified as prime agricultural lands;
- Aquifer recharge areas;
- Water bodies used for domestic supply or support of fish and wildlife;
- Mangrove areas supporting critical ecological functions or on which people depend for livelihood; and
- Coral reefs which have critical ecological functions.

Projects not covered under the EIS System include:

- Projects that are not ECPs or not located in ECAs
- Projects or structures that have been operating or existing since 1982, even if they are ECPs or in an ECA; however, expansion of developed area or production output by these enterprises requires an ECC.

If any of the above criteria apply, DENR-EMB or the Regional Office can issue a Certificate of Non-Coverage (Exemption Certificate) certifying that the project will not significantly affect the quality of the environment.

Many coastal habitats such as mangroves, coral reefs, and water bodies that support fish are considered ECAs. Therefore, the LGU should ensure that all development projects that impact these areas are subject to a submission of an IEE and an environmental review.

DENR provides direction and review of the EIS System and issues an ECC. EMB is responsible for review and issuance of ECCs for all ECPs. The DENR Regional Office reviews and issues ECCs for projects located in ECAs (Figure 9).

DAO 96-37 also explains:

- The preparation of an initial EIA;
- Scoping procedures;
- Who is allowed to prepare EIS and IEE documents;
- Who shall be accountable for the validity of an EIS;
- Who reviews the EIS or IEE;

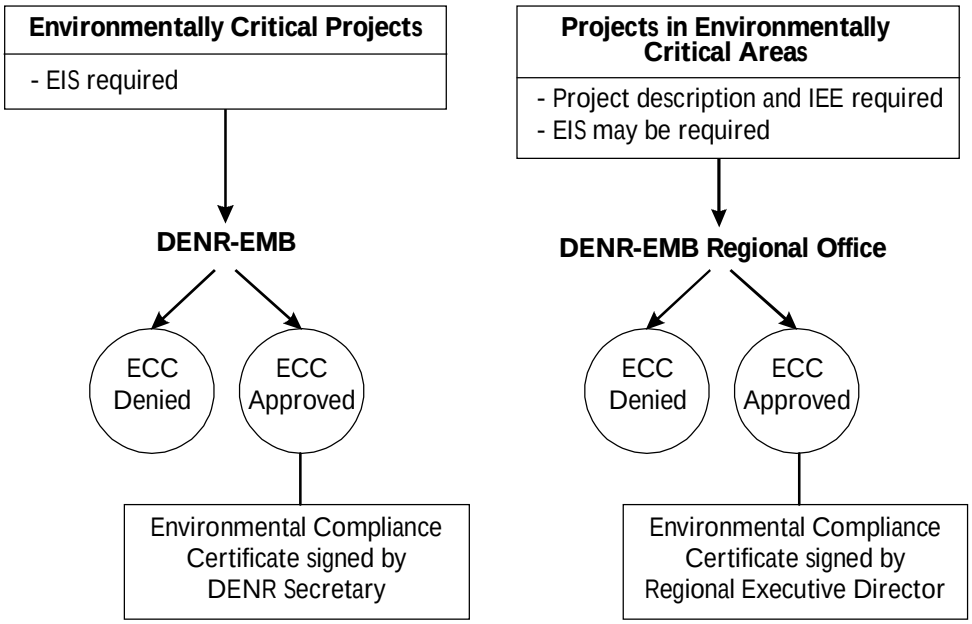


Figure 9. Overview of national EIS System.

- How decisions are made on a proposed project's ECC;
- How appeals on an ECC can be made;
- The fees and costs needed for processing and review of an EIS;
- Monitoring the project's compliance;
- The environmental monitoring and guarantee funds;
- The role of public participation and documenting the social acceptability of a proposal; and
- Penalties and sanctions for violating requirements of the EIS System.

The LGU has a critical role in ensuring that all development projects in their jurisdiction that are classified as ECPs or located in ECAs are subjected to the EIA review process. While not all projects may require a detailed EIA, all proposed development activities should be screened to decide which projects need a detailed evaluation of environmental impacts. Many coastal zone habitats are considered ECAs, so an environmental review of projects in the coastal zone may be warranted under PD 1586. The LGU should also facilitate community participation through public outreach. It is in the best interests of all stakeholders to design and choose the best development and mitigation options or to encourage DENR to deny an ECC if a project does not meet environmental standards.

Review Process for Environmentally Critical Projects

Proponents of projects classified as ECPs are required to conduct an EIA study and to submit an EIS report to DENR's EMB. The following are basic steps in the EIA process for these types of projects (Figure 10).

EIA Scoping

Scoping should begin as soon as the project is conceptualized and is focused on identifying issues and alternatives. Scoping is crucial because it allows stakeholders – those affected by the project – to identify issues that need to be addressed in the EIA. If the proposed project requires an EIA, then a preliminary evaluation is accomplished and meetings are held among DENR, LGU, local

The EIS System requires the participation of LGUs, NGOs, and local communities in the environmental evaluation and decision-making for proposed development projects and activities that may affect them. Regular consultation with DENR is warranted to get advance notice on proposals that may require an ECC and EIS, including development proposals originating both within and outside DENR.

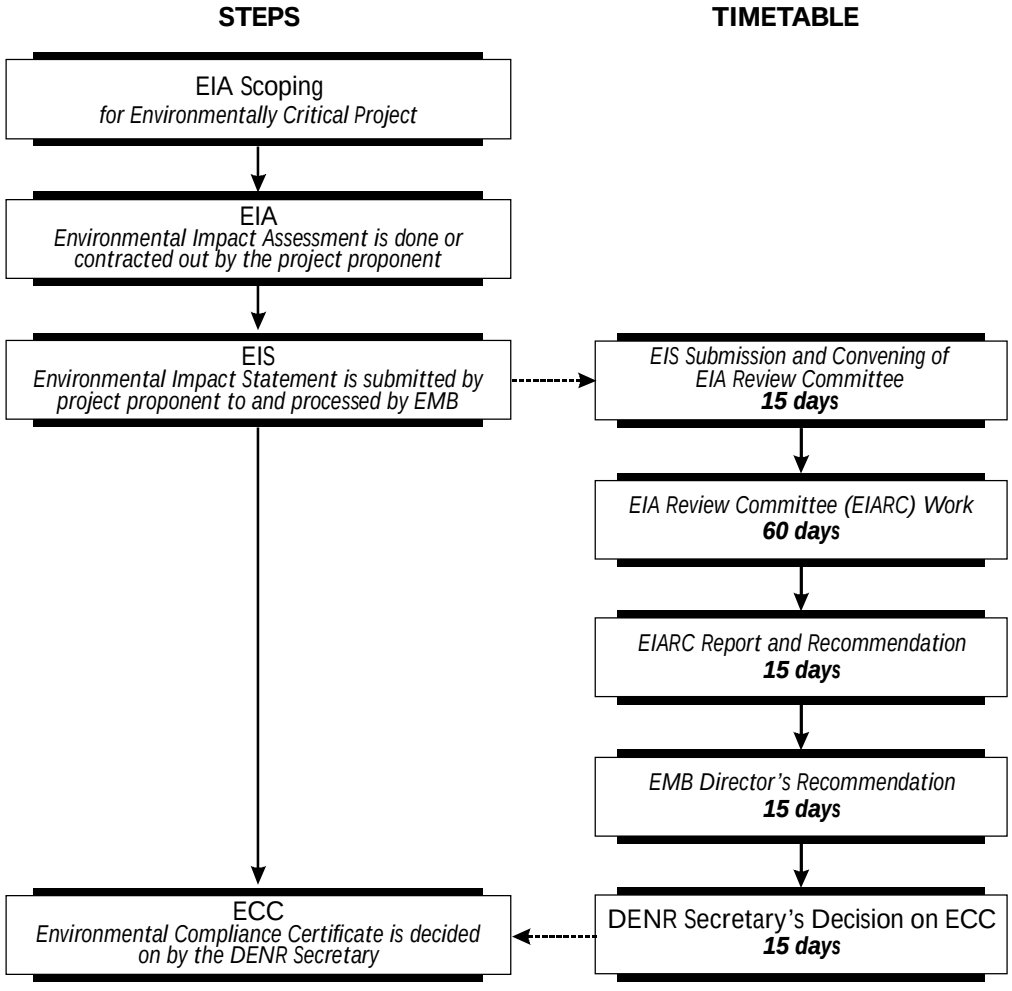


Figure 10. Steps and timetable for review of ECPs.

communities, and possibly NGOs and academic institutions to decide on the scope of the EIA. Scoping helps all parties understand the level of analysis required, specify the alternatives to be evaluated, identify potential impacts, and suggest possible mitigation and monitoring measures that should be addressed. Scoping is also used to determine if an environmental risk assessment (ERA) is needed and what factors may affect social acceptability of the project. Scoping sessions and consultations are used to solicit public input. Scoping meetings are documented by the proponent and signed by all representatives of stakeholders and integrated into a scoping report that documents the consultative process.

Affected local governments and communities need to provide their input during scoping to ensure that their concerns are going to be addressed in the EIA before it is completed. The LGUs should consolidate all local input and provide it in writing directly to the proponent with copies provided to the lead national development agency and DENR-EMB. DENR and the LGUs have the responsibility to ensure that all potential environmental impacts will be addressed in the EIA and to identify issues that may affect social acceptability.

EIA

The EIA is done or contracted out by the project proponent and is needed as the first step in the preparation of an EIS. The EIA should include evaluation of the proposed project's environmental and socioeconomic impacts and should identify alternatives (including the no-action alternative) and mitigation measures to reduce project impacts. The EIA should address impacts at all stages of project development from construction and operation through closure, and provide alternatives to manage and minimize impacts. The proponent submits the completed EIS to EMB which then evaluates it to determine the specific EIA System requirements for the proposal. Affected LGUs should request and obtain a copy of the submitted EIS Report, and in turn make it available to local communities and NGOs for comment.

Environmental Impact Statement and Environmental Management Plan

The proponent or consultants certified by DENR accomplish the required studies and prepare the EIS Report.

The EIS should contain an assessment of the most likely impacts of the project and should provide an environmental management plan (EMP) that lays out the measures to prevent or minimize impacts from the project.

In addition, DENR may require the EIS to include an ERA especially if the proposal involves hazardous, toxic, flammable, or explosive *materials* or *chemicals*, or involves the construction of *structures* such as dams, bridges, *which would endanger life, property, or the environment should they fail*. An Environmental Risk Assessment Report, Risk Management Plan, and Emergency Response and Contingency Plan would accompany the EIS. ERAs are described later in this chapter.

Local governments and communities should be provided the EIS for review in a timely manner, well before the EIS is finalized and forwarded to DENR for action. Comments should be compiled by the LGU and sent both to the proponent and DENR. The LGU and other reviewers should ensure that the required sections of the EIS are present (Table 8). The LGU should also note whether accredited individuals have prepared the report as directed under the EIS System (Table 9).

Table 8. Required sections or outline of the EIS document (DENR AO 2000-05).

- **EIS Summary,** a five-page summary of the EIS highlighting the results of the EIA, the EMP, and proponents' conclusions on the environmental acceptability of the proposed project;
- **Project Description** provides the project rationale, including data on project location, process technologies, material and waste streams, timing and phasing of implementation, and costs including alternative sites or action/no-action alternatives;
- **Summary of Scoping Agreements** in the form of matrix of issues and concerns to be addressed in the EIS including validation letter from EMB;
- **Baseline Environmental Conditions** for land, water, air, and people focusing on the sectors (resources) most significantly affeced by the proposed action;
- **Impact Assessment and Analysis** focuses on discussion of critical/significant impacts on the environment (from routine activities including cumulative impacts);
- **Environmental Risk Assessment** focuses on accident scenarios i.e., failure of pollution control devices or structures such as dams, accidental explosion, ignition and toxic dispersion, when appropriate;
- **Environmental Management Program/Plan** that detail the prevention, mitigation, emergency response, compensation, contingency, monitoring, and institutional measures to be taken during project implementation and operation to avoid/minimize and control adverse environmental impacts and the actions and resources needed to implement these measures;
- **Supporting Documents** such as: technical/socioeconomic data used/generated;
- **Proposals for Environmental Monitoring and Guarantee Funds** including justification of amount, when required; and
- **Accountability Statement** of preparers and proponents.

Table 9. Who can prepare an EIS or IEE?

- Only accredited individuals, offices, or organizations are allowed to do EIAs and prepare EIS or IEE documents. This is to ensure that only competent, credible, and qualified individuals are involved in the studies required to prepare these documents.
- DENR's EMB and Regional Offices are empowered to accredit individuals or organizations to be EIS or IEE preparers.
- DENR personnel are prohibited from participating in the preparation of EIS or IEE, except in their mandated role to provide guidance to the proponents.
- The IEE/EIS may be prepared by the proponents' technical staff or a professional group commissioned by the proponent, provided that only appropriate and duly recognized professionals with valid Philippine licenses can sign the required accountability statements. The DENR may opt to accredit entities and institutions conducting training on EIA preparation and those who successfully complete such courses can be recognized preparers.

EIS Review

The EIS is submitted to DENR's EMB which then forwards it to the EIA Review Committee (EIARC) for evaluation. The EMB will not accept an EIS document for review if it is incomplete or not adequately organized. The EIARC is composed of technically trained professionals in the natural, physical, and social sciences. The EIARC meets within 10 working days of submission of the EIS and completes its report and recommendations for an ECC within an additional 5 days. The EIARC can hold meetings with the proponent, conduct site visits, technical tests, and consultations with the stakeholders to ensure a thorough and substantive review of the EIS. The EIARC makes a report and recommendation to the EMB Director on whether the project should be issued an ECC. The EMB Director subsequently makes a recommendation to the DENR Secretary for approval/denial of the ECC application.

Questions that should be asked by the LGU or community representatives in the course of reviewing the EIS are included in Table 10. If there are any local objections to the quality or content of the EIS, the LGU should communicate them to DENR's EIARC.

Table 10. Questions to ask when reviewing an EIS report *(adapted from Carpenter and Maragos 1989)***.**

- Is the spatial and temporal scope of the EIA adequate?
- What alternatives are considered: No project? Other sites? Other technologies?
- Are all potential adverse environmental effects clearly identified and addressed?
- Are there impacts on environmentally critical areas or protected species?
- What mitigation measures are proposed and who is responsible for implementing them?
- What parameters need to be monitored?
- Has public participation through a consultative process been employed?

Environmental Compliance Certificate

The ECC certifies that the project proponent has complied with the procedures of the EIS System. For ECPs, the EIS together with the Committee's report is sent to the Director of the EMB, who in turn forwards documents and recommendations to the Secretary of DENR within 15 days. If the EIS and supporting documentation are complete, the Secretary makes a decision on the EIS. If documentation is incomplete, the Secretary may need more time to make a decision on the EIS and ECC or request additional input from the proponent.

Local governments and communities should continue coordinating with EMB regarding the ECC decision on a proposed project and communicate any local concerns or objections. The LGU may also want to recommend revision and follow-up coordination on the EIS to the DENR Secretary before final decisions are made on the project and its ECC.

Environmental Monitoring

After a project's ECC has been granted, the environmental management plan (a part of the EIS) is implemented, especially the initiation of environmental monitoring. The primary purpose of monitoring under PD 1586 is to ensure compliance with the conditions set in the ECC and the EMP. The EMP guides the implementation of the project to ensure environmental soundness in all project phases. Monitoring is usually initiated before construction starts and continues through project construction and project operation. Monitoring helps document the actual impacts of the project and provides the opportunity for determining compliance and identifies needed corrective measures.

A multi-partite monitoring team (MMT) shall be formed immediately after the issuance of the ECC to work out the operational details and develop a memorandum of agreement (MOA) that spells out the roles and responsibilities of the monitoring team and the funding required for the monitoring activities. An environmental monitoring fund (EMF) to provide funds for the monitoring team is established by the proponent before the construction phase. Normally, the core members of the team include representatives of the proponent, affected communities and women, LGU, EMB Regional Office with support from the concerned PENRO/CENRO and other sectors identified in the negotiations. The monitoring team evaluates compliance with the ECC and EMP, gathers information if damage occurs or public complaints are raised, prepares and disseminates monitoring reports, and conducts community education and information campaigns (EMB-DENR 1995).

Review Process for Projects in Environmentally Critical Areas

Environmental review procedures are somewhat different for proposed projects that may be located in environmentally critical areas (ECAs). The review of the proposed development is conducted through DENR's Regional Offices and consists of the following steps (Figure 11).

Initial Environmental Examination

The project proponent submits an initial environmental examination (IEE) to DENR's EMB Regional Office. The IEE contains a brief project description, expected impacts, and measures to be undertaken to control, manage, or minimize impacts on the environment.

IEE Review

DENR-EMB processes and reviews the IEE within 30 days. DENR-EMB reviews the IEE to see if it has provided sufficient and accurate information on the project and its impact, and to ensure that the EMP will sufficiently address adverse impacts. The review team can include technical experts from DENR, other agencies, academe, and EIA practitioners. The DENR-EMB Regional Office may conduct site investigations or public consultations during the course of the review; these efforts should be coordinated through the DENR Provincial or Community Environment and Natural Resource Officers of the provinces or municipalities where the project is located. The Sector's recommendations would then be forwarded to the Director of the DENR-EMB Regional Office for approval.

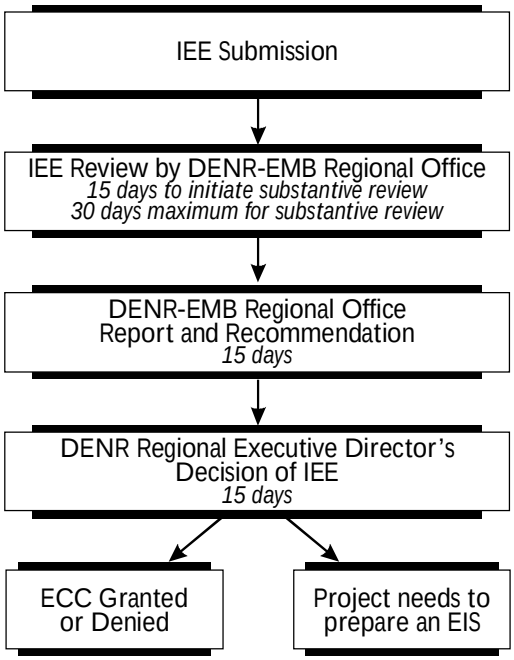


Figure 11. Steps and timetable for review of projects in ECAs.

Local governments and communities would follow the same strategies to ensure involvement in the review process for proposals in ECAs as described above for ECPs. The affected LGUs can also submit coordinated comments on a proponent's IEE and provide recommendations on the IEE, the ECC, or the project as a whole to the DENR-EMB Regional Office and the Regional DENR Director.

Decision on Requirement for EIS

The DENR Regional Executive Director (RED) determines whether the Project IEE may further require an EIS, is acceptable as described, or is unacceptable. For proposals with potentially severe adverse impacts, the project itself or its ECC may be denied by the DENR Regional Executive Director, which would then force the proponent to modify the project. An EIS is required for projects expected to cause significant impacts, involving large areas, altering the landscape, or relocating communities. The EIS for a project in an ECA is subject to a similar review as an EIS prepared for an ECP, but at the regional level.

Environmental Compliance Certificate

The RED determines whether an ECC will be granted or denied. For ECCs issued pursuant to an IEE, the CENRO or PENRO is tasked with monitoring compliance with the ECC and EMP.

Accountability for the Validity of the EIS on IEE

Adequate and appropriate information in the EIS or IEE is crucial for the development of good projects and measures to minimize or avoid significant impacts. The proponent and the EIS/IEE preparers are jointly responsible for the accuracy and completeness of these documents. They sign "accountability statements" that are attached to the EIS or IEE which requires them to provide all the necessary information for a complete and valid EIS or IEE. They also promise to bring any new information that comes to light to the attention of DENR. The proponent and preparers can be charged administratively or criminally if they are found to have provided misleading or false information or neglected to include important information in the EIS or IEE (EMB-DENR 1994).

Environmental Guarantee Fund

An environmental guarantee fund (EGF) should be set up for projects posing significant risks to people, property, and the environment, based upon the findings of the earlier completed ERA. Normally, a memorandum of agreement on the EGF would be signed by the proponent, DENR, LGUs (up to *barangay* level), and affected communities. The memorandum would specify the means to establish, manage, use, and account for the EGF. The specific purposes of the fund would include rehabilitation of damaged environments, compensation to injured parties and communities, raising public awareness, and contingency cleanups required due to project-related impacts.

Social Acceptability and Public Participation

Social acceptability is the resolution of all valid concerns regarding the project and is accomplished through public consultation, public hearings, alternative dispute and conflict resolution procedures, and posting or publishing public notices in advance of scheduled meetings. These strategies provide opportunities for all sectors to learn about proposals and offer input to influence the outcome of project decisions. In addition, appropriate attention should be given to the concerns of indigenous people and women who will be affected by the project. LGUs can play key roles in achieving compliance with this policy by helping DENR disseminate project information, helping to bring together stakeholders, and encouraging participation in the MMT.

The EIS System has provisions for public involvement and consultation. Public participation is strengthened through:

- **Public consultation**: Free and open exchange of information and discussion by the proponent and stakeholders.
- **Public hearings**: Hearings facilitated by a hearing officer designated by DENR are held especially if the project impacts a lot of people or if there is public concern about the project.
- **Alternative dispute or conflict resolution**: Mediation, negotiation, or other methods may be used to reach consensus if there are complex issues or unresolved issues between the proponent and the stakeholders that stall the EIS process or hinder the determination of social acceptability.

- **Public information**: Public notice of scoping meetings, submission of documents for review, and DENR's decisions on ECCs are essential to inform the public and should be paid for by the proponent.

The community should be involved at all stages, but especially during scoping, review, and monitoring to ensure community support for the decisions that will be made. Ideas on how to involve communities in the EIA process are provided in Table 11 and additional information can be found in *Guidebook 4: Involving Communities in Coastal Management*.

Table 11. How to involve communities in the EIA process.

- Provide public notice of proposed development and opportunities for public input;
- Announce public meetings in newspapers and on the radio;
- Conduct public meetings in the affected community;
- Make the EIA or EIS reports available to community representatives; and
- Notify and request comments from affected people's organizations, NGOs, community groups.

If the project is socially acceptable, agreements should be made on what economic benefits should go to the community. Other agreements on environmental protection and compensation in case of damages should be reached. Agreement among parties is forged through a memorandum of agreement (MOA) which is included in the EIS or IEE.

LGU Involvement in the EIS System

Local governments and communities should consult frequently with DENR to learn of new projects that need to be scoped, the review schedule, decisions on the need for an EIS, and whether an ECC will be granted. If there are any objections at the local level, the LGU can write to the DENR for the rationale of the decision. Additional correspondence or public involvement may be needed to resolve differences, if any.

At the local level, the following steps should be followed by the LGU to assess impacts of proposed projects:

- **Screening** - Verify that all ECPs or projects in ECAs, including those in the coastal zone that impact reefs and fisheries, are subject to the EIS requirements. Be aware of DENR's screening process and focus review and participation efforts on proposals with the potential for major adverse impacts. Visit project sites before the scoping sessions to identify potential impacts.
- **Scoping** - Ensure LGU and community participation in the scoping process. Focus on the major impacts, and outline the feasible alternatives, analyses, mitigation, and monitoring that needs to be covered for each proposal. Hold public meetings to begin the consultative process.

- **Analysis and EIA report** - Make sure the proponent (and consultants) comply with the agreed upon scope and the requirements of the EIS System. Review and offer comments on the EIA, preferences on the project alternatives, environmental mitigation, and environmental monitoring. Request for a public meeting if there are outstanding or controversial issues.
- **EIS and project decisions** - Check for adequacy and accuracy of the EIS or IEE and understand the rationale for the decision on an ECC. Request for additional meetings if things are still unclear or unacceptable.
- **Environmental compliance certificate and environmental management plan** - After decision-making, make sure that the ECC and EMP comply with the requirements of the EIS System.
- **Environmental monitoring and compliance** - Check on monitoring to insure that it is correctly implemented and to insure that the project construction complies with environmental standards and regulations.

The LGU should strive to request, read, and understand all environmental documents to evaluate the impacts of proposed projects on the local environment. The tables and guidelines provided in Chapter 3 will help in the evaluation of selected development activities. The LGU should request explanations or assistance from DENR and insure that local communities and governments participate at every step, from the beginning. The IEE, EIS, and ECC are public documents available upon request to DENR and should be readily available to the LGU and the community.

What if there is local opposition to development projects? A consultative process is required in the issuance of an EIS since the documentation of an MOA on social acceptability is a critical step. Local communities and governments should be involved in the project review process and communicate their objections through established channels to higher authorities at every possible step of the way, as suggested above. The stakeholders may appeal a decision made by the DENR RED in granting or denying an ECC. LGUs may compel DENR to require more extensive environmental monitoring or to conduct an environmental audit of the completed project to identify residual impacts that warrant remedy or correction. The LGU should be aware of fines and penalties for lack of compliance with the EIS System and ensure that enforcement is occurring and appropriate penalties are applied (Table 12).

ECONOMIC FACTORS AND EVALUATION TECHNIQUES

Economic factors should also be considered during the evaluation of proposed development activities. A healthy Philippine coastal environment (and associated coastal resources) offer tremendous value to the economy and to the welfare of the people (White and Trinidad-Cruz 1998). Economic evaluation procedures are, therefore, an important part of CRM, development

Table 12. Fines and penalties under PD 1586.

Projects that are established or operating without an ECC: Any project or activity that has been classified as an ECP or in an ECA and is established or operating without a valid ECC can be ordered closed through a cease-and-desist order (CDO), and subject to a fine of PhP50,000 for every violation.

Projects violating conditions of ECC, EMP, or rules and regulations: Projects violating any conditions of the ECC or EMP or rules of the EIS System shall be punished by suspension or cancellation of the ECC and suspension of operations and/or a fine not to exceed PhP50,000 for every violation.

Misrepresentation in the IEE or EIS or other documents: Misrepresentations in any documents submitted in the EIA process shall be punished by suspension or cancellation of the ECC and/or a fine not to exceed PhP50,000 for every misrepresentation.

planning, and EIA. The benefits of a proposed project should exceed the combined economic and ecological costs of constructing and operating the project over its useful "design" life.

Benefits include those that can be easily measured in monetary terms, such as the proceeds, dividends, profits, and increase in the value of capital (for example, the sale of shrimp collected in newly constructed ponds). However, less tangible benefits are just as important, such as future possible user fees to visit a park or enhancing public health (and reducing health care costs) due to treatment of contaminated water supplies or sewage effluents. Costs also include those that can be easily measured in monetary terms (such as the construction cost to build the shrimp ponds) and less tangible costs (such as the loss in productivity of coastal fisheries due to the clearing of mangroves for the ponds). *Thus, a benefit lost or foregone is a cost, and a cost avoided or reduced is a benefit*. The economic feasibility of a project is often portrayed in terms of *net benefits* (e.g. all benefits minus all costs), or as *a ratio of benefits over costs*. Projects demonstrating positive net benefits or a benefit-cost ratio of one or more would theoretically be considered feasible.

A major shortcoming of many analyses for proposed projects is focusing only on easily measured direct costs and benefits and ignoring environmental "*externalities*," e.g., intestinal illness due to contamination of food or water from project pollution, or damage to a coral reef from soil erosion from a logging project which reduces the benefits to coastal fisheries and ocean tourism. Many of the unaccounted for costs of pollution and habitat degradation are borne not by the developer or proponent of a project but by society and the government through decreased natural productivity of fisheries (and corresponding decreases in revenues) or increased tax spending (e.g., to restore damaged forests or reefs or to subsidize the welfare of fishers and tourism operators who have lost their livelihood due to nearby logging).

Many developers prefer to limit their economic analyses to strict financial analyses (e.g., profits and losses based on market prices). Why? Because there is no incentive for their analyses to account for environmental externalities and costs that they would not need to pay (e.g., compensation and mitigation costs as conditions of project approval), if they are not identified in the first place. Thus, it is critically important for local communities and government regulators to insist on a broader economic analysis that ensures that all major costs and benefits are accounted for, and in turn are taken into consideration when comparing the advantages and disadvantages of various development options for a proposal.

Valuation Techniques

Valuation techniques are used for estimating the costs and benefits for a proposed project, including less tangible environmental externalities. In particular, these techniques enable some environmental impacts to be quantified as economic losses. Some useful examples of quantifying losses or gains resulting from development projects include the following (Carpenter and Maragos 1989; White and Cruz-Trinidad 1998):

- Estimating the market value of changes in fish catches (either gains or losses) attributed to a project;
- Changes in the market value of a house or hotel, which are either increases (e.g., due to development of nearby parks or shopping centers) or decreases (e.g., due to development of a fish processing plant or coal fired power plant nearby);
- Decreases in the cost of health care attributed to pollution abatement (e.g., reduction in intestinal diseases due to treatment of mariculture effluents), or increases due to new sources of pollution (e.g., mine tailing discharges in coastal waters);
- Interviews or surveys of people's preferences, willingness to pay visitation fees or transportation costs, or demands for compensation, linked to predicted project costs and effects;
- The costs of relocation (or re-employment) of people displaced (or their livelihoods lost), or conversely, the benefits of new housing and employment opportunities, attributed to a proposed project; and
- The value of increases in scientific research or educational opportunities, habitat restoration, recreational, conservation, or aesthetic values.

ENVIRONMENTAL RISK ASSESSMENT

Environmental risk assessment is a process used to evaluate potential hazards to the environment, human health or property from development projects or other activities. A hazard is a danger, peril, or source of harm to people, property, or the environment such as (ADB 1990):

- Chemicals toxic to humans, plants, or animals;
- Materials highly flammable or explosives;

- Mechanical equipment, the failure of which would endanger persons and property;
- Structural failure (dams, bridges, etc.);
- Natural disasters; and
- Ecosystem damage (eutrophication, habitat loss, erosion).

The EIS System now requires ERA for some types of projects if they involve hazardous materials or the construction of structures that would endanger people, property, or the environment if they fail.

Simply stated, *risk = probability of occurrence* x *severity of impact*. ERA is used to estimate the importance of project impacts for which there is some uncertainty as to whether impacts will occur, but which may have severe consequences if they do occur. For example, port construction may increase the probability of a tanker grounding and oil spill, because tanker traffic would increase from projected use of the proposed facility. Although the probability of occurrence is very small, the ecological consequences to adjacent reefs and beaches would be disastrous if a large oil spill or ship grounding was to occur. Risk assessment would help to gauge the relative importance of the risk and help planners decide on the level of mitigation or whether an alternative port location with less risk of an oil spill should be included in the planning process and EIA. An approach for evaluating probability and severity of a hazard is shown in Figure 12.

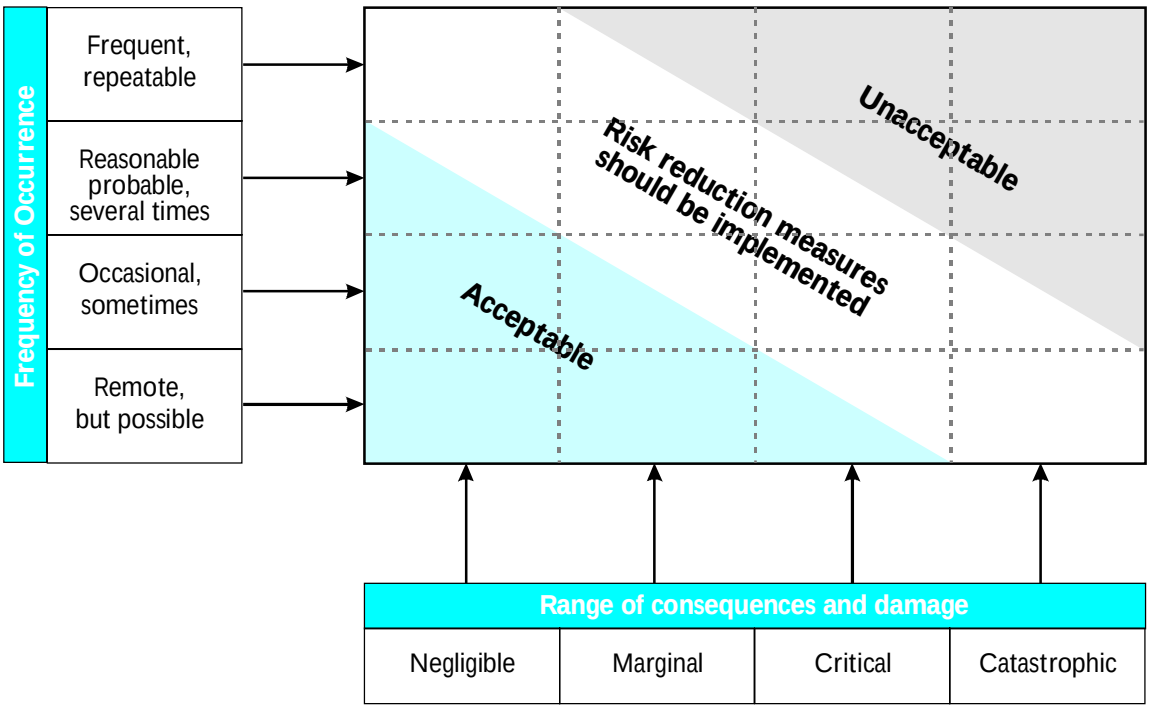


Figure 12. Evaluation of frequency of occurrence and severity of risks *(ADB 1990)*.

Risk assessment is used in situations where a project may materially lead to increases in the loss of human life, property, or catastrophic loss to valuable ecosystems. Risk assessment is particularly useful for projects that may be vulnerable to natural disasters such as dam failure due to a tectonic activity, construction of a high rise hotel in an area prone to tsunamis or typhoons, or construction of housing in a coastal zone prone to flooding. Risk assessment is also widely applied to projects that result in the release of chemical pollution that may cause adverse effects to human health and the environment.

The risk assessment process includes (Figure 13):

- **Hazard Identification**: builds on the identification of impacts in an EIA and identifies potential significant risks associated with the project.
- **Hazard Accounting**: sets the practical boundaries and scope of the ERA for the project.
- **Environmental Pathway Evaluation**: considers routes by which people or the environment could be exposed to the hazard and the expected effects of that exposure.
- **Risk Characterization**: estimates the frequency and severity of adverse impacts and presents the information in a format that can be used to make management decisions.
- **Risk Management**: describes the selection and implementation of risk-reduction measures.

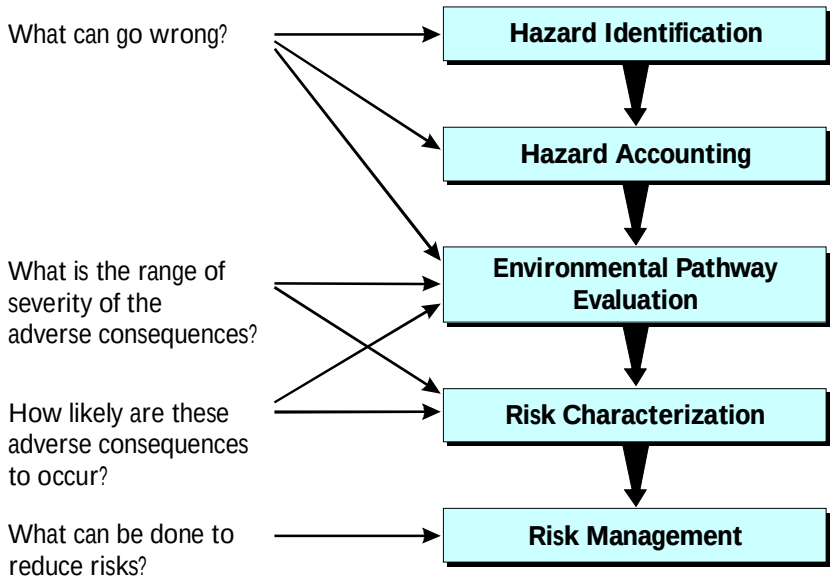


Figure 13. Overview of ERA process *(ADB 1990)*.

It is beyond the scope of this guidebook to treat risk assessment in much detail, but there are other references available for additional information (Carpenter and Maragos 1989; ADB 1990; Suter 1993). Risk assessment is also useful for long range planning by helping to establish priorities for future development and conservation initiatives. *Comparative risk assessment*, for example, can be used to rank the risk of various anthropogenic (human caused) stresses on a variety of coastal ecosystems in a particular province. Comparative risk assessment can help the government and other resource managers focus their use of limited funds to address top priority needs. The risk assessment in this case may show that overfishing and the use of destructive fishing techniques (e.g., cyanide, bleach, explosives, *muro-ami*) may collectively pose much greater risks to ecosystems than other anthropogenic stresses and should therefore be the focus of management efforts.

In summary, the LGU should use the planning framework and environmental review of projects to ensure that adverse environmental impacts are minimized. Local level plans should be developed using the planning framework described in *Guidebook 3: Coastal Resource Management Planning*. The planning efforts should be participatory and consultative. Any proposed development should be evaluated in the context of local land use, development, and CRM plans. EIA is the main tool to evaluate the potential impacts of the proposed development on the environment and human welfare. The LGU should take an active role in the environmental review of development projects using EIA. The LGU should work closely with DENR to be an active participant in the environmental review of projects under the EIS System, including projects requiring an IEE and those requiring an EIS. The LGU plays a key role to ensure local plans and concerns are addressed and that a participatory process has been utilized to address adverse impacts. The following chapter provides guidelines for assessing impacts of specific types of development.

chapter 3
Impacts of selected coastal development activities

This chapter reviews ten categories of coastal development activities and focuses on different sets of actions, impacts, and controls needed to reduce or avoid adverse environmental impacts. These reviews also draw upon project case studies and experiences outside the Philippines that have relevance to coastal development issues in the Philippines. Environmental guidelines that can serve as starting points for identifying potential impacts and mitigation measures for the coastal zone are described in this section. Only the downstream effects of upland development (e.g., mining and agro-forestry) are treated here.

COASTAL CONSTRUCTION AND RECLAMATION

Coastal construction involves the *removal* or *placement* of *deposits* and the *building* of structures *in or near coastal waters* for a variety of purposes (shore protection, land reclamation, ports, airports, bridges, coastal roads/causeways, housing, resorts, industries, sewage treatment plants, offshore moorings, etc.). This includes the dredging and filling (land reclamation) of coastal waters or the erection of structures for the purposes of increasing inhabitable land area, construction of transportation facilities (ports, airports, roads/bridges), or protection of shorelines prone to erosion. Common structures include navigation channels and turning basins, docks, seawalls, jetties, groins, breakwaters, replenished beaches, causeways, roads, and buildings. The possible consequences of poorly planned changes in shoreline are shown in Figure 14.

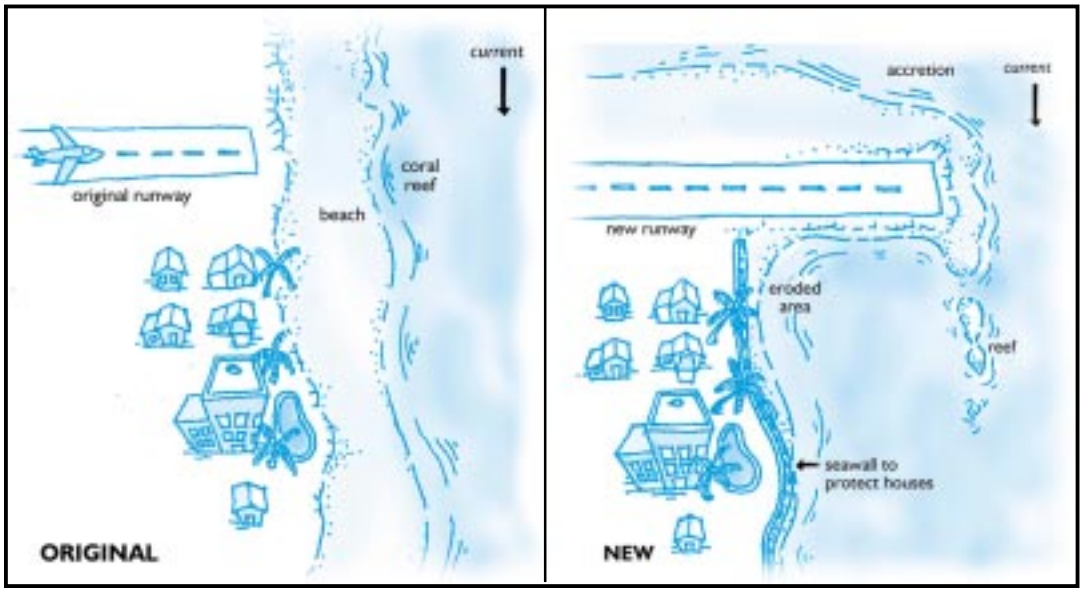


Figure 14. Extension of airport runway interferes with sand movement, Dumaguete City.

Coastal construction has been the most widespread of activities affecting coastal resources, especially with the advent of modern earth-moving equipment and the use of explosives for construction purposes during the past century. Invariably coastal construction in one form or another is required for most urban-related development including the expansion of settlements, industry, transportation facilities, utilities, businesses, and resorts. Coastal mining is a special category of coastal construction covered elsewhere in this section. Coastal engineering problems can be classified by their objectives and management considerations (Figure 15).

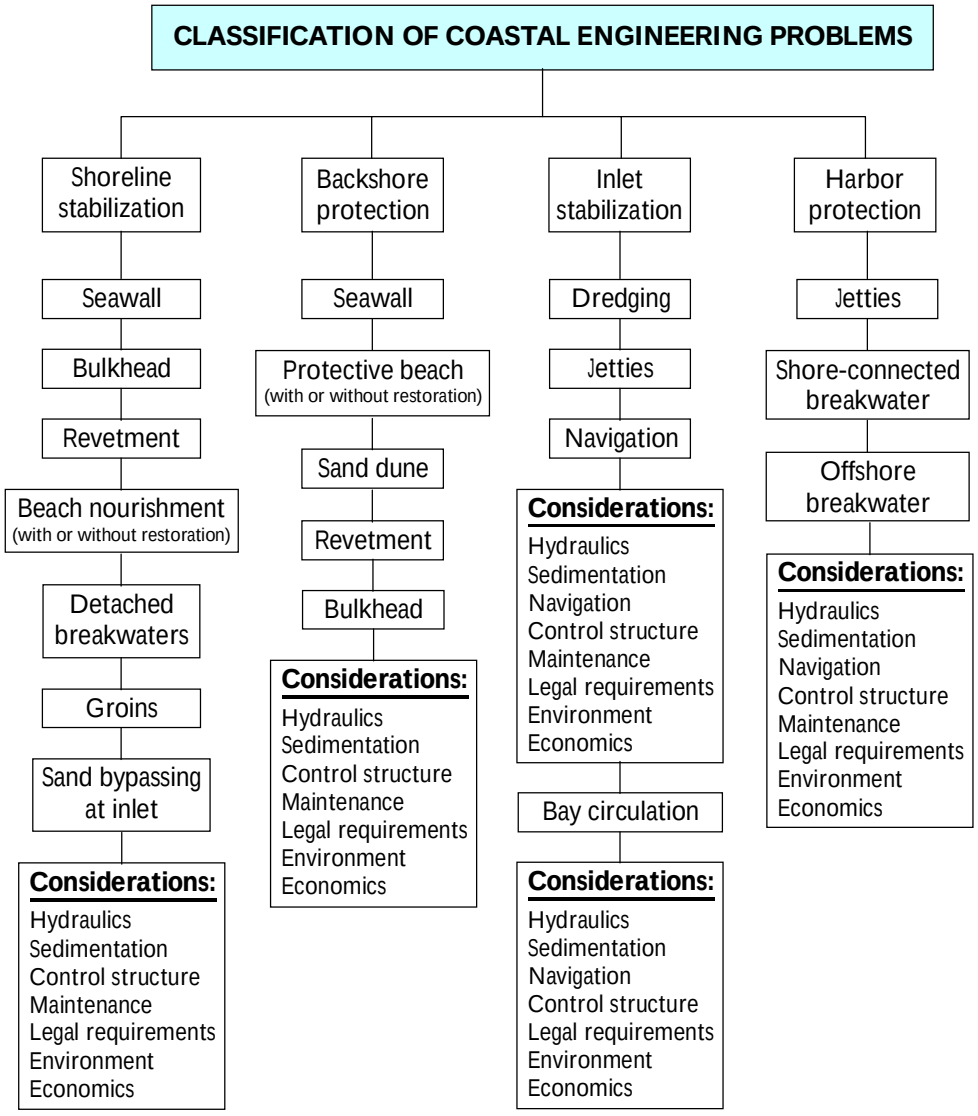


Figure 15. Classification of coastal construction activities and some important considerations *(adapted from U.S. Army Corps of Engineers 1984).*

Both the direct and indirect effects of coastal development have been severe on coastal resources. Any construction that modifies the shoreline will invariably change currents, wave action, tidal fluctuations, and the transport of sediments along the coast. Fill or land reclamation activities result in the permanent loss of marine habitat while excavation and dredging will permanently alter habitats and displace native ecosystems such as mangroves, seagrasses, coral reefs, and beaches. Coastal construction that restricts the circulation of coastal water bodies can also degrade water quality and coastal ecosystems. The use of explosives can fracture reefs and injure marine life, and some forms of dredging equipment can release or generate large amounts of sediments that can be transported well beyond the immediate vicinity of the construction activity and bury or smother bottom dwelling marine life and chase fish away. Removal of vegetation from adjacent land areas can destroy wetlands and other native coastal habitats and promote soil erosion and sedimentation. Dredging activities should be conducted using best management practices such as silt screens and careful management of dredge spoil materials (Figure 16).

Reclamation causes serious and permanent damage to coastal ecosystems and should only be done as a last resort when suitable terrestrial sites are not available. The loss of coastal fringe and impacts from dredging of fill material permanently destroy valuable coastal habitats. If reclamation is absolutely necessary, appropriate management considerations should be made (Table 13).

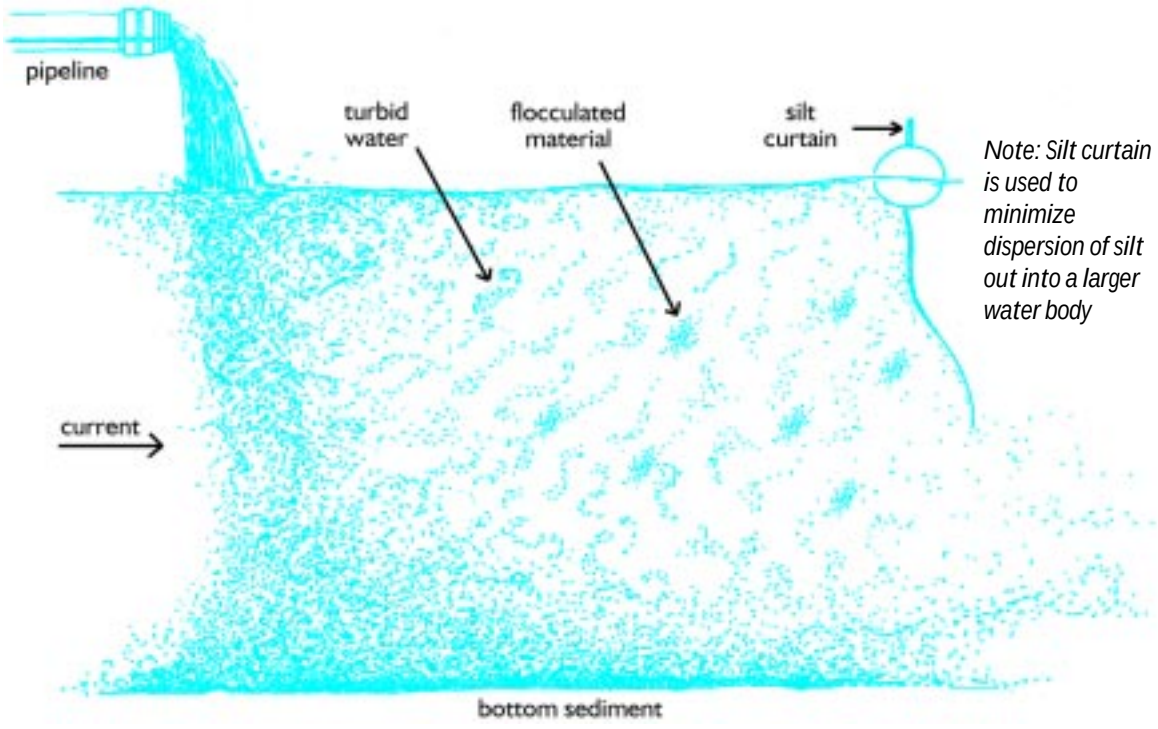


Figure 16. Factors affecting the capability of silt curtains to control dispersion of dredge spoil *(adapted from U.S. Department of Interior 1990).*

Table 13. Management considerations for reclamation *(Clark 1996)***.**

Reclamation of coastal areas for industrial, urban, aquacultural, agricultural, or port development should only be done as a last resort when no other land is available. Reclamation should:

- Be preceded by a survey and classification of wetlands and the economic value;
- Be preceded by a complete evaluation of best-use alternatives for the site;
- Be preceded by EIA of alternatives, including the no-action alternative;
- Be confined to zones where there is the least interference with critical habitats and coastal protection functions;
- Avoid interference or contamination of freshwater inputs;
- Use best management practices, such as silt screens to minimize sedimentation, to reduce impacts during construction; and
- Alternate with natural areas that provide nursery grounds for fish and invertebrates.

Development projects in the coastal zone often do not include appropriate setbacks to protect the foreshore from adverse impacts from erosion and storm damage (Table 14). In addition, current shoreline development patterns do not address the foreshore rights of local fishers or public access to the beach and water (Mayo-Anda 1998). The foreshore areas from mean high tide to 40 m inland are protected by law and reserved as open access space where no building or private ownership is allowed. The foreshore areas therefore are part of the public land and cannot be appropriated by a private person. DENR has jurisdiction on the management and disposition of the lands in the public domain; foreshore leases can be approved by the Secretary for Field Operations, the Regional Executive Director, or the Provincial Environment and Natural Resource Officer, depending on the size of the area (DAO 98-24 and DAO 2000-11) (see *Guidebook 2: Legal and Jurisdictional Framework for Coastal Management*).

Table 14. Importance of setbacks and protection of the coastal fringe.

One of the most important tools for protecting the coastal fringe and ensuring access by resources users is a "setback". A setback is a protected zone along the water's edge where development is prohibited. Setbacks provide a buffer between the ocean and upland areas that allow room for the natural patterns of tidal change, storm surge, and seasonal cycles of natural shoreline erosion. A setback is an area that is left free of any physical modification. Setbacks prevent property damage and also allow access to the coastal fringe by subsistence fisherfolk and recreational users (Mayo-Anda 1998). Setbacks also ensure that septic tanks are placed far enough away from the water's edge to minimize leachate runoff (Clark 1996).

The future prognosis regarding coastal construction is that it will *always* be needed to some degree to facilitate virtually all forms of future coastal development. Enough is known of the consequences to design some operational guidelines to effectively limit environmental damages. Table 15 summarizes the impacts of coastal construction. Other useful references include Carpenter and Maragos (1989), Dept. of Civil Engineering, University of Queensland (1991), Clark (1996), and Maragos (1993).

Table 15. Environmental consequences of coastal construction *(adapted from Carpenter and Maragos 1989; Maragos 1993)***.**

Activity	Consequences to the environment	Ecosystem impacts	Human health and welfare impacts	Mitigation
Dredging and filling	turbidity sedimentation bottom disturbance	degraded water quality loss of habitat loss of species possible toxicity	subsistence losses recreational losses economic losses to tourism & fisheries productive land losses degraded aesthetics	avoid high value areas control siltation, using silt curtains, settling ponds, & appropriate techniques
Blasting	concussion noise seismic shock	shattering of corals fish kills disturbance to marine mammals & turtles	property damage subsistence losses recreation losses economic losses to tourism & fisheries	timed to avoid migratory species & spawning seasons minimize charge size load charges in holes
Site clearance and grading	denuded landscape altered soil profile altered topography	soil erosion degraded water quality loss of habitat & species increased runoff increased land slippage	cultural resource loss subsistence losses recreational losses economic losses to tourism & fisheries productive land losses displaced residents degraded aesthetics	avoid sensitive areas archaeological surveys grading controls, using drainage berms, settling basins, & replanting vegetation population relocation
Construction activities	noise fugitive dust machinery emissions traffic congestion structural changes to coastal landscape fertilizers & pesticides	disturbance to wildlife habitat loss & toxicity degraded water quality & eutrophication	worker safety respiratory risks reduced quality of life subsistence losses recreational losses reduced aesthetics	noise controls emission controls control of toxics timed to avoid migratory seasons & spawning seasons compensatory enhancement
Labor importation	immigrant workers sewage & trash temporary housing	degraded water quality littering	introduced diseases sanitation problems overburdening of: infrastructure & public facilities cultural conflicts productive labor losses	noise controls emission controls control of toxics timed to avoid migratory & spawning seasons environment enhancement minimize contact with local population construct adequate housing & facilities

HUMAN SETTLEMENTS AND URBANIZATION

Expansion of existing settlements or founding of new settlements in response to an ever growing human population will occur with or without proper planning, especially in the Philippines where population continues to grow rapidly and concentrate in urban areas. Common features include housing, parks, schools, medical centers, government centers, utilities (power, water, sewage treatment, and trash disposal), drainage, local transportation, religious/cultural, and commercial facilities. Many types of infrastructure development to support human settlements have serious impacts and are typically controlled through a permitting process (Figure 17).

Coastal zones will continue to attract new migrants, including itinerants (e.g., "squatters") because of the perception of greater economic and subsistence opportunities there. Proper planning for settlements is complex and requires special attention to the many needs of residential areas, such as schools, hospitals or health clinics, businesses, police, fire prevention, satellite government centers, water supply, electrical power, trash pickup and disposal, sewage treatment and discharge, roads, street lighting, traffic control, libraries, parks, churches, etc. Industries and other employment centers may also need to be close by if new settlements are expected to attract

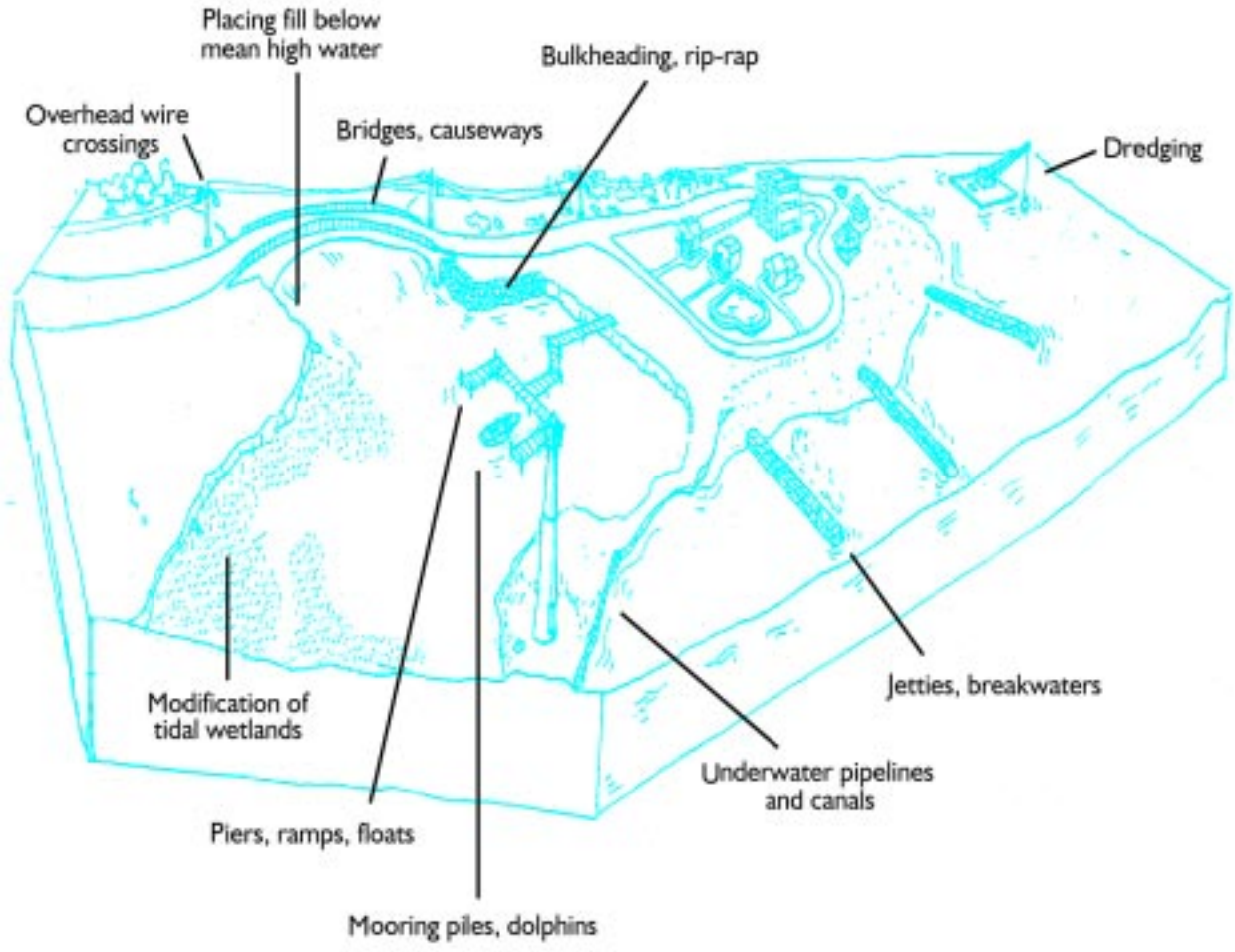


Figure 17. Development activities that require environmental review and environmental clearance because of potential impacts *(adapted from Carroll 1976)*.

residents. Long range planning and land use zoning are required for attractive settlements and their orderly expansion. Otherwise, slums and squatter areas expand where planning is poor or absent.

Settlements and urban centers can result in many major impacts on the coastal zone, and these have expanded substantially in the Philippines and other Asian and Pacific areas during the past half century following World War II. The principal effects are damages from coastal construction, declines in coastal water quality, loss or degradation of coastal ecosystems, increased incidence of diseases, depletion of nearshore fisheries, increases in fuel and oil spills, pollution from manufacturing and industries, littering and increased refuse and hazardous waste disposal, and overuse and damage to coastal recreation areas. The concentration of domestic wastes in landfills that are improperly sited next to the coast or improperly designed and managed can also cause serious impacts to coastal waters and human health (Figure 18). Also, settlements that do not plan for natural hazards can lead to exacerbated damage to coastal resources such as eroded beaches, loss of mangroves, and filling of coastal estuaries.

The prognosis is that the demand for new or expanded settlements will increase in proportion to population increases in the Philippines, with ever-increasing demands for housing and other related services in urban centers. The impacts to coastal resources will worsen and spread to adjacent coasts, especially in the absence of orderly planning and EIA. Table 16 is a tabular summary of the impacts of settlement development and urbanization on coastal resources.

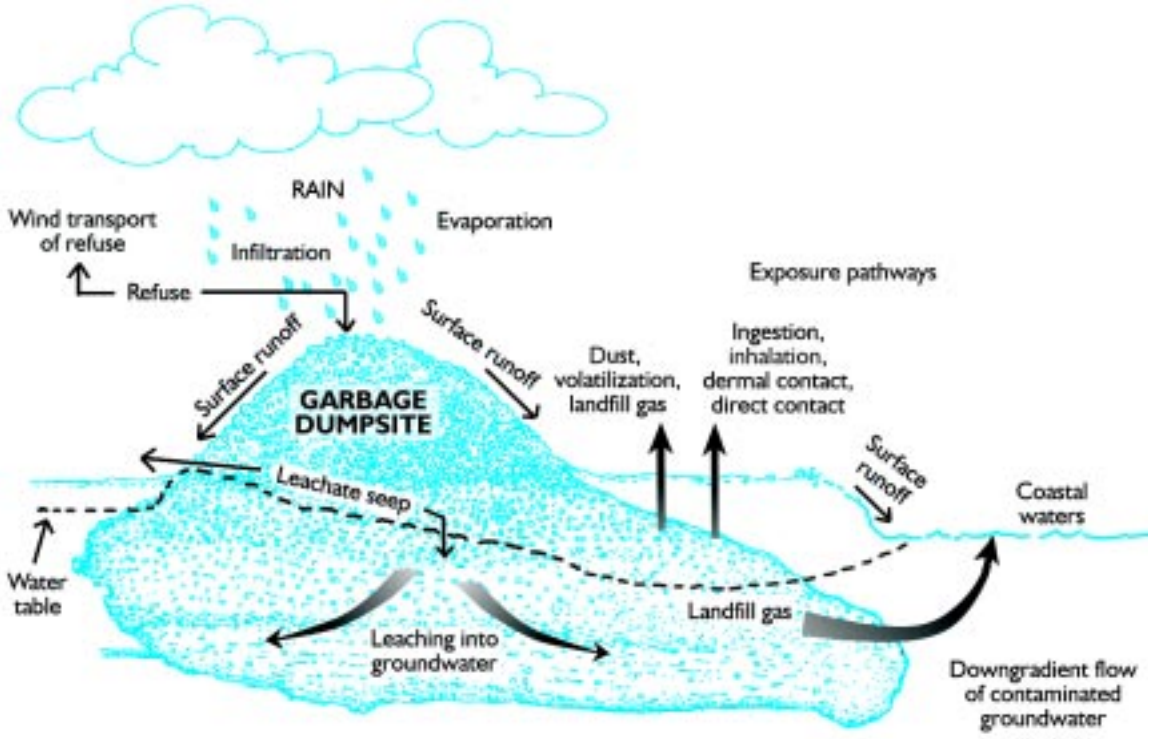


Figure 18. Impacts of garbage dumpsites on the coastal zone.

Table 16. Environmental consequences of human settlements and urbanization *(Carpenter and Maragos 1989).*

Activity	Consequences to the environment	Ecosystem impacts	Human health and welfare impacts	Mitigation
Housing & schools	loss of rural/open land coastal encroachment	habitat & wildlife loss disturbed water bodies	agricultural losses subsistence losses	land use zoning shoreline setbacks
Medical services	medical waste	water & solid waste species contamination	infection & disease subsistence losses	locate inland waste management
Sewage collection, treatment & disposal	discharge of sewage	water pollution species contamination eutrophication	illness & disease subsistence losses recreational losses losses to businesses	land use zoning post-treatment discharge in open waters, away from valuable areas
Electric power	air & noise emissions distribution systems cooling water discharge	disturbance to wildlife thermal pollution other water pollution species losses habitat disturbance	air & noise nuisance subsistence losses income loss from fisheries loss of recreation reduced tourism	nuclear safety plan land use plans & zones temperature limits on heated effluents controls over noise/air emissions (filters)
Water supply	loss of surface & ground waters	loss of wetlands seawater infiltration loss of fish & wildlife	water recreation losses subsistence losses rise in cost of water loss of agriculture	water conservation withdrawals away from valuable areas control withdrawals
Roads & transportation	conversion of open lands & coasts	increased access & harvest of species	lifestyle disturbance subsistence losses	land use planning shoreline setbacks
Solid waste management	landfills & dumps air pollution leachate discharges pests & disease vectors	decline in species habitat loss water pollution coastal contamination	recreational losses odor & smoke nuisance agricultural losses subsistence losses public health declines	prohibit dumps & landfills near coast waste reuse, recycling & reduction land use planning
Cemeteries	water contamination	habitat loss	public health risks	site away from coast and water sources
Parks & recreation	habitat changes	more human access to coastal species & habitats	loss of subsistence	add to land use plans focus on valuable areas resolve use conflicts
Airfields & docks	disturbance or loss of coastal areas air & noise emissions oil discharges	water pollution habitat & species loss increased access to coastal habitats disturbance & hazards to wildlife & fish	subsistence losses air & noise nuisances air operations hazards agricultural losses less shoreline losses recreational losses lifestyle & cultural loss	airport compatibility & safety plans pollution control plans port master plans with public access port designs avoiding shoreline erosion
Business & shops	loss of rural & open space	water pollution solid waste pollution	traffic nuisances noise, air, solid waste	land use & zoning plans site away from coast
Drainage/ flood control	channelization dams & reservoirs shoreline fortifications	loss of wetlands & coastal habitats loss of species	loss of productive land land use & access loss higher costs for safety	setbacks away from flood & zoning plans
Shore protection	(see Table 15)	(see Table 15)	(see Table 15)	require shoreline setbacks for structures
Reclamation (see Tables 13 & 15)	permanent conversion of water to land use permanent change in coastal circulation	destruction of coastal species & habitats water pollution water current changes	subsistence loss recreational loss cultural loss economic (tourism) loss	reclamation should be the last resort restrict to only coastal dependent uses

INDUSTRY

Industrial development in the coastal zone is concentrated near population centers to take advantage of other services, clients, suppliers, and labor sources. This category includes both light and heavy industries such as manufacturing, tanneries, beverage distilleries, canning, bottling and packaging plants, paper mills, lumber mills, printers, photo-processing laboratories, garment factories, electroplating, slaughter houses, smelting plants, chemical plants, sugar mills, refineries, fish processing plants, and the waste or pollution control facilities required for any of the above.

Often coastal waters are used as convenient sites for the disposal of effluents and solid waste. Thus, major impacts on coastal resources include water pollution, and declines in marine biota, contamination of food fish, and solid waste pollution. Industry is also inherently incompatible with other land uses, especially residential, resort, recreational, religious, and other land uses on account of the potential for air emissions, noise, odors, traffic congestion and safety, water pollution, solid waste accumulation, and aesthetic impacts. Long range or special area planning is essential for siting and laying out industries efficiently and away from incompatible uses such as in industrial parks. A summary of industrial impacts is provided in Table 17.

Table 17. Environmental consequences of industrial development *(Carpenter and Maragos 1989)**.***

Activity	Consequences to the environment	Ecosystem impacts	Human health and welfare impacts	Mitigation
Fish processsing Poultry & pig farms Tanneries Slaughter houses	animal waste wastewater discharge air emissions pollutants	habitat losses species losses pest infestations water pollution solid waste pollution	noise & odors public health hazards recreational losses subsistence losses aesthetic losses	move away from coast & residential areas waste management plan treatment of air & water pollution
Sugar mills & refineries Distilleries	washwater discharges air & steam emissions vegetable waste	habitat losses sedimentation of coast & streams eutrophication	subsistence losses some air & noise pollution solid waste pollution	move away from coast sedimentation basins recycle washwater
Manufacturing Garment factories	disposal of chemicals solid waste disposal	solid waste pollution water pollution discharge of toxics	lifestyle changes	move away from coast waste management plan land use & zoning plan recycle chemicals
Canneries & bottling plants	sludge & effluents solid waste disposal	solid waste pollution pest infestations heated effluents water pollution	lifestyle changes noise disturbances odors public health hazards	move away from coast recycle steam & washwater treatment and proper disposal of all solids
Paper & lumber mills Printers & photo labs.	solid waste disposal wastewater discharges toxic chemical use & discharge	habitat losses deforestation species declines water pollution toxic chemical waste	low paying jobs lifestyle changes noise disturbances	move away from coast and residential areas separation & proper disposal of toxics paper & wood recycling

(continued)

Table 17. (continued)

Activity	Consequences to the environment	Ecosystem impacts	Human health and welfare impacts	Mitigation
Smelting plants Chemical plants Fertilizer plants	stack emissions solid & chemical waste dust and noise loss of land & coasts	slag, sludge, chemical & solid waste toxic chemical waste water pollution habitat & species loss unhealthy air quality	subsistence losses lifestyle losses recreational losses business losses & gains public health hazards noise & air disturbance aesthetic losses	move away from coast & for all toxic waste and discharges sedimentation basins stack emission controls
Cement plants	sand mining dust and noise loss of land erosion/runoff	habitat loss air pollution	noise disturbance truck traffic public health hazards	land use and zoning avoid sand mining in sensitive areas control dust with water
Electro-plating	toxic chemical use and discharge (heavy metals) wastewater/runoff air emissions	toxic chemical waste water pollution habitat and species loss	public health hazards contaminated seafood	move away from coast control toxic waste and discharges on-site waste treatment plant

TOURISM

Tourism includes resorts, hotels, golf courses, recreation, beaches, other visitor destination areas, and associated residential and support services such as transportation, waste/effluent treatment, tour operations, sightseeing, businesses, and handicraft industries.

Tourism, including resort development, provides opportunities for jobs, income, and reduction in national trade imbalances. Properly designed and sited tourism also provides the opportunity for cultural and ecological resource protection at visitor destination sites and promotes other low impact business and job opportunities. Conversely, tourism can also lead to severe ecological, cultural, and socioeconomic effects if not properly conceived and implemented. Tourism development sites and designs also require consideration of aesthetic and scenic values. Many tourism developments fail because they are not attractive to visitors. Protection of environmental quality is a prerequisite for successful coastal tourism. Tourism ventures are potentially damaging to coastal zone resources and poor implementation may result in lost opportunities for the region (Figure 19).

Tourism needs to be located where it will not be intrusive to local communities and removed from industry and other incompatible land uses. A good case can be made to use special area planning procedures during the first phase of planning for future tourism to insure resorts are accessible to visitor attractions, do not overburden utilities and transportation facilities, and are

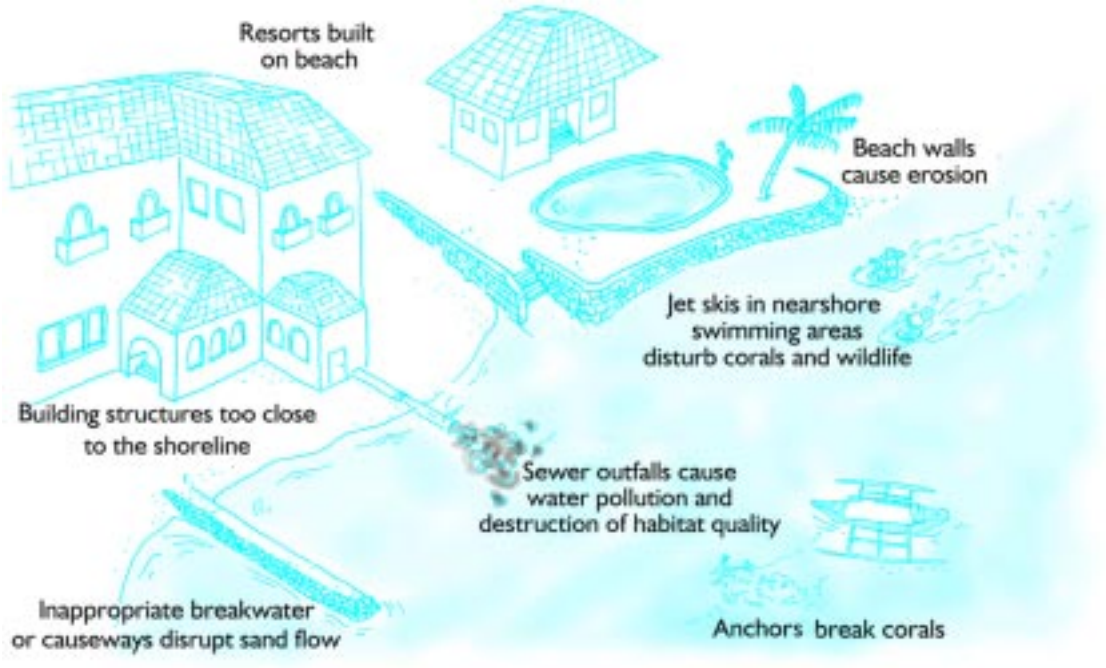


Figure 19. Frequent environmental impacts of tourism development and activities on the coastal zone.

not sited near incompatible land uses. Land use zoning is an excellent strategy for long-range protection of prime tourism sites from encroachment from conflicting types of development and activities.

Tourism development can result in many types of adverse impacts to coastal resources. A very prevalent problem is the encroachment of resorts on beaches. Seasonally large waves or storm activities can temporarily erode beaches. If resort structures are too close to the water's edge, they can be severely damaged or destroyed. For concrete or high-rise style resorts, the structures cannot be moved or removed and resort owners are often forced to install seawalls and revetments to prevent structural damage or offshore breakwaters and groins to help trap new beach sand. In turn these structures invariably prevent natural replenishment of beaches during favorable weather or cause beach erosion at adjacent lands (Figure 20). The net effect is an expanding cycle of beach loss and increase in coastal fortifications, degraded aesthetics, and increased costs for protection and artificial beach replenishment. New sources of sand then must be obtained elsewhere to place on the eroded beaches, potentially expanding impacts to beaches and sand deposits in other areas, well outside of the resort area. In retrospect, a good resort plan could have avoided these environmental and economic problems in the first place by requiring all permanent structures to be set back far enough inland so as not to be threatened by wave action and subsequent beach erosion. If shoreline protection measures are required, appropriate designs to minimize environmental impacts should be used (Figure 21).

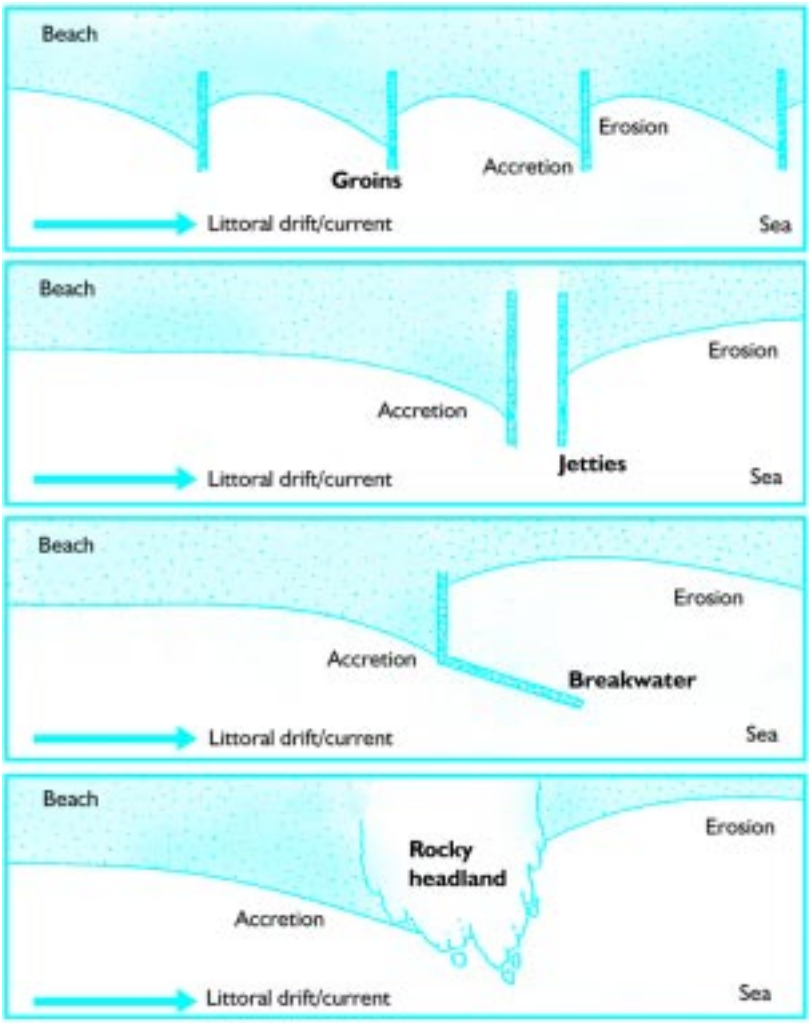
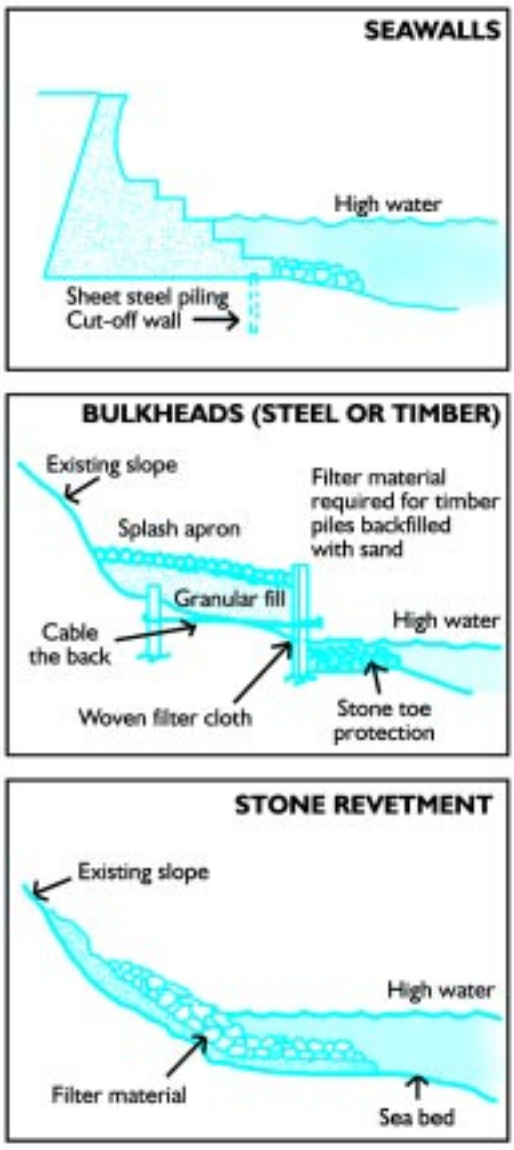


Figure 20. Examples of downdrift erosion resulting from hard engineering solutions (*adapted from Clark 1996****).***

Other major problems caused by large resorts include removal of valuable agricultural land and wetlands for golf courses and marinas; removal of mangroves for artificial beaches; overfishing of subsistence fisheries to supply resort restaurants; conflicts between local fishers and sport divers and sport fishers; inflation in the cost of housing, food, and transportation; increased sewage pollution and demands on existing sewerage and treatment facilities; similar over-taxing of power, telephone, and transportation facilities; overuse and anchor damage at boating, snorkeling, and diving sites, and depletion of ornamental fish and shells by aquarium fish collectors and souvenir sellers.



ADVANTAGES: Provides protection both from wave action and stabilizes the backshore; Low maintenance cost; Readily lends itself to concrete steps to beach; Stabilizes the backshore.

DISADVANTAGES: Extemely high first cost; Subject to full wave forces, fail from scour, flanking of foundation; Not easily repaired; Complex design and construction problem. Qualified engineer is essential; Slope design is most important; More subject to catastrophic failure unless positive protection is provided.

ADVANTAGES: Provides positive protection; Maintains shoreline in fixed position; Low maintenance cost; Materials are available locally.

DISADVANTAGES: Vertical walls induce severe beach scouring. Adequate toe protection required; High first cost; Subject to flanking; Bulkheads must be tied back securely; Pile driving requires special skill and heavy construction equipment; Complex design problem; Limits access to beach.

ADVANTAGES: Most effective structure for absorbing wave energy; Flexible — not weakened by slight movements; Natural rough surface reduces wave runup; Lends itself to stage construction; Easily repaired — low maintenance cost; The preferred method of protection when rock is readily available at a low cost.

DISADVANTAGES: Heavy equipment required for construction; Subject to flanking and moderate scour; Limits access to beach; Moderately high first cost; Difficult construction where access is limited.

Figure 21. Advantages and disadvantages of different shoreline protection structures *(adapted from U.S. Army Corps of Engineers 1984).*

Table 18 provides a tabular summary of tourism-related impacts and mitigation measures. The future prognosis is that tourism development and the need for its proper planning will grow throughout the Philippines and will continue to be a priority coastal management concern. It will also be a major economic concern as tourism development increases in neighboring countries and increases competition for tourism income. The handbook titled *Managing Coastal Tourism Development* (Huttche *et al.* 2001) provides more guidelines for this development activity.

Table 18. Environmental consequences of tourism *(Carpenter and Maragos 1989)***.**

Activity	Consequences to the environment	Ecosystem impacts	Human health and welfare impacts	Mitigation
Solid waste disposal	trash and litter pollution leaching from landfills smoke & fumes from burning	degraded water quality degraded air quality toxicity to species degraded habitat entanglement of marine life	public health risk economic losses (tourism) aesthetic losses cleanup costs	plentiful supply of litter receptacles routine cleanups adequate treatment & disposal technology waste management program
Sewage disposal	suspended solids pathogenic organisms chlorine freshwater demand eutrophication	degraded water quality eutrophication species toxicity habitat loss	public health risks from pathogen exposures & food web toxicity subsistence losses recreational losses economic losses to fisheries & tourism aesthetic degradation cleanup costs	waste management program sewerage treatment plants and infrastructure
Land use changes	secondary development enhanced access	land cover changes overfishing & resource depletion ecosystem changes	air pollution urbanization water pollution reduced quality of life	land use planning and controls fish catch limits public education
Tourist activities: sightseeing reef walks souvenir collection	enhanced access increased contact with local culture	resource depletion ecosystem changes	loss of agricultural lands overburdening of infrastructure aesthetic changes	siting away from sensitive areas
Employment of local residents	labor shift to service from production round-the-clock work shifts	loss in non-tourism production capacity	disruption of traditional family values cultural conflicts social differentiation reliance on cash new mobility lifestyle changes dependence on imports	employee training upward mobility
Immigrant employees	increased population	increased demand on fisher resources	housing shortages overburdening of infrastructure social gaps (outsiders fill high-level jobs) subsistence losses	housing impact fees employee training employee interpretation educate outsiders on locals' resource needs
Landscaping & golf courses	fertilizers & pesticides ground clearing maintenance water demand increase exotic species	toxicity & habitat loss soil erosion and sedimentation loss of species spread of exotics	public health risk subsistence losses changes in recreation agricultural losses other land use losses	manage chemical use intercept & treat runoff water soil erosion control use native species

COASTAL AND SEABED MINING

Coastal and seabed mining includes enterprises that use manual labor, explosives, or heavy equipment to extract minerals from the coastal zone such as quarry stone, rock, gravel, sand, or other construction materials and corals for producing chemicals such as cement and lime.

Coastal deposits of rock and sand are attractive sources of construction and building materials because they are often located near development sites. Collection sites seaward of the shoreline will not require government compensation payments to private landowners because, throughout the Philippines, private land ownership terminates landward of the shoreline. Thus, for government sponsored development or mining projects, these resources are considered "free" relative to the cost of similar materials purchased from private sources. Faced with limited budgets for construction projects, government officials may find coastal sources of construction materials more attractive than any other sources. However, mining of sand and other materials leads to serious impacts which should be avoided (Table 19).

For similar reasons, coastal sources of quarry and armor rock may be cheaper and more attractive. Normally these resources are excavated from hard reef flats well beyond the shoreline. The use of explosives and heavy equipment on reefs to excavate quarry rock can damage the ecology and structure of coral reefs. Removal of reef rock may also expose onshore beaches to greater wave action and erosion. The resulting quarry holes may intercept sand transported along the shore and rob downstream beaches of sand. Mangroves may need to be cleared to gain access to mining sites.

Table 19. How sand mining contributes to coastal instability.

Sand is produced from the erosion of carbonate skeletons of corals, foraminifera, and calcareous algae that live in coral reef, seagrass beds, and other coastal habitats. Sand is a renewable resource; however, destruction of these habitats results in a loss of new sources of sand and sand mining can overexploit sand supplies. Large-scale use of sand resources for construction or commercial mining is almost always unsustainable since the rate of production of new sand is very slow (Carpenter and Maragos 1989).

Sand beaches are dynamic and constantly changing in width and slope due to winds, waves, tides, and storms. Sand is the key to natural protection of beachfront property as quantities of sand held in storage by the beach dissipate storm energy as sand is lost offshore to sand reservoirs via storm waves. This sand is later restored naturally to beaches by currents and waves in a natural cycle of loss and replenishment. While sand for construction or beach restoration is a valuable commodity, sand mining of a beach or offshore area disrupts this natural cycle and leads to coastal erosion and beach recession (Clark 1996). Removal of sand from the offshore areas by dredging results in a depression in the bottom; this depression is naturally filled by sand transported by waves from nearby beaches. Thus, a perpetual cycle of dredging sand offshore and placing it on the beach with resulting beach loss and need for more replenishment will result. For this reason, large-scale removal of sand from the beach or offshore areas should be prohibited. If offshore sand mining is necessary, areas that are affected by wave action (often to depths of 10-15 m) or near coral reefs or seagrass beds should be avoided.

The impacts can be more serious for quarry rock, sand, and gravel, excavated from reef flats and transported offshore via ships and boats. To facilitate transfer, channels may be dug so that boats can be moved across the reef to stockpiles to facilitate loading operations. The resulting channels may create rip currents, which can intercept sand moving along the shore and transport it offshore into deep water where it is permanently lost to the littoral sand cell and beach system, resulting in permanent beach loss. Some types of coastal mining involve the use of cranes moving along offshore temporary earthen causeways which are initially constructed on the reef or sand flats. This allows the cranes to gain access to offshore sources of sand or other sediment sources. The cranes then scoop the materials from either side of the causeway and stockpile the material in the water where it is de-watered and later loaded onto dump trucks, which gain access to the stockpile sites via the same causeways.

The main adverse impacts of coastal mining are physical damage or destruction of habitats (coral reefs, seagrass beds, mangroves, and beaches) which are cleared, eroded, buried, or crushed by mining activities. Resulting turbidity and alteration of currents can then extend impact zones well beyond the immediate mining sites. Corals and seagrasses are sensitive to sediment burial and compaction and crushing via heavy equipment operations. Habitats can be chronically or permanently degraded by coastal mining, although some submerged quarry holes on outer reef flats often permit recolonization of corals and fish. Collection of live corals as a source of minerals or building materials is among the severest of impacts because the corals build reefs and provide habitat. Table 20 provides a summary of impacts and mitigation measures for coastal mining.

Table 20. Environmental consequences of coastal and seabed mining and extraction *(Carpenter and Maragos 1989)*.

Activity	Consequences to the environment	Ecosystem impacts	Human health and welfare impacts	Mitigation
Coastal rock quarries	blasting cutting & rock crushing productive land loss	loss of land habitats loss of vegetation loss of wildlife	loss of historic sites subsistence losses recreational losses commercial losses	locate away from coast land use & zoning plans locate & protect important sites
Reef flat quarries	drilling and blasting heavy machinery excavation	shattering & injury to fish, corals, turtles, marine mammals, etc. heavy equipment crushes reef & corals sedimentation shoreline erosion	loss of shore & reef access subsistence losses recreational losses commercial losses to tourism & fisheries ciguatera fish poisoning cultural & lifestyle loss	place explosives in drilled holes confine operations to inside quarries design outer reef flat quarries to promote coral & fish recovery monitor for fish toxicity locate far from beaches
Coastal sand & gravel mining	manual harvest harvest by excavators dragline, bucket & clamshell dredging cutterhead dredging	shoreline beach erosion sedimentation at both dredge & disposal sites	subsistence losses tourism losses recreational losses lost income from fish lifestyle changes	prohibit mining & collection from beaches install barriers to stop spread of sediments

(continued)

Table 20. (continued)

Activity	Consequences to the environment	Ecosystem impacts	Human health and welfare impacts	Mitigation
	temporary access fills & causeways temporary stockpiles	habitat & species loss circulation changes eutrophication water quality declines	cultural changes property damage from shoreline erosion	discharge slurry on land within basins avoid or remove causeways when finished
Harvesting live corals Collecting live rock	manual removal dragline & bucket dredging clamshell dredging	habitat & species loss loss of key reef-building species loss of fish habitat more reef erosion	subsistence losses recreational losses more shoreline erosion less income from fish & tourism	allow coral collection only for science & education control live rock collection allow only manual collection methods protect valuable reefs

UPLAND MINING

This category includes mining activities landward of the coastline for ores such as nickel, cobalt, mercury, gold, copper, silver, bauxite or quarry rock, but which may include slurry discharges, mine tailings, or other waste and pollution that may reach the coast.

Although upland mining activities occur landward of the coastal zone, there are several potentially serious threats to coastal resources and public health which can result from poorly planned mining projects. Initial phases involve exploratory prospecting and evaluation of the commercial value of the ore deposits which can result in the clearing of vegetative cover and possible downstream transport of eroded soils. Full-scale surface and open pit mining can result in the clearing of vast areas of natural ground cover and the movement of mobilized sediments and soils towards the coast, especially during wet weather. Most mining projects require processing of ore deposits to concentrate or separate out the valuable or desirable materials from the waste (called tailings).

Large amounts of water are often used for separation and chemical treatment, and heating of ore deposits is also common. The net result is the generation of huge amounts of tailings and discarded ore deposits which may need to be regularly moved away so as not to interfere with active mining of the ore. Sometimes the tailings are stockpiled and abandoned on site or are actively transported to the coast and dumped or discharged. Some exposed ores (e.g., copper, mercury) and the treatment chemicals (e.g., cyanide etc.) are highly toxic to marine organisms and pose serious hazards to public heath via contamination of water supply, ingestion of contaminated food, or inhalation of toxic dust from tailings, etc. Mining frequently requires large sources of water and power and improved transportation facilities (roads, ports) to transport ores to factories for further processing and manufacturing. All of these secondary effects can be disruptive and otherwise overload utilities and transportation facilities in demand for other community and urban needs.

The proper design and operation of mining projects requires careful and often sophisticated analyses that can only be handled by specialists. Monitoring and mitigation of adverse effects are complex, and require advice from experts. Table 21 is a summary of the possible impacts from and mitigation for upland mining.

Table 21. Environmental consequences of upland mining *(Carpenter and Maragos 1989)***.**

Activity	Consequences to the environment	Ecosystem impacts	Human health and welfare impacts	Mitigation
Exploration Exploratory mining & testing	land clearing & soil exposure fracturing rock	soil erosion & downstream sedimentation habitat & species loss coastal sedimentation	reduction in species noise and shock loss of recreation loss of aesthetics	prohibit exploration in valuable areas land use plans & zoning noise buffer zones
Site preparation	land clearing & grading roads, power & water	same as above	subsistence losses recreational losses	erosion control & re-vegetation plans
Open pit & surface mining	permanent landscape changes & clearing collect & stockpile ore	major increase in impacts listed above disposal of toxic waste	all of the above plus: nuisance dust & smoke contaminated water	the above plus dust & emission controls sedimentation basins
Subsurface mining	surface accumulation of rock and ore mine tailings contaminated runoff	same as above massive sedimentation	same as above public health hazards	worker safety plans pollution containment
Sluicing & washing ore	wastewater discharge downstream to coast	water pollution poisoning of species	all of the above additional water & food contamination	additional sediment & water recycling
Separating ore from waste (tailings)	thermal & chemical treatment of ore slag, sludge & tailings storage of fuel, water, chemicals, containers	downstream discharge of tailings & water open accumulation of toxic & hazardous waste additional habitat & species losses	public health hazards subsistence losses recreational losses commercial losses to fishery & tourism aesthetic degradation	effluent controls dewatering basins for tailings & sludge tailing disposal plan prohibit coastal tailings disposal
Transport of ores from mine to ship or rails	construction of roads, bridges, rails, ports	coastal habitat losses more sedimentaiton more species losses	traffic & noise dust & air emissions changes in access	land use & zoning plan traffic control plan air quality control plan
On-site processing of ores	processing & smelting plants	chemical waste disposal oil & air pollution	all of the above temporary housing	all of the above plus slag waste disposal plan

OFFSHORE OIL AND NATURAL GAS DEVELOPMENT

This category includes coastal or offshore exploration for commercially valuable oil or natural gas deposits, and associated offshore and onshore pumping, extraction, recovery, storage, refinery, or distribution facilities. Offshore oil and natural gas deposits have been discovered and developed on the extensive submerged shelves off the west coast of Palawan Island. Underwater pipelines are of major concern due to destruction of the seabed during pipeline construction and the potentially severe impacts from spills if pipelines break or leak. So far there have been no other petroleum or other fossil fuel deposits reported from the Philippines, although it is possible that future oil fields or deposits may become known.

The present worldwide demand for energy resources, development of oil and gas reserves, and the corresponding concern over environmental safeguards has led to reasonably well planned development of the Philippine oil and gas deposits. However, potential adverse environmental impacts are still possible from expanded development, including onshore pipeline transfers, offshore oil tanker moorings, and onshore oil refineries and tank farms (storage sites for various kinds of fuels and oil products). Underground storage tanks have now been documented to cause severe contamination of groundwater reserves outside of the Philippines, and the need for proper planning and preventive measures is always warranted for containing and cleaning up oil spills, both on land and sea. Catastrophes such as tanker collisions and ship groundings, refinery fires, and blowouts on oil platforms can lead to collateral damage and destruction of coastal resources such as fisheries, coral reefs, beaches, wetlands, and marine mammals and reptiles, and can impair other coastal development such as tourism, mariculture, and subsistence activities.

Table 22 provides a summary of the impacts and mitigation measures for offshore oil and gas development. There are also other useful references in the literature, including Gilbert (1982) and Maragos *et al.* (1983).

Table 22. Environmental consequences of offshore oil and gas development *(adapted from Gilbert 1982; Maragos 1983).*

Activity	Consequences to the environment	Ecosystem impacts	Human health and welfare impacts	Mitigation
Seismic exploration	use of explosives & low frequency sound	injury to fish, marine mammals & reptiles habitat disturbance	subsistence losses loss of income from fishing	survey during non-breeding & non-migratory seasons reduce size of charges
Exploratory drilling	holes drilled in bottom drilling mud waste metallic waste	disturbance to bottom species displaced water pollution	loss of subsistence loss of income during explorations	conduct drilling during non-fishing seasons
Platform construction	erection of permanent & large structures	water pollution solid waste pollution shading effects circulation changes loss of bottom habitat changes in fisheries	loss of access to fishing grounds contaminated fish loss of subsistence loss of income social conflicts	site platforms away from fishing grounds establish solid waste & water pollution control plan controls over workers

(continued)

Table 22. (continued)

Activity	Consequences to the environment	Ecosystem impacts	Human health and welfare impacts	Mitigation
Production drilling	drilling activity drilling mud waste oil leakage	bottom disturbance changes to fisheries sedimentation contamination of fish oil pollution	loss of subsistence loss of commercial fisheries	drilling plans to reduce threat of pollution & bottom disturbance seasonal suspension of drilling for fishing
Production pumping & pipeline transfers	pipelines and pumps cause oil leaks leaks from tanks	oil pollution during pumping oil pollution & spills	loss of subsistence fishery losses	contingency spill plans regular inspections
Offshore storage	accidental ruptures, leaks & spills	oil spills & pollution major fisheries losses	loss of subsistence income from fish	regular maintenance
Surface transfer & transport by tankers Pipeline landfall & onshore storage		habitat disturbance wildlife losses oiling of beaches	recreation losses tourism losses high cleanup costs	oil spill prevention plan oil spill contingency plan require on-site cleanup & contain. equipment double hulled tankers
Refineries	air & noise pollution water pollution	loss of land habitat wildlife losses	disturbed communities polluted water & food	pollution controls land use plans/controls
Underwater pipelines	habitat loss accidental ruptures, leaks, and spills	oil spills and pollution fisheries losses loss of bottom habitats	subsistence losses high cleanup costs	minimize use of pipelines regular maintenance list pipelines on navigational charts oil spill contingency plan

AQUACULTURE

Aquaculture development has been extensive throughout the Philippines over the last several decades. Aquaculture is defined in the Fisheries Code (RA 8550) as "fishery operations involving all forms of raising and culturing fish and other fishery species in fresh, brackish, and marine areas". Prior to the establishment of facilities for aquaculture projects, an ECC is required from DENR and a permit is required from the local government. *Guidebook 6: Managing Municipal Fisheries* provides guidelines for appropriate aquaculture practices.

Key aquaculture development includes: 1) coastal earthen ponds for rearing shrimp and milkfish, 2) cages suspended above the bottom for rearing groupers and other fish, and 3) plots of red algae (*Eucheuma*) attached to stretched lines staked to the bottom over shallow reef flats. Less widespread aquaculture development includes giant clam and crab grow-out in cages and reef flat enclosures, pearl shell, mussel, or oyster culture on suspended rafts or baskets, and grow-out areas for other species (green snail, *Trochus*, etc).

By far the most damaging activity has been pond culture because historically most development involved clearing of mangroves to provide space for ponds (Siddall *et al.* 1995). Over half of the mangroves in the Philippines were damaged or destroyed due to pond development, leading to declines in the abundance of coastal fisheries dependent on mangroves and loss of other mangrove values (shore protection, construction materials, firewood, etc.). Furthermore, many of the ponds have now been abandoned due to poor technical design and management, lower than expected shrimp and fish yields, and commercial failure. Mangroves have recovered slowly in some of the abandoned ponds, but the quality of mangrove habitat throughout the nation remains severely degraded. Seaweed culture is more successful and less damaging except in localities where plots are so concentrated that they displace natural reef habitat and exclude other uses (Melana *et al.* 2000).

The environmental effects of other types of aquaculture are probably not significant or widespread. However, cultured populations of fish and shellfish that are reintroduced to natural, undisturbed habitats are less genetically diverse, and their breeding with wild stocks can lead to lower genetic variability and vitality in successive generations. Other common impacts of aquaculture development include water pollution from increased waste discharges, and changes in water currents and shoreline sediment transport due to ponds, plots, rafts, and cages. The economic success of aquaculture ponds depends on the siting of the ponds and their subsequent management (Figure 22).

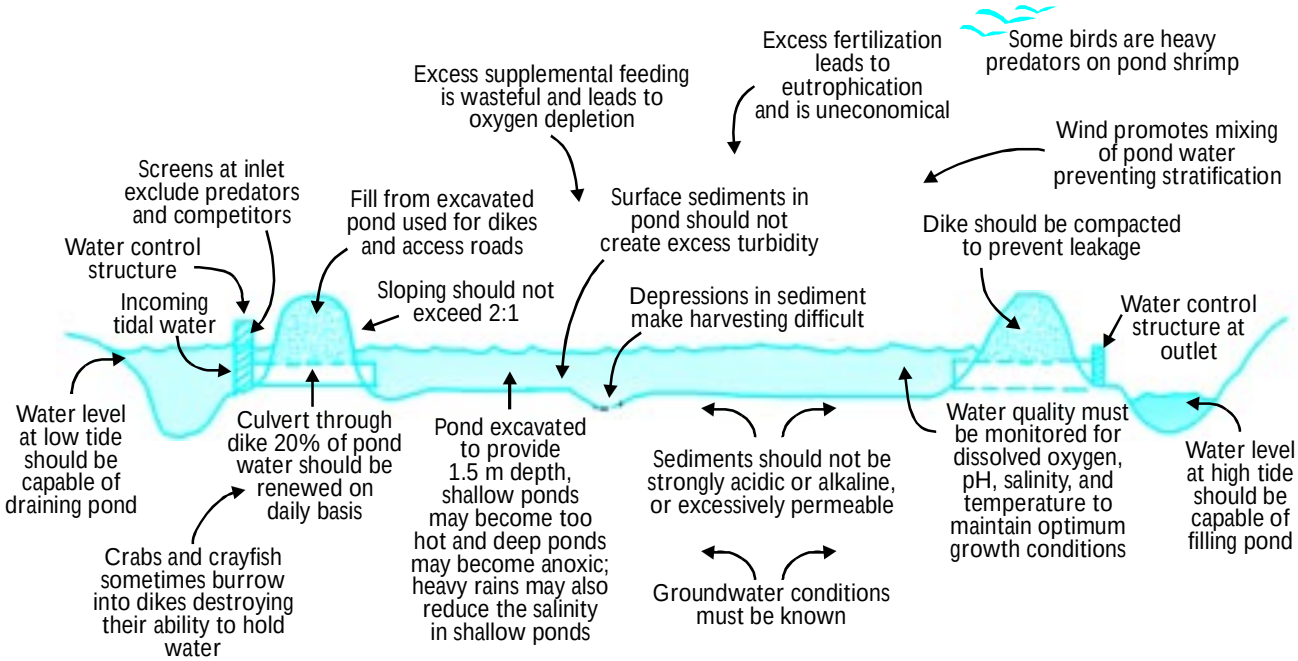


Figure 22. Factors affecting economic and ecological success of aquaculture ponds *(adapted from Snedaker and Getter 1985).*

Table 23 provides a summary of aquaculture impacts and measures to reduce adverse effects. Siddall *et al*. (1995) provide a good environmental review and comparison of fishpond development and impacts in the Philippines, Ecuador, and Panama.

Table 23. Environmental consequences of aquaculture *(Carpenter and Maragos 1989)*.

Activity	Consequences to the environment	Ecosystem impacts	Human health and welfare impacts	Mitigation
Creation of wage labor	increased urban development	noise & air pollution water pollution land cover changes	higher living costs degraded subsistence land use changes	training & preference of local labor
Introduction of non-native and cultured species	escape to coastal habitats invasive species	displacement or loss of native species introduced predators & parasites reduced genetic variability of wild populations	reduced subsistence food supplies recreational losses	preference for native aquaculture species strict guidelines on entry & quarantine of exotic species
Construction of ponds, rafts, plots, & cages	displacement of coastal & marine habitat use of alien species	loss of mangroves shading of coral reefs water pollution displacement of native species degradation of soft-bottom habitats	reduced access to coast & marine areas reduced catch of wild stocks subsistence losses user conflicts navigational hazards	restore abandoned fishponds prohibit new ponds in mangroves involvement of LGU and locals in fisheries planning site aquaculture away from valuable areas
Effluent & waste disposal	increased freshwater demand increased effluents	degraded habitats loss of fish stocks	loss of water for other purposes higher cost for water public health risks	treatment of waste recycle water for reuse reduce waste volumes site discharges away from valuable areas

AGRICULTURE AND FORESTRY

This category is a catch-all for a variety of agricultural, forestry, and related development in upstream terrestrial habitats and includes cropping, irrigation, hillside farming, orchards, tree plantations, logging, ranching, dairy farms, game reserves, poultry farms, pig farms, and swidden agriculture. Collectively, these activities result in the removal of groundcover, expose soil to erosion, introduce non-native species, cause fires, and introduce pesticides and fertilizers that can be carried into streams and be discharged into coastal areas along with eroded soils.

Coastal irrigation and wet crop agriculture can also discharge large quantities of fresh waters, soils, fertilizers, and pesticides into coastal waters during the wet season, potentially expanding the zone of impacts many kilometers offshore. In turn, these pollutants and eroded soils can smother seagrasses, kill coral reefs, and degrade mangrove forests. The disposal of animal wastes

and remains into coastal areas can contaminate waters and degrade the aesthetic and scenic quality of coastal areas, pose public health hazards, and foreclose development and use options. Wood chipping and excessive cutting of mangroves can also reduce their sediment retention characteristics and increase sedimentation in coastal waters. Downstream impacts of agriculture and forestry activities and their mitigation are summarized in Table 24.

Table 24. Environmental consequences of agriculture and forestry *(Carpenter and Maragos 1989)***.**

Activity	Consequences to the environment	Ecosystem impacts	Human health and welfare impacts	Mitigation
Increased crop production on undeveloped land	land clearing native vegetation loss soil exposure & erosion fertilizers & pesticides added to ecosystem groundwater loss new exotic species higher surface runoff more fires	sedimentation to coast increased runoff to coasts native habitat & species losses competition from crops & weeds pesticides enter food chain	loss of subsistence loss of recreation lifestyle & cultural loss loss of shore & reef access changes in jobs dust & smoke emission tourism losses fishery losses loss of domestic water	soil conservation terraced farming in lieu of slash-and-burn long-term land leases to individuals composting & recycling prefer native strains water conservation avoid sensitive areas
Logging, tree plantations, & mangrove cutting	removal of old growth soil exposure & erosion logging roads & trails new exotic species water retention losses groundwater loss higher surface runoff	loss of native habitat loss of native species increased discharges downstream sedimentation in waterways coastal & marine losses of habitat & species	subsistence losses tourism losses recreational losses cultural & lifestyle loss fishery losses loss of domestic water	social forestry mangrove conservation restoration & replanting sustainable forestry soil conservation composting & recycling avoid valuable areas
Lowland wet or irrigated agriculture	high wet season runoff fertilizers & pesticides added groundwater & surface water withdrawal dams & channelization	seasonal eutrophication of coastal waters heavy seasonal coastal sedimentation pesticides & nutrients enter coastal zone inundation of habitats	subsistence losses less income from fish recreational losses seasonal tourism loss increased flooding less domestic water	control pesticide use soil conservation plan flood prevention
Ranching & grazing	loss of groundcover soil exposure & erosion new exotic animals	heavy sedimentation to coastal waters other water pollution in coastal waters	subsistence losses recreational losses & gains tourism losses & gains public health hazards	waste management control plan carrying capacity controls for livestock

In summary, general types of impacts can be identified for categories of development activities. A careful review of specific development projects requires evaluation of site-specific and project-specific considerations, in addition to the general impacts described in this chapter. Pollution is one major type of impact common to many development activities and warrants additional discussion in the next chapter.


ALAN WHITE

Acid mine drainage and heavy metals from mining operations eventually reach the sea through surface water runoff in the watershed.


ALAN WHITE

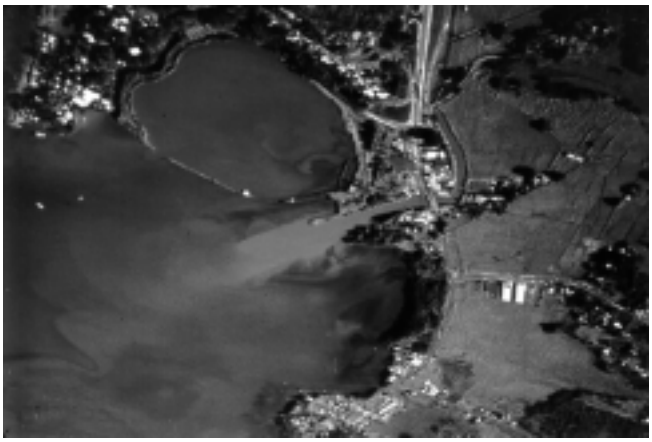
Proper development setbacks on beaches allow for natural cycles of sand movement and storm surge that prevent property damage. Public access can also be maintained in the foreshore area.


ALAN WHITE

Natural cycles of erosion and accretion of beaches is one reason why development setbacks are critical for protecting coastal properties.


ALAN WHITE

Proper development setbacks and respect for foreshore access rights of local fisherfolk promote multiple uses of the coastal zone.


ALAN WHITE

Upland mining and deforestation cause erosion and release large amounts of sediment to coastal waters.


ALAN WHITE

Shoreline protection structures often result in greater erosion since the natural cycles of sand depletion and replenishment are blocked and storm surge undercuts seawalls.

chapter 4

Managing coastal and marine pollution at the local level

All development activities contribute to coastal and marine pollution. People all over the world have long thought of the ocean as vast and limitless. As a result, the ocean has been used as a dumping ground for all kinds of wastes – hazardous waste, sewage, and solid waste. Uncontrolled population growth and increasing urbanization and industrialization have overwhelmed the capacity of the ocean and coastal waters to dilute and disperse this growing volume of wastes. Urban and industrial pollutants such as heavy metals, petrochemicals, sediments, sewage, and solid waste are degrading Philippine coastal waters and impacting the health of coral reefs, fisheries, and the communities which depend on them. Appropriate planning, waste management, and pollution prevention and control are important strategies to minimize the adverse impacts of development on the coastal zone and marine environments.

Pollution does not respect political, administrative, or ecological boundaries, and pollutants can change form as water and air carry them from one area to another. Pollution can originate far from the point where the impacts are noted, thus making it difficult to control. To complicate matters, the responsibility for addressing pollution may be split along sectoral lines so that, like the pollutant, the agency regulating the polluting activity may have no direct link to the resource being affected. For example, sediment from erosion during upland logging activities which are regulated by the forestry sector can have direct adverse effects on coral reefs and municipal fisheries located many kilometers from the site. These conditions underscore the necessity for an integrated approach for managing pollution that promotes collaborative efforts between sectoral agencies and local governments and includes a watershed approach to identifying problems and solutions in a geographically-relevant context. The environmental, human health, and economic benefits associated with pollution management are significant and, therefore, an integrated approach to coastal pollution control supports rather than detracts from economic development activities. Integrated coastal management can help unite sector agencies and local governments to address in a holistic manner the problems of coastal and marine pollution.

MAJOR TYPES OF POLLUTION AND THEIR IMPACTS

Pollution makes air, water, soil, and food impure and decreases the capacity of the ecosystem to support living things. The major types of pollution, their sources, and adverse impacts on the environment and human health are discussed below. Impacts of specific types of pollution are summarized in Table 25.

Table 25. Typical water pollutants and their effects *(Clark 1996)***.**

Pollutant	Sources	Effects
Inorganics (heavy metals)	Fuel and exhaust of boats and automobiles; industrial emissions and effluent; landfill wastes and leachate; urban runoff; hazardous waste disposal or spills	Accumulate in fish and shellfish and are passed to humans causing health impacts Contaminate drinking water supplies, causing cancer, birth defects, and chronic illness
Persistent organic pollutants	Forestry, urban, and agricultural runoff; industrial emissions and effluent; landfill wastes and leachate; urban runoff; hazardous waste disposal or spills	Contaminate seafood and water causing cancer, birth defects, and chronic illness
PAHs/petroleum	Fuel exhaust; motor oil and grease; power plant emissions; industrial discharges; spills and dumping; leaking underground storage containers; urban runoff	Spills can kill aquatic life, damage beaches and wetlands Runoff can be toxic to marine organisms — causing death, disease, and reproductive problems
Nutrients	Agriculture, forestry, and urban runoff; raw and treated sewage; septic tanks animal feedlots; food processing plants; industrial discharges	Enrichment (eutrophication) of rivers and coastal waters can cause algal blooms, oxygen depletion, and fish kills
Sediments	Land clearing; logging; dredging; erosion	Cause turbidity in marine waters shading light dependent organisms and reducing primary productivity Smothering of organisms
Pathogens (bacteria, viruses)	Densely placed septic tanks; raw sewage; boat discharges; animal feedlots; urban runoff; food processing plants	Contaminate fish and shellfish so that consumption may cause disease Contaminate groundwater used for bathing or drinking, thus causing disease Contaminate surface water such that swimming may cause disease or infection
Thermal	Factories; electricity generating plants; urban runoff	Alter reproduction of fish Reduce dissolved oxygen which may kill fish

Inorganic Contaminants

The inorganic chemicals of primary concern because of their toxicity include the "heavy metals" (cadmium, mercury, zinc, copper, nickel, lead, and silver) and metalloids (arsenic and selenium). While some metals are considered essential and are required by living organisms in small amounts (such as copper and zinc), most metals in these two groups are toxic at higher concentrations. Toxicity of metals varies depending on the chemical form of the metal since the chemical form affects the rate and means of uptake by plants and animals. Metals are only toxic if they are bioavailable or present in a form that is readily taken up by organisms. Marine organisms take up metals through ingestion of food, sediment or water and dermal uptake across the gills or skin. Bioaccumulation of metals depends on environmental factors and the ability of the

organism to regulate metal concentrations in the body. Some metals, such as mercury and selenium, are taken up in organic forms, accumulate in the tissues of plants and animals, and can biomagnify (or become more concentrated) higher up in the food chain. Above a threshold, all metals are potentially toxic and exposure may result in effects on growth, reproduction, development, and survival in marine organisms (Kennish 1997).

Sources of metals in coastal waters include weathering of rocks and leaching of soils, surface runoff and riverine input, atmospheric deposition, and anthropogenic activities. The major human inputs include automobile emissions, urban runoff, mining, electroplating, sewage, and industrial wastewater. Although metals exist in the dissolved, colloidal, or particulate phase in seawater, concentrations are typically low. Metals rapidly adsorb into particles and ultimately are removed to bottom sediments as particles settle. Sediments thus become the major sink for metals and can continue to be toxic to bottom-feeding or bottom-dwelling organisms (Kennish 1997).

Cyanide is another important inorganic contaminant in coral reef systems, where it is used to stun and catch fish for the aquarium and live food fish trades. Sodium cyanide has toxic effects on non-target species and its widespread use in the Philippines has made it a contaminant of concern in coastal waters (Barber and Pratt 1997).

Pollution can be defined as: "the introduction by man, directly or indirectly, of substances or energy into the marine environment, resulting in deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities including fisheries, impairment of quality for use of seawater, and reduction of amenities" *(GESAMP 1982).*

Persistent Organic Pollutants

Halogenated hydrocarbons such as many pesticides, herbicides, polychlorinated biphenyls (PCBs), and dioxins are ubiquitous, persistent, and toxic to marine ecosystems especially near urban, industrial, and agricultural centers. The higher molecular weight compounds, including organochlorines such as many pesticides and PCBs, are particularly toxic and bioaccumulate in the tissues of animals. Pesticides and herbicides in the aquatic environment are primarily derived from agricultural and home use while other persistent organic pollutants such as PCBs and dioxins are derived from industrial and manufacturing processes and improper disposal and treatment of wastes (Kennish 1997).

The chlorinated hydrocarbons are broad spectrum toxins that poison a wide variety of organisms in the aquatic environment. They tend to accumulate in fatty tissues and biomagnify up the food chain such that they can pose a significant risk to humans who ingest contaminated seafood. The unique properties of persistent organic pollutants, including persistence in the environment, chemically stable nature, resistance to degradation, bioaccumulative capacity, and potential for toxicity – make them especially important to address in pollution management. The residues of persistent compounds, such as dichloro-diphenyl-trichloroethane (DDT) and PCBs, may be present in the environment for many decades.

Common persistent organic pollutants include the following (Kennish 1997; Peters *et al.* 1997):

- Pesticides such as DDTs, aldrin, endrin, dieldrin, chlordane, and many others are potent biocides that are nerve poisons directed at selected groups of insects, rodents, etc. Pesticides also cause neurological and reproductive failure in non-target organisms.
- Herbicides such as 2-4-dichlorophenoxyacetic acid (2-4-D), paraquat, atrazine, and many others are described as selective or non-selective depending on the specificity of their effects on target plants. Herbicides are acutely toxic to non-target organisms, including fish and aquatic vegetation (seagrass and mangroves).
- PCBs are a complex mixture of many synthetic compounds with the properties of inertness and stability that make them useful in transformers, hydraulic fluids, and plastics. PCBs bioaccumulate and cause reproductive abnormalities in marine mammals and chronic diseases in humans; they are potentially carcinogenic.
- Dioxins and dibenzofurans are trace contaminants resulting from industrial sources, combustion products, wood burning, and automotive emissions. These compounds are very toxic and persistent in marine environment and cause weight loss, reproductive impairment, and developmental abnormalities in aquatic organisms.

Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons (PAHs) are toxic organic compounds released into the environment from industrial activities, oil spills, waste incineration, asphalt production, and combustion of fossil fuels. Atmospheric deposition from combustion of fossil fuels, runoff of industrial and domestic effluents, and oil spills near or in the sea are the primary sources of PAHs to coastal waters. Crude oil, for example, contains 0.2 to 7 percent PAHs (Kennish 1997). PAHs are toxic and carcinogenic to aquatic organisms and humans. The toxicity of specific compounds depends on their molecular weight and the ability of the organisms to metabolize them. PAHs tend to sorb onto sediments and persist for long periods of time on the seafloor.

Oil and Petroleum Products

Oil pollution in coastal environments results from accidental spills, intentional discharges from ships and refineries, urban and river runoff, and atmospheric deposition. Oil pollution has physical effects (smothering, reduced light), habitat impacts (alterered pH, decreased dissolved oxygen) and toxic effects (primarily from volatile organic compounds and PAHs) on coastal and marine plants and animals. The chemical dispersants and solvents used to clean up oil spills also have detrimental and toxic effects on marine life. Crude oils and refined petroleum products, such as gasoline and diesel fuel, contain many different chemical constituents depending on the grade of the crude and the degree of processing. In general, the light aromatic compounds tend to be most toxic but also tend to evaporate most rapidly. The evaporative loss of the volatile constituents reduces the toxicity; however, the heavier constituents can persist and cause physical and toxic effects in the marine environment (Kennish 1997). Mangroves, coral reefs, and seagrass beds are sensitive to toxic and physical effects of oil pollution (Peters *et al.* 1997).

Excessive Nutrients and Organic Loading

Coastal and marine waters receive large amounts of nutrients and organic inputs from industrial and municipal wastewaters, agriculture and livestock production, sewage, and urban runoff. Excessive nutrient enrichment and organic loading in coastal waters causes serious impacts to water quality and ecosystem health. The coastal margins trap nearly all of the nutrients exported from rivers and surface runoff and shallow coastal areas that are poorly flushed are the most susceptible to impacts of excessive nutrients. Input of large volumes of nutrients and organic matter greatly accelerates primary productivity and causes a condition known as eutrophication where the growth of aquatic plants and algae becomes excessive. Eutrophication can result in blooms of phytoplankton (some of which may be toxic and form "red tides"), increases in the abundance of macroalgae (seaweeds), increases in turbidity, oxygen depletion, and mortality of fish and invertebrates.

Eutrophication is caused by an excess of nutrients, mainly nitrogen and phosphorus, which are usually the limiting elements in primary production. At typical levels, nitrogen and phosphorus are essential for plant growth and it is only when they are found in excess that they cause an unhealthy increase in the rate of growth of algae and aquatic plants. In water, nitrate is the major form of dissolved inorganic nitrogen while phosphate is the major fraction of dissolved inorganic phosphorus. Nutrient cycling in coastal systems depends on the exchange of nutrients between the water column and bottom sediments; this cycling can be affected by excessive inputs into the system that results in an imbalance. The source of excessive nitrogen or phosphorus in coastal waters is almost always human activity on land, though some mariculture activities can also be a major contributor on a local level. Sewage, agricultural runoff of fertilizers, and animal wastes are the main sources of excessive nitrogen and phosphorus in coastal waters.

Blooms of algae resulting from over-enrichment of coastal waters lead to oxygen depletion as the accumulation of decaying algae fosters high rates of decomposition and respiration in bottom waters (Kennish 1997). Inputs of organic solids exacerbate anoxic conditions by elevating the biochemical oxygen demand (BOD - the oxygen consumed during the microbial decomposition of organic matter) and chemical oxygen demand (COD - the oxygen consumed during the oxidation of ammonium and other compounds) in coastal waters. This depletion of dissolved oxygen in the water results in death of fish and invertebrates. Coastal systems subject to oxygen depletion show changes in species composition and ecosystem function (Clark 1996; Kennish 1997). Inputs of dissolved and particulate organic carbon from organic loading of untreated domestic sewage and industrial wastewater also contribute to oxygen depletion and high BOD. Figure 23 shows the effect of distance from a sewage outfall on levels of oxygen and BOD in coastal waters. Typical sewage treatment plants do not significantly reduce the levels of nitrogen and phosphorus, which is why sewage outfalls are typically located far out in the ocean to carry wastes away from coastal environments.

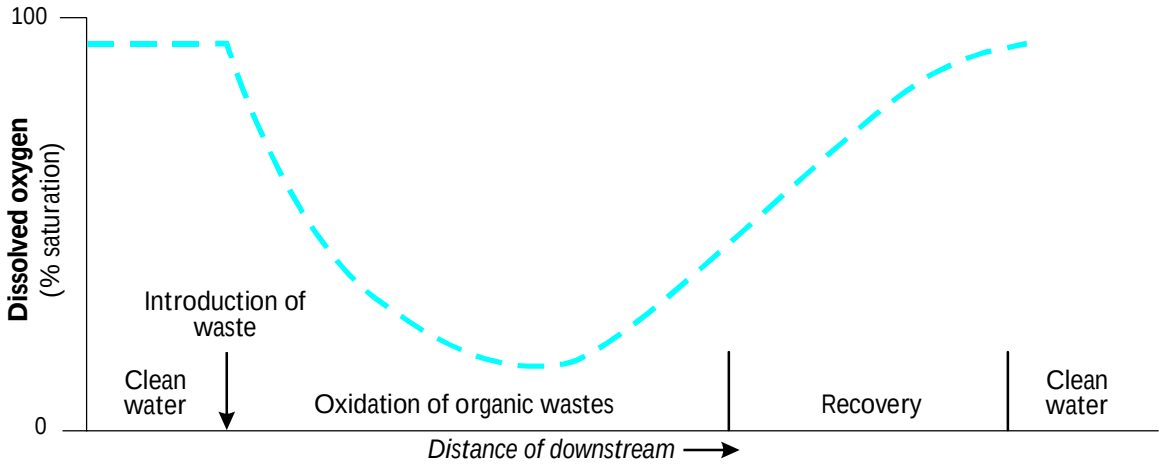


Figure 23. Changes in water quality parameters with distance from a sewage outfall *(adapted from Carpenter and Maragos 1989).*

Eutrophication progresses through a series of phases, typically including: (1) enhanced primary productivity, (2) changes in plant species composition, (3) dense phytoplankton blooms, often toxic, (4) oxygen depletion (anoxia), (5) adverse effects on fish and invertebrates, and (6) changes in structure and composition of benthic communities (GESAMP 1990). Eutrophication can cause a reduction in health and abundance of seagrass beds from shading effects of abundant phytoplankton and the growth of epiphytic algae on seagrass blades. Coral reefs, which typically thrive in nutrient poor and clear waters, can be seriously impacted by eutrophication that increases turbidity (and shading of corals that require light to grow) and causes excessive growth of seaweeds that smother corals (Pastorak and Bilyard 1985; Tomascik and Sander 1985).

Sedimentation

Coastal waters receive inputs of terrestrial sediments in riverine and surface runoff. Land clearing, forestry, agriculture, mining, and development activities can cause significant erosion and runoff of sediments into coastal waters (Figure 24). Terrestrially-derived sediments, especially fine-grained silt and organic particles stay suspended in the water column and are transported in coastal waters. Sedimentation in coastal waters causes direct and indirect impacts on coral reef and seagrass communities through increased turbidity, loss of light, and direct smothering of corals and seagrasses. Sedimentation kills corals by shading and smothering them and reduces recruitment of juvenile corals such that the long-term persistence and recovery of coral communties are compromised (Hodgson and Dixon 1988).

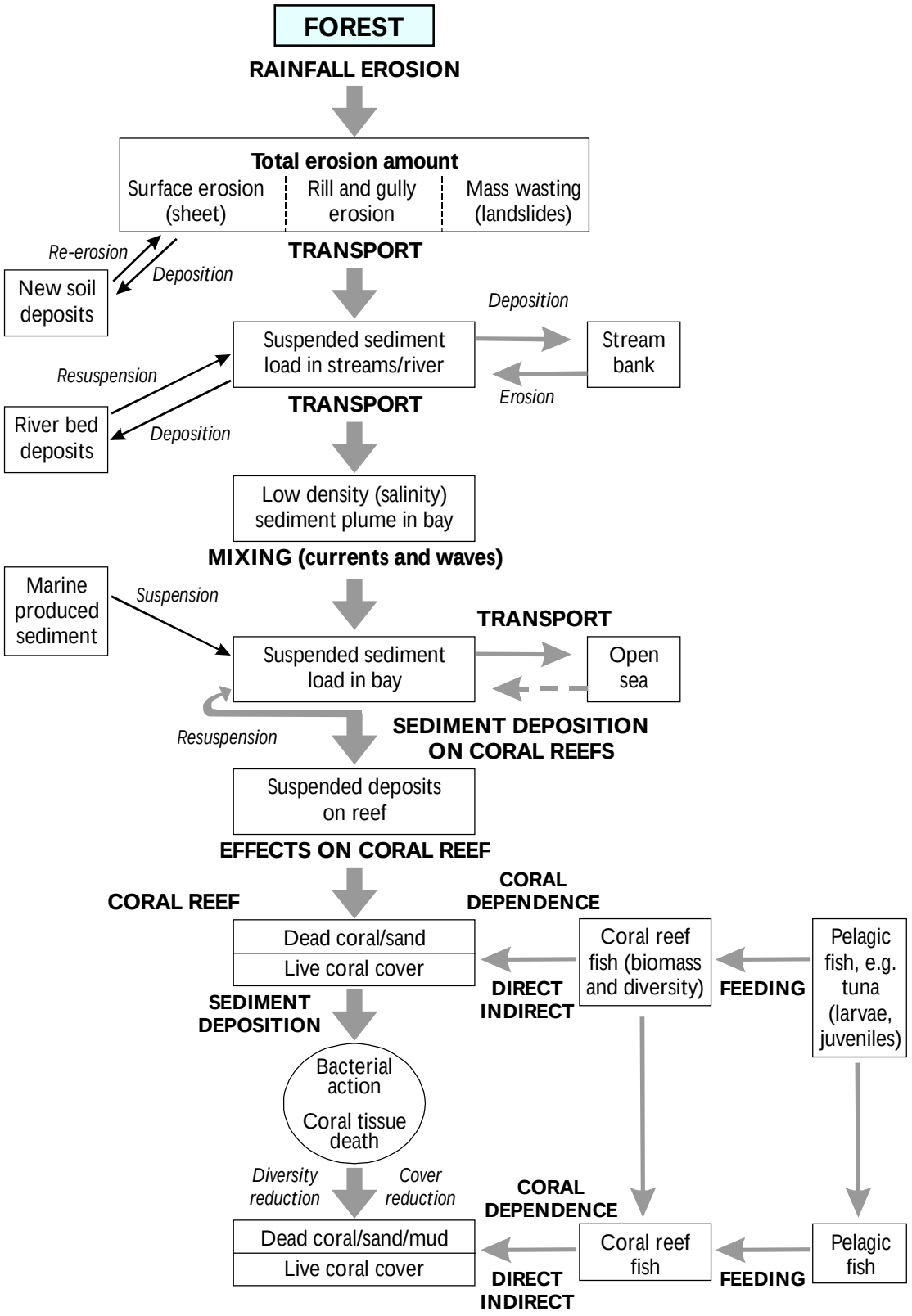


Figure 24. A generalized pathway of soil eroded from the forest floor as it is transported to coastal waters *(adapted from Hodgson and Dixon 1988)*.

Pathogens

Pathogenic microorganisms such as bacteria, viruses, protozoans, and helminths are found in domestic sewage, animal waste, medical waste, and food processing wastes and can cause significant risk to human health from ingestion of contaminated seafood or swimming in contaminated water. Diseases such as cholera and viral hepatitis are serious human health impacts that result from contamination of coastal waters. Pathogens also cause diseases and mortality of fish and invertebrates in coastal waters, such as finrot disease in fish exposed to sewage sludge (Kennish 1997). Fecal coliform bacteria from sewage wastes and septic tanks also cause nearshore contamination and human health risks.

Solid Waste and Marine Debris

Dumping of solid wastes or siting garbage dumps near the coastal zone causes runoff of polluted surface water and groundwater and the loss of aesthetic qualities due to the presence of litter and debris in the coastal zone. Water falling on garbage dumps percolates through the waste and creates a polluted leachate that can enter the coastal zone through runoff and groundwater transport (Clark 1996). Marine mammals, sea turtles, and seabirds are injured or killed by ingesting plastics and other kinds of debris.

Thermal

Power stations discharge large amounts of heat to the aquatic environment during their operation. Heat stress in the receiving waters can alter the abundance and composition of biological communities, increase metabolism rates, change rates of primary productivity, and reduce levels of dissolved oxygen. Some organisms, such as corals, are very sensitive to thermal stress, and increasing water temperatures by just a couple of degrees centigrade can cause coral bleaching and death (Glynn 1993). Finfish can sometimes behaviorally avoid thermal plumes but can also experience heat or cold-shock mortality and changes in reproduction (Kennish 1997).

Radiological

Anthropogenic sources of radiation and radiological wastes include nuclear power plants, nuclear weapons testing, and disposal of medical wastes. Marine and estuarine organisms and humans can experience genetic changes, physiological changes, acute toxicity, cancer induction, and death from exposure to radiation. Radionuclides tend to accumulate in bottom sediments in coastal waters and can accumulate in marine organisms (Kennish 1997).

MAJOR SOURCES OF POLLUTION

Most development and economic activities in upland areas, along the coastal margins, and in coastal waters contribute some form of pollution to the ecosystem (Figure 1). Some examples of major sources of pollutants are listed in Table 26.

Table 26. Major sources of pollution.

Source	Pollutants
Industry	Persistent organic pollutants, metals (chromium, zinc, cadmium, copper, lead, etc.), gases (carbon dioxide, sulfur dioxide, nitrogen dioxide)
Urban runoff	Persistent organic pollutants, metals, oils, nutrients, solid waste
Domestic sewage	Persistent organic pollutants, metals, nutrients (nitrogen and phosphorus) and organic carbon, gases (carbon dioxide, methane), pathogens, and parasitic helminths
Agriculture	Persistent organic pollutants, metals (copper, mercury, cadmium), nutrients, and sediment
Mining	Metals, sediment, and low pH runoff
Vehicles and ships	Metals (zinc, iron, lead), gases (carbon monoxide, carbon dioxide, sulfur dioxide), particulates, oil, solid waste and marine debris

Point versus non-point pollution sources

Effective management of pollution recognizes that there are many sources that must be addressed. Some sources, such as a smokestack or drainpipe coming from a particular industrial site, are site-specific discharge points known as point sources. Pollution management agencies can identify these sources and regulate the quantity and quality of the discharges. Controls can be in the form of siting restrictions or by "end of the pipe" treatments that make waste less polluting. Rather than focusing only on treatment solutions, industries can also change manufacturing processes to reduce or eliminate the amount or kind of waste generated using clean technology, cleaner production, and waste minimization.

Non-point source pollution (NPSP) or "polluted runoff" comes from sources that are not site-specific and is a type of pollution that is much more difficult to control than point sources. For example, rainwater collects pollutants, such as pesticides or fertilizers from agricultural fields, as it washes over the surface of the land. This polluted runoff enters a water course, such as a river, which eventually reaches the sea causing degradation of water quality in the receiving waters. Another very important type of NPSP is urban runoff from the roads and drainage ditches in settlements and urban areas that carry untreated sewage, industrial wastes, stormwater, and solid waste to the coast. Groundwater can also be contaminated and can carry NPSP to coastal waters. Sewage and leaking fuel tanks are common sources of contaminants to groundwater. Such diffuse and common sources make the control of NPSP very difficult and expensive to monitor and manage.

Surface water runoff with its associated contaminants is a major contributor to degraded water quality; therefore the abundance of impervious surfaces can be used as an environmental indicator of polluted non-point runoff (Arnold and Gibbons 1996). Impervious surface is defined as any material that prevents infiltration of water into the soil, such as rooftops and roadways. As landscapes are paved and the hydrological cycle is disrupted, the volume and velocity of surface runoff increases and infiltration is decreased (Figure 25). Maintenance of greenbelts and other permeable surfaces can be used as a spatial planning tool to reduce surface runoff.

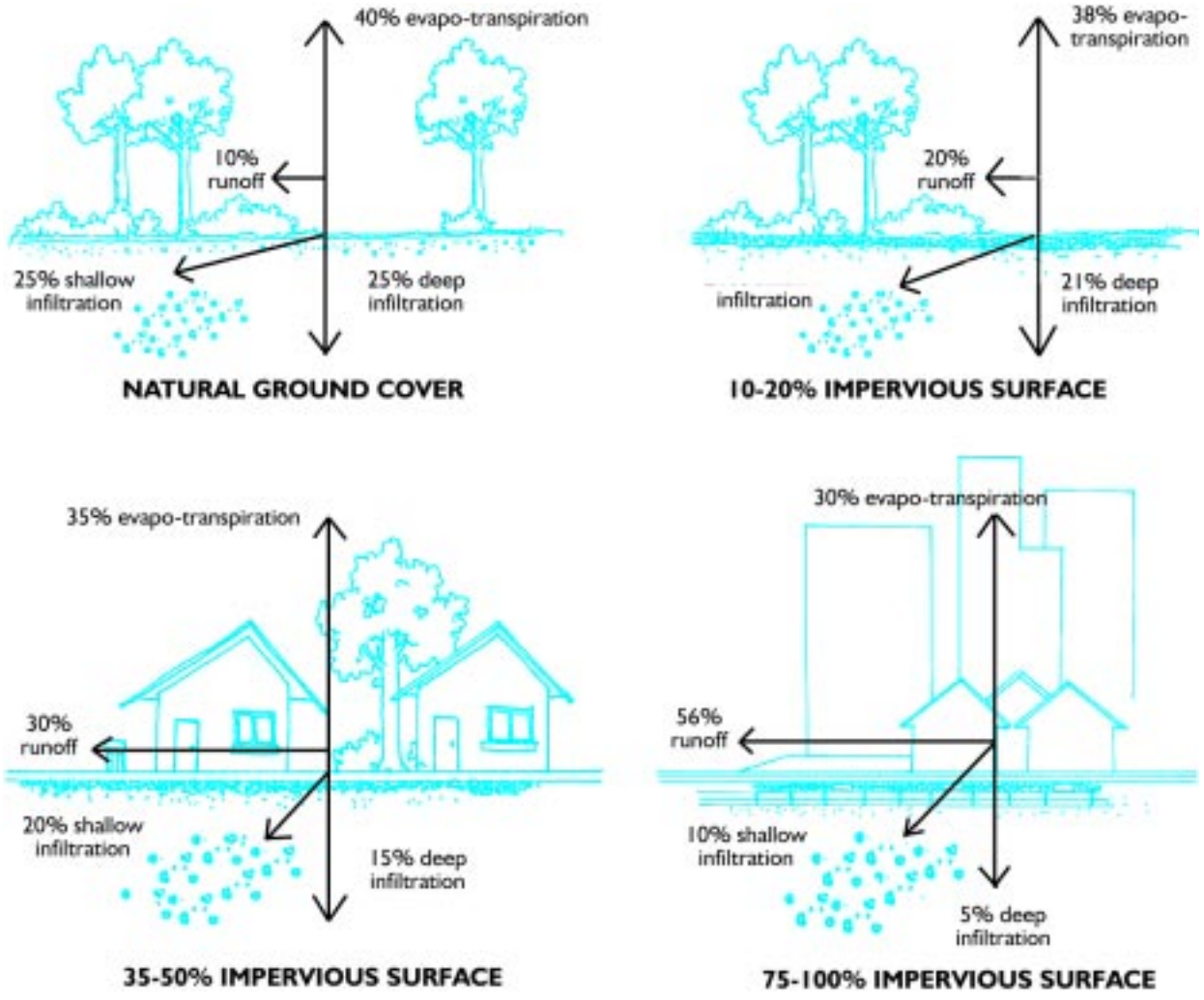


Figure 25. Water cycle changes associated with urbanization and an increase in impervious surfaces *(adapted from U.S. EPA 1993)*.

Land-based pollution

Most of the pollution in coastal waters originate on land. Most coastal areas in the Philippines lack sewage treatment facilities and most homes do not have toilets or septic tanks; sewage is discharged directly to the receiving water body (river or sea). Growing urban population densities and lack of infrastructure have led to contamination of drinking water, rivers, and coastal waters. Sewage, contaminated storm water runoff, and unregulated industrial discharges are all eventually carried to the sea.

Surface waters, soil, groundwater, and coastal waters are polluted by direct discharge or accidental spillage of industrial waste. The industries that contribute the most to water pollution are textiles, paper, metal preparation, tanning, finishing and engineering, paint, petrochemical processing, food and beverage, and distilleries.

Livestock production and associated wastes, such as piggeries, contribute large volumes of nutrients and pathogens to surface waters. Heavy use of pesticides and fertilizers in agricultural practices degrades the soil, causes toxic effects in humans and wildlife, and contributes to pollution of coastal waters. Runoff of fertilizers raises nitrogen and phosphorus concentrations in coastal waters causing eutrophication. Many pesticides are persistent and accumulate through the food chain causing toxic effects to humans and wildlife.

Solid wastes, including garbage, refuse, and other materials discarded in upland areas eventually reach the sea. Sources include settlements, industries, hotels and businesses, and improperly sited landfills.

Air pollution generated by burning of fossil fuels in vehicles, industrial smokestacks, and fires releases particulates and chemical pollutants (such as lead from leaded gas) into the air. These pollutants cause direct adverse effects on human health and also eventually settle out of the air or are washed out by rain and ultimately reach coastal waters where they cause environmental degradation. Jeepneys, buses, and trucks are a major source of air pollution in Philippine cities.

Sea-based pollution

Shipping is a significant source of pollution, in the form of waste oil from washing oil tanker holds, discharge of oil-contaminated bilge water, and emissions from motorized boats. Exotic species can also be introduced to coastal waters when ballast water is dumped. Oil spills, including the numerous small spills that often go unrecorded, are a major source of oil and PAHs in coastal waters.

Aquaculture activities can contribute to high BOD loads from feces and uneaten foods, particularly in discharges during cleanout of ponds and in sediments under fish cages (Figure 26).

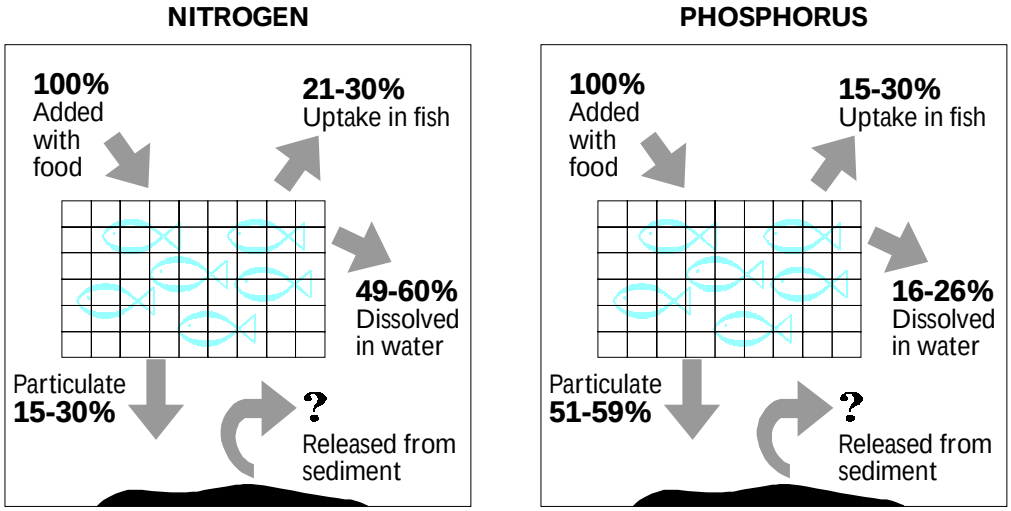


Figure 26. Contributions of nitrogen and phosphorus from cage feeding to the pollutant load in coastal waters *(adapted from Barg 1992).*

FATE AND TRANSPORT OF POLLUTANTS

Water is a major player in the transport of pollution and an understanding of the hydrologic cycle and site-specific conditions is key to developing a conceptual model of fate and transport (Figure 27). The hydrologic cycle has four main phases relevant to coastal pollution: precipitation, evaporation, surface flow, and groundwater flow. Evaporation of water and condensation in rain clouds lead to precipitation; rain falling on the ground surface is transported in surface flow or percolates down to groundwater. Streams and groundwater flow downhill and eventually reach the sea. Similarly, wastes generated and disposed in upland areas eventually reach the sea through surface water or groundwater transport. Air pollution also impacts coastal environments as particulates and chemicals settle out in surface waters or are removed from the air during rain events. These multiple sources of contaminants that eventually reach the sea are depicted in Figure 28.

An exposure pathway is the physical route by which a contaminant moves from a source to a human or ecological receptor where it is taken up by the organism as a “dose” and may cause toxicity (Figure 29). A pathway may involve movement of the contaminant among media (water, soil, food) and may involve the chemical transformation of the contaminant.

A generalized conceptual model of exposure pathways and potential fate and transport of pollutants in tropical coastal systems is shown in Figure 30. Complex patterns of water and sediment dynamics in coastal areas and chemical specific factors need to be evaluated on a site-specific basis to determine potential exposure pathways and fate and transport (Connell and Hawker

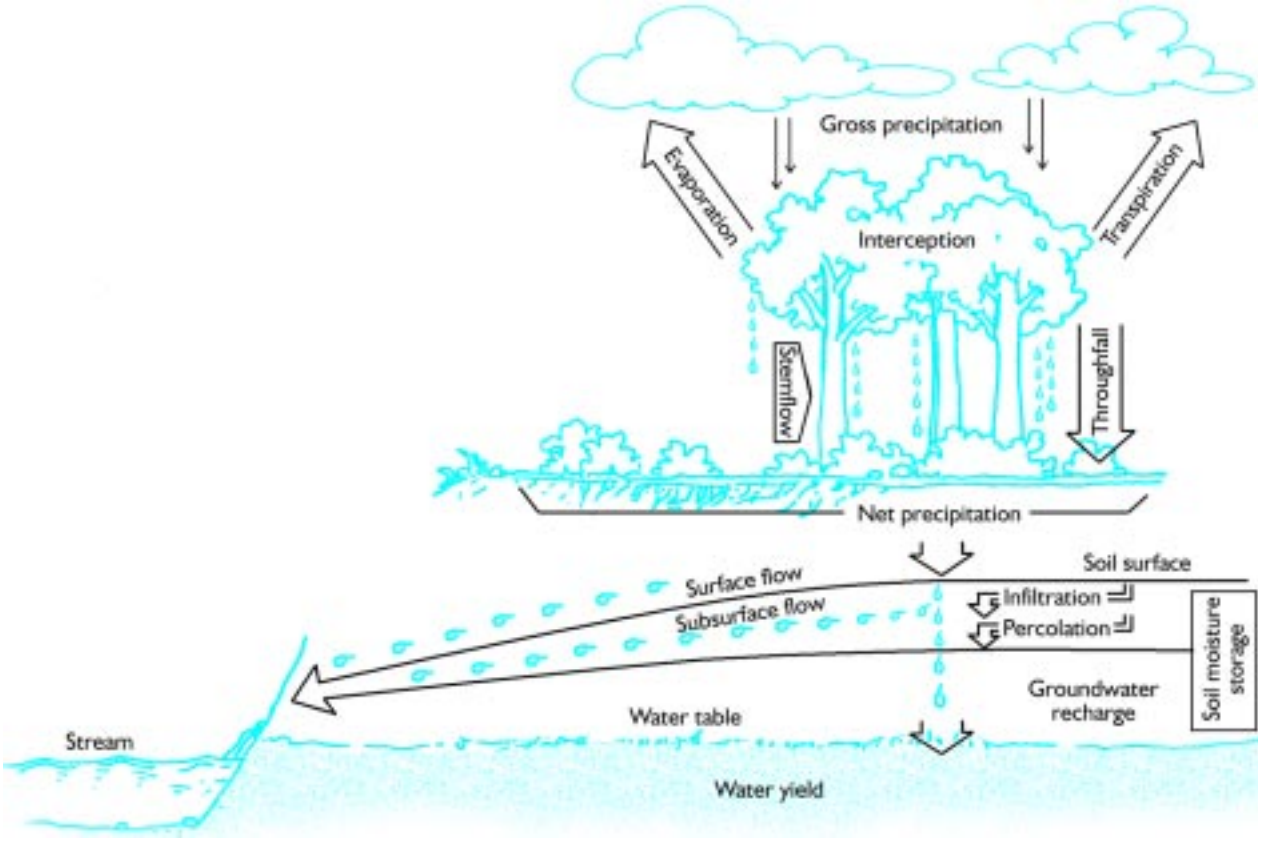
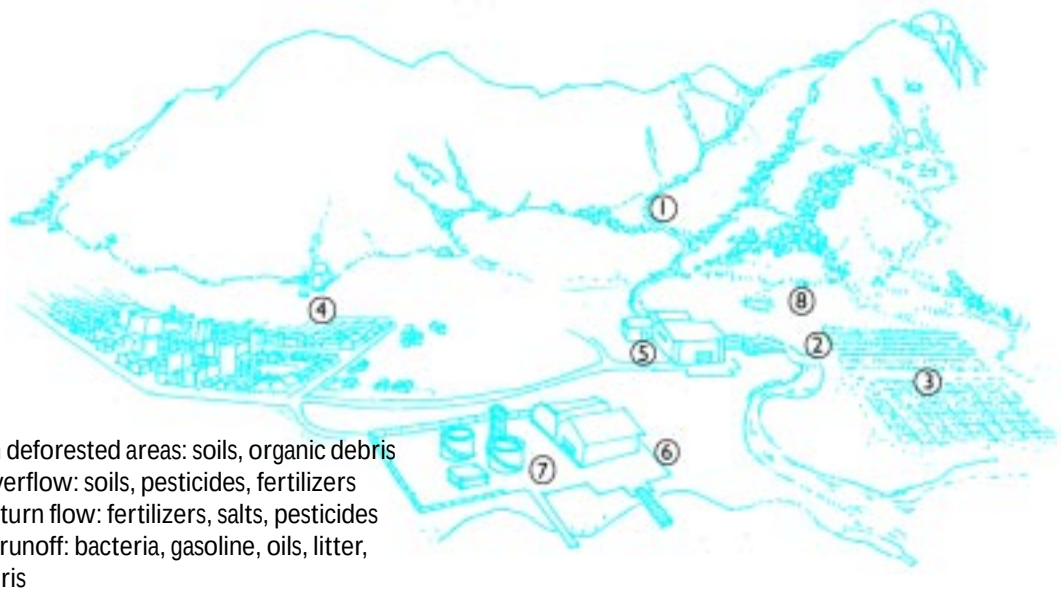


Figure 27. Terms in the hydrologic cycle *(adapted from Carpenter and Maragos 1989)*.



1 - Runoff from deforested areas: soils, organic debris
2 - Irrigation overflow: soils, pesticides, fertilizers
3 - Irrigation return flow: fertilizers, salts, pesticides
4 - Urban area runoff: bacteria, gasoline, oils, litter, organic debris
5 - Sewage effluent: BOD, viruses, minerals, nitrogen, and phosphorus compounds
6 - Surface runoff from industrial areas: oils, chemical spills
7 - Industrial wastes without treatment: toxic chemicals
8 - Subsurface waste disposal

Figure 28. Paths of wastewater in the hydrologic cycle *(adapted from Carpenter and Maragos 1989)*.

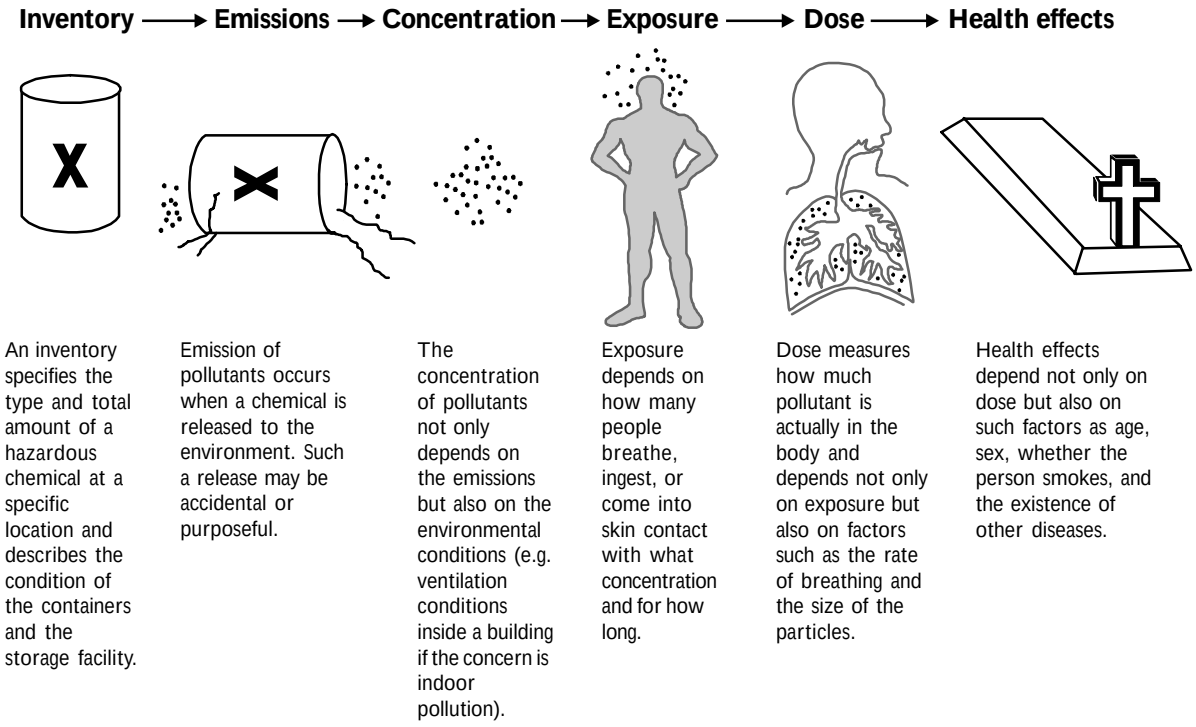


Figure 29. An exposure pathway showing relationship between quantity of pollutants, dose, and health effects in humans *(adapted from Carpenter and Maragos 1989)*.

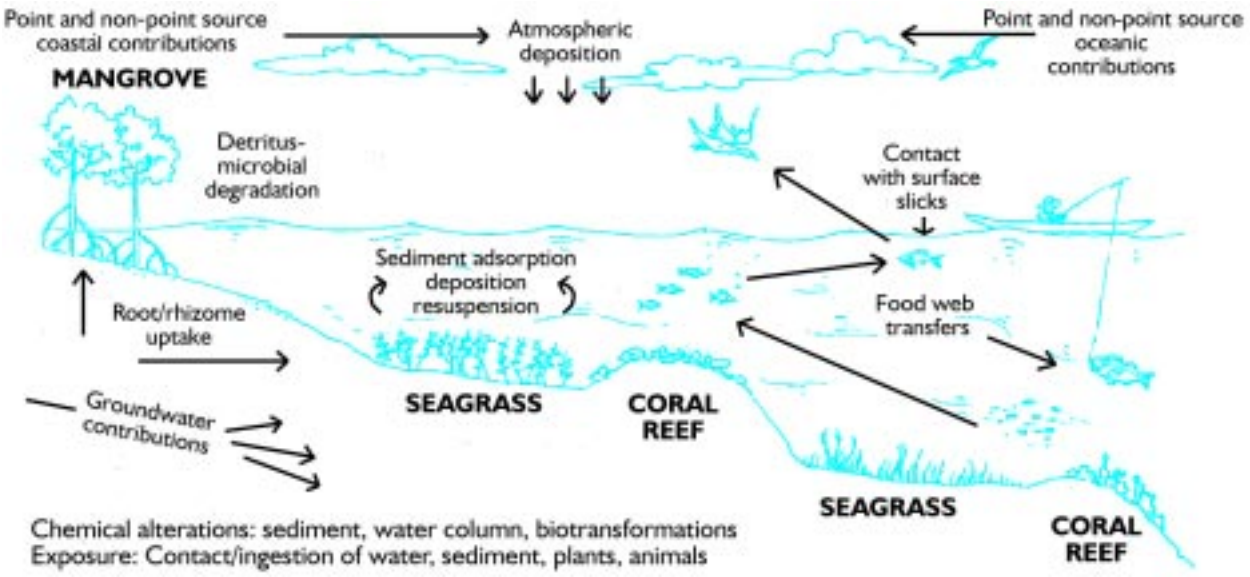


Figure 30. General conceptual model of sources of pollutants and fate and transport in tropical marine ecosystems *(adapted from Peters* et al. *1997)*.

1991; Peters *et al.* 1997). Fate and transport processes are very complex and vary with the type of pollutant and the type of habitat impacted. As examples, Figure 31 depicts potential fate and transport of oil after a spill at sea while Figure 32 shows dispersion of pesticides through the environment.

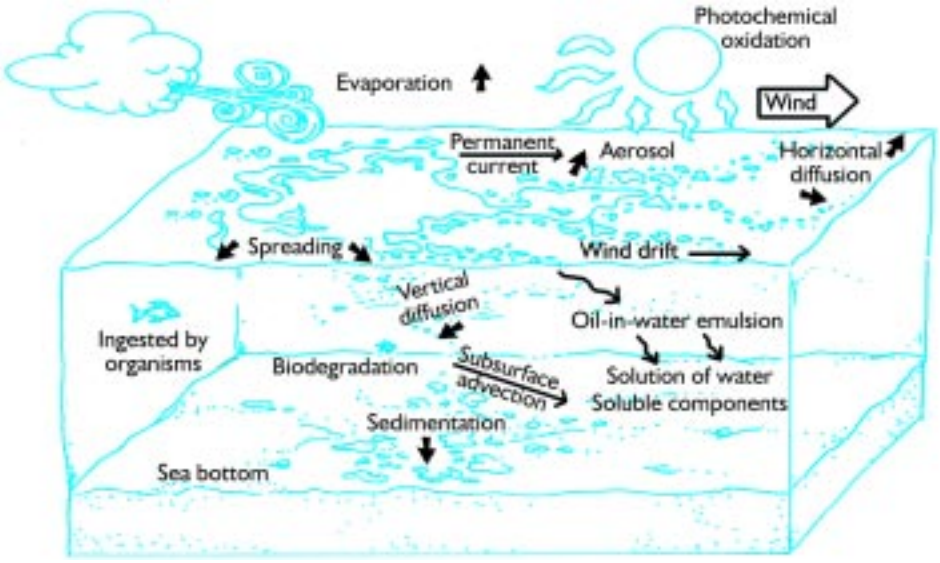


Figure 31. Effects of wind and other factors on the movement of polluting oil at sea *(adapted from Bishop 1984)*.

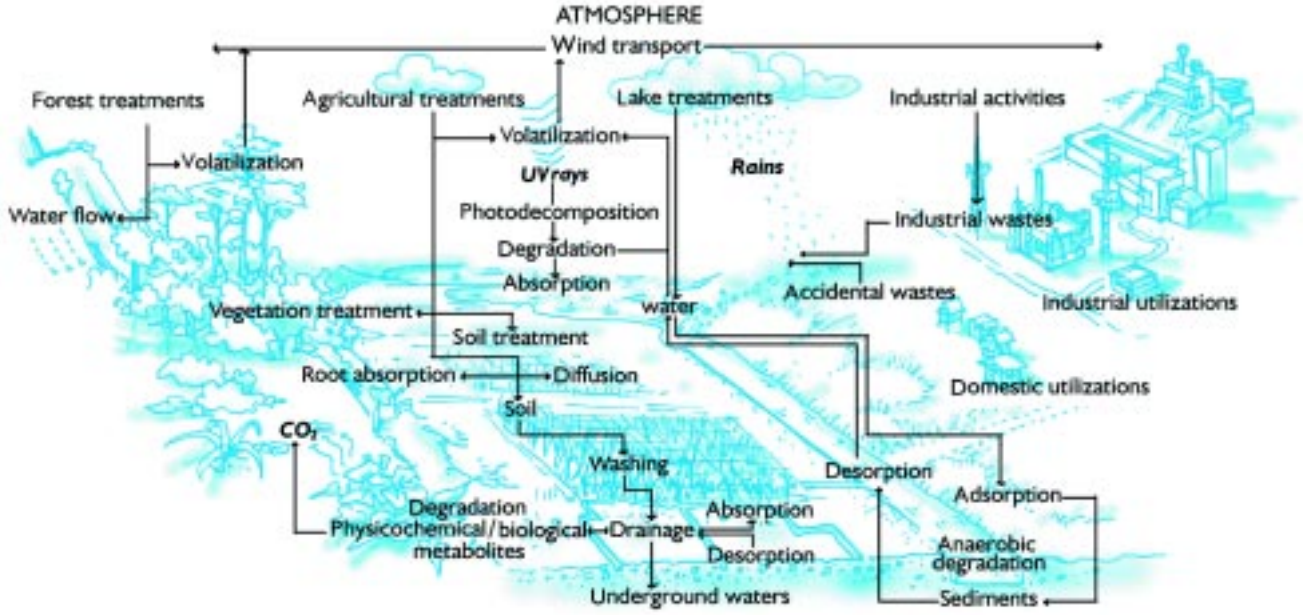


Figure 32. Dispersion of pesticides through the environment *(adapted from Boudou and Ribeyre 1989)*.

Many pollutants do not remain in the water column but settle out and are adsorbed by sediments. Sediments in mangrove areas sequester and reduce bioavailability of heavy metals due to the presence of high organic content and fine particles and anaerobic conditions; the presence of mangroves along the coast can therefore act as buffer to coral reefs and seagrass beds. However, metals can also be accumulated in mangrove leaves and concentrated as exported detritus to reefs or seagrass beds (Peters *et al.* 1997). Low wave action also makes mangroves act as traps for oil pollution and solid waste.

The lower organic content of calcareous sediments in seagrass and coral reef areas may result in higher bioavailability of contaminants. Corals are sensitive to contaminants dissolved in seawater or absorbed onto particles because the thin layer of living tissue is rich in lipids and readily accumulates certain types of chemicals (Peters *et al.* 1997). Changes in water quality on reefs can also interfere with chemical cues that are critical for reproduction and recruitment in this habitat (Peters *et al.* 1997).

LEGAL AND JURISDICTIONAL MANDATE FOR POLLUTION MANAGEMENT

There are many existing laws and regulations designed to control pollution and protect the environment in the Philippines; many of these have evolved to meet the pressures of increasing urbanization and industrialization. Better enforcement and clarification of conflicting authority to manage pollution at the local level are needed to make the laws effective. An overview of existing laws and regulations is provided in *Guidebook 2: Legal and Jurisdictional Framework for Coastal Management*. A few key legislative or regulatory tools are described in this section, as are the roles and responsibilities of key players in pollution management.

The Toxic Chemical and Hazardous and Nuclear Wastes Act (RA 6969)

In 1990, Congress enacted the Toxic Chemical and Hazardous and Nuclear Wastes Act (RA 6969) that mandates the control and management of the importation, manufacture, process, distribution, use, transport, treatment, and disposal of toxic, hazardous, and nuclear wastes. RA 6969 intends to protect public health and the environment from unreasonable risks posed by toxic chemicals (Title II) and hazardous and nuclear substances (Title III). Hazardous wastes are substances that are without any safe commercial, industrial, agricultural, or economic usage and are shipped, transported, or brought into the country or are by-products, residues, equipment or other substances from manufacturing operations which present unreasonable risk to human health or to the environment.

The compliance and enforcement strategy of DENR is based on a permitting system, inspections, monitoring, and educational campaigns to encourage voluntary compliance. DAO 29, issued by DENR in 1992, provides guidelines on implementation of RA 6969; most of the rules are implemented by the EMB. DENR maintains an inventory of chemical substances known as the Philippine Inventory of Chemicals and Chemical Substances (PICCS) that are used, transported,

stored, imported, exported, distributed, manufactured, processed, and disposed of in the country. Chemicals which pose a risk to human health or the environment may be the subject of a Chemical Control Order (CCO) and their use is subject to controls or conditions set in a permit from DENR to waste generators that are designed to minimize risk. Transport and storage of toxic or hazardous wastes is also subject to control by DENR; waste transporters are licensed and vessels, containers, and tanks for storage must be clearly labeled.

Presidential Decree 984 and RA 9003

Presidential Decree 984 (PD 984) and its implementing rules and regulations are the key regulatory tools for pollution management. Numerous DENR Administrative Orders (DAOs) form the framework of PD 984; however, DAO 34 and DAO 35 are the most important administrative orders related to coastal and marine pollution.

DAO 34 classifies water bodies (Table 27) and provides the environmental standards or criteria to maintain quality of the water body. The classification of the water body and resulting criteria are set by DENR according to the best beneficial use of the water body, the dominant use, and the existing water quality. The water classifications are arranged in order of protection required; Class SA has the most stringent water quality standards and Class SD has the least stringent standards. For example, Batangas Bay is classified as SC and all industries must comply with Class SC standards. The assigned classification of the water body does not mean that it cannot be used for other purposes, as long as the use does not affect the water quality. Many

Table 27. Classification of coastal and marine waters according to beneficial usage.

Classification	Pollutants
Class SA	Waters suitable for the propagation, survival, and harvesting of shellfish for commercial purposes; National marine parks established under Presidential Proclamation Number 1801 and other existing laws and/or declared as such by appropriate government agency; and Coral reef parks and reserves designated by law and concerned authorities.
Class SB	Tourist zones and marine reserves primarily used for recreational activities such as bathing, swimming, skin diving, etc. under existing laws and/or declared as such by appropriate government agency; Recreational Water Class I (areas regularly used by the public for bathing, swimming, skin-diving, etc.); and Fishery Water Class I (spawning areas for milkfish and similar species).
Class SC	Recreational Water Class II (boating); Fishery Water Class II (commercial and subsistence fishing); and Marshy and/or mangrove areas declared as fish or wildlife sanctuaries.
Class SD	Industrial Water Supply Class II (e.g. cooling, etc.) and Other coastal and marine water, by the quality, belong in this classification.

Source: Section 68 (a) and (b) of DENR Administrative Order (DAO) 34 and Section 1 (b) of DAO 97-23 (issued on 24 July 1997 modifying tourist zones and marine reserves as Class SB

water bodies have not yet been classified. The classification of some major water bodies is provided in Table 28. LGUs can be proactive and pass an ordinance classifying waters under their jurisdiction, with consultation by DENR, based on beneficial use or dominant use. Water quality criteria developed to maintain the quality of the water body are provided in Table 29.

Table 28. Classification of some Philippine water bodies as of 1998.

Classified surface water	Location	Region	Class	Year classified
Bagac Bay	Bataan	3	SB	1993
Cabigo Point	Bataan	3	SC	1993
Looc Bay	Bataan	3	SB	1993
Napot Point	Bataan	3	SC	1993
Batangas Bay	Batangas	4	SC	1993
Cajimos Bay	Romblon	4	SC	1997
Puerto Galera (Muella Bay)	Oriental Mindoro	4	SA	1996
Camotes Sea	Leyte	8	SD	1997
Dupon Bay – southeast of bay	Leyte	8	SD	1997
Dupon Bay – southwest of bay	Leyte	8	SC	1997
Matiang Bay – northwest of bay	Leyte	8	SD	1997
Matiang Bay – southeast of bay	Leyte	8	SC	1997
Ormoc Bay	Leyte	8	SC	1997
Gingoog Bay	Misamis Occidental	10	SC	1993
Iligan Bay	Cotabato City	12	SC	1997
Panguil Bay	Cotabato	12	SD	1995

Table 29. Water quality criteria for conventional pollutants and toxic substances for coastal and marine waters.

Water quality parameter	Class SA waters	Class SB waters	Class SC waters	Class SD waters
Color (PCU)	No abnormal discoloration from unnatural causes			
Temperature (°C rise)	3	3	3	3
pH (range)	6.5-8.5	6.0-8.5	6.0-8.5	6.0-9.0
Dissolved oxygen (minimum percent saturation)	70	70	70	50
5 day 20°C biological oxygen demand (mg/L)	3	3	7(10)	—
Total suspended solids (mg/L)	Not more than 30% increase	Not more than 30 mg/L increase	Not more than 30 mg/L increase	Not more than 60 mg/L increase
Surfactant (mg/L)	0.2	0.3	0.5	-
Oil and grease (mg/L)	1	2	3	5
Phenolic substances as phenols (mg/L)	Nil	0.01	Not present in concentration to affect fish flavor and taste	-
Total coliform (Most Probable Number/100 mL)	70	1,000	1,000	-

(continued)

Table 29. (continued)

Water quality parameter	Class SA waters	Class SB waters	Class SC waters	Class SD waters
Fecal coliform (Most Probable Number/100 mL)	Nil	200	-	-
Copper (mg/L) as dissolved copper	-	0.2	0.05	-
Arsenic (mg/L)	0.05	0.05	0.05	-
Cadmium (mg/L)	0.01	0.01	0.01	-
Chromium-hexavalent (mg/L)	0.05	0.1	0.1	-
Cyanide (mg/L)	0.05	0.05	0.05	-
Lead (mg/L)	0.05	0.05	0.05	-
Total mercury (mg/L)	0.002	0.002	0.002	-
Organophosphate (mg/L)	Nil	Nil	nil	-
Aldrin (mg/L)	0.001	-	-	-
DDT (mg/L)	0.05	-	-	-
Dieldrin (mg/L)	0.001	-	-	-
Heptachlor (mg/L)	Nil	-	-	-
Lindane (mg/L)	0.004	-	-	-
Toxaphane (mg/L)	0.005	-	-	-
Methoxyclor (mg/L)	0.1	-	-	-
Chlordane (mg/L)	0.003	-	-	-
Endrin (mg/L)	Nil	-	-	-
PCB (mg/L)	0.001	-	-	-

Notes: Nil - Extremely low concentration and not detectable by existing equipment
- - Means the standard not considered necessary at the present time, considering the stage of the country's development and DENR's capabilities, equipment, and resources.

Source: Tables No. 3 and 4 DENR AO No. 34 and Section 2 of DENR AO 97-23

Table 30. Effluent standards for conventional pollutants and toxic substances for protected coastal and marine waters.

Water quality parameter	Class SB	Class SC	Class SD
Color (PCU)	100	No limits so long as the discharge does not cause abnormal discoloration in the receiving waters outside the mixing zone	
Temperature (°C rise)	3	3	3
pH (range)	6-9	6-9	5-9
Chemical oxygen demand (mg/L)	60	200	200
Settleable solids – 1 hr (mg/L)	0.3	-	-
5 day 20°C Biological oxygen demand (mg/L)	30	100	120
Total suspended solids (mg/L)	50	-	-
Total dissolved solids (mg/L)	1,000	-	-
Surfactant – MBAS (mg/L)	2	10	-
Oil and grease (mg/L)	5	10	15
Phenolic substances as phenols (mg/L)	0.05	0.5	1.0
Total coliform (Most Probable Number/100 mL)	3,000	-	-
Arsenic (mg/L)	0.1	0.5	0.5
Cadmium (mg/L)	0.02	0.1	0.2

(continued)

Table 30. (continued)

Water quality parameter	Class SB	Class SC	Class SD
Chromium-hexavalent (mg/L)	0.05	0.2	0.5
Cyanide (mg/L)	0.1	0.2	-
Lead (mg/L)	0.1	0.5	-
Mercury (total) (mg/L)	0.005	0.005	0.01
PCB (mg/L)	0.003	0.003	-
Formaldehyde (mg/L)	1.0	1.0	-

Notes: - - Means the standard not considered necessary at the present time, considering the stage of the country's development and DENR's capabilities, equipment, and resources.
Source: Tables 2A and 2B of DENR AO No. 35; Table 1 of DENR AO No. 35

DAO 35 provides standards for point-source pollution which vary according to the classification of the receiving water body**.** Under DAO 35, the least stringent Class SD standards are applied to "unclassified" water bodies. Since industry discharge standards are based on the classification of water bodies and there are a high number of "unclassified" water bodies, there can be conflicts between industry and government on the classification of water bodies. This provides another reason why LGUs should strive to adopt more protective classification of water bodies of high quality in their jurisdictions. Table 30 provides effluent standards for receiving water bodies of different classes.

PD 984 is implemented through permitting and compliance monitoring. Construction, installation, modification, or operation of sewage works, industry, or commercial facilities or any other operation that causes discharges of pollutants into the air, water, or land resources require permits from DENR. DENR regional offices issue two kinds of permits under PD 984:

- Authority to Construct (AC): issued before the construction of the pollution source or control installation and used to ensure that the pollution control systems will be sufficient and appropriate;
- Permit to Operate (PO): issued annually to authorize continued operation and to ensure compliance with existing standards.

The AC and PO are not issued unless inspection shows compliance with the conditions imposed in the ECC and all emission and discharges to the air, water, and environment comply with the existing environmental quality standards.

PD 984 stipulates that identified sources of pollution be monitored by the DENR-EMB Regional Office or the Provincial Environment and Natural Resources Office twice a year or at least before a PO is issued. Inspectors are granted the right to entry to the facility during regular

working hours. If violations are found, a notice of violations is sent and the establishment is called to a technical conference to identify corrective actions. Usually an establishment is given an opportunity to comply and only when it fails to do so is a complaint filed with the Pollution Adjudication Board (PAB). Violations are penalized through fines or through the issuance of a cease-and-desist order by DENR; the LGU is often called upon to monitor compliance of the violator with the order.

Other Pollution Laws and Regulations

Agricultural fertilizers and pesticides are regulated under PD 1152 that also mandates control of production, storage, and distribution of other toxic substances. Section 33 regulates the use of fertilizers and pesticides, prescribing a tolerance level for their use; however, the control is applied not on the application of pesticides and fertilizers near water sources, but on their production and importation. The Fertilizer and Pesticide Authority (FPA) of the Department of Agriculture was created to monitor these substances and has the authority to restrict or ban use of pesticides that pose imminent hazards to human health or the environment, prevent or regulate the import and export of pesticides with residues above accepted tolerance levels, and conduct inspections of pesticide handlers to ensure that health and safety and pollution regulations are followed.

PD 979 governing marine pollution prohibits the discharge, dumping, or deposit of any oil, noxious gaseous or liquid substance, liquid refuse, or material of any kind from any sea-based or land-based activity into navigable waters. The National Operations Center for Oil Pollution (NOCOP) was created in the Philippine Coast Guard Headquarters by virtue of PD 602. Its function is limited to contacting and coordinating the activities of other agencies for oil spill cleanups and negotiating with local companies for use of oil containment and recovery facilities.

Mine tailings disposal is governed by PD 984 and pertinent mining laws such as PD 463, PD 1251, and the Mining Code (RA 7942). Monitoring of mine tailings and imposition of mine tailing fees is managed by the Mines and Geosciences Bureau.

Roles and Responsibilities

In the Philippines, many environmental management functions, such as pollution control and enforcement, fall under the purview of DENR. Generally, DENR is responsible for land-based sources of pollution while PCG is responsible for sea-based sources of pollution. The PCG was designated as the primary agency responsible for enforcement of laws pertaining to marine pollution; however, PCG and DENR have joint responsibility to coordinate with each other in the enforcement of PD 979.

The LGC empowers the local government to play an important role in providing environmental services and adopting local ordinances to promote environmental protection at the local level. With devolution of authority and rapid increase in development, the responsibility for management of pollution at the local level is increasingly borne by the LGU. The challenge today is to create an

atmosphere of shared responsibility, collaboration, and partnership between the LGUs, national agencies, and communities to ensure that best management practices are implemented and pollution laws are being enforced.

WATERSHED APPROACH TO MANAGING POLLUTION

The ocean is the ultimate sink for pollutants from land-based activities since all waste eventually flows to the sea as a result of the hydrological cycle. Since the hydrological cycle is key to understanding pollution fate and transport, the watershed model is an appropriate tool for integrating pollution management and other coastal management efforts at the local level. The watershed is that land, bounded topographically, from which any water falling on it will eventually drain through a common outlet or system of outlets; a watershed therefore includes the hills, slopes, floodplains, and receiving bodies of water (Clark 1996).

A watershed management approach is a "coordinating framework for environmental management that focuses on public and private sector efforts to address the highest priority problems within hydrologically-defined land areas, taking into consideration both ground and surface water flow" (U.S. EPA 1994). Thus, the watershed is the management unit rather than an administrative boundary. By using the watershed approach, management strategies can address varied activities that occur upstream and outside the strict definition of the coastal zone yet still have direct adverse impacts on coastal resources. A comprehensive watershed management plan would address the most important water quality issues in the watershed, such as toxic pollutants from point and non-point sources, sedimentation from land clearing activities, and nutrients from sewage and livestock. Thus, the watershed approach addresses multiple pollutants and multiple sources and will likely require multiple management strategies to be implemented.

A watershed approach to pollution management is also inherently an ICM approach, as discussed in *Guidebook 1: Coastal Management Orientation and Overview*, and incorporates the concerns of numerous stakeholders regarding the environmental, socioeconomic, legal, and institutional aspects of pollution management. Stakeholders typically include local and national government, NGOs, people's organizations, the private sector, and scientific and educational institutions. The challenge is to identify all of the individual activities that contribute to coastal and marine pollution, evaluate their cumulative impacts, identify priority problems, and design cost-effective and feasible management strategies. In addition, the watershed approach can be expanded beyond water quality issues to address issues of water quantity, flood protection, habitat quality and biological diversity (Figure 33).

The guiding principles of watershed management include (U.S. EPA 1991):

- Stakeholder involvement – identification and involvement of representatives of people most affected by management decisions in the watershed;
- Partnerships – between public and private sectors;
- Geographic focus – focus on the watershed, which may be broken up into geographic subunits;
- Management plan and coordinated management activities – use of the planning framework to collect baseline information, prioritize problems, create goals, and select coordinated strategies; and
- Monitoring and assessment – of success of implementation of strategies.

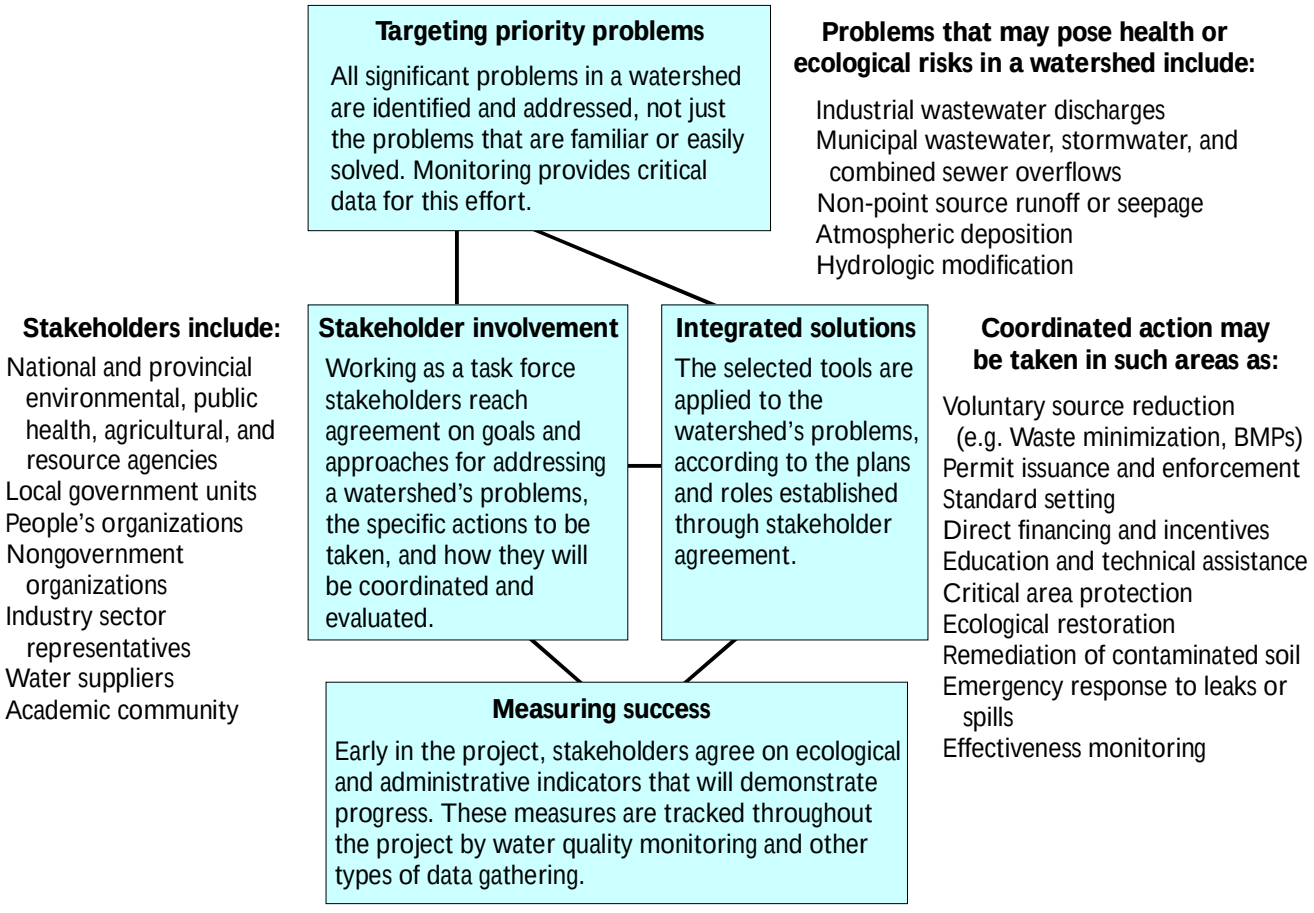


Figure 33. Features of a watershed protection approach *(adapted from U.S. EPA 1991)***.**

A watershed management approach is much more effective than isolated management efforts at tackling cumulative impacts and multiple pollution sources. A watershed approach can also be more cost-effective as collaborative efforts can save resources, direct resources toward priority problems, and improve coordination of strategies (Figure 33). A planning process, very similar to the coastal resource management planning framework described in *Guidebook 3: Coastal Resource Management Planning*, should be employed. A watershed management plan should identify key water quality impacts from land uses in the watershed, prioritize issues and problems to be addressed, and develop goals and objectives that are to be achieved with the implementation of pollution management strategies and actions (U.S. EPA 1994). Figure 34 diagrams a watershed-level planning framework that could be used to address pollution from major sources in the watershed that impact a bay shared by several LGUs. Table 31 describes the Batangas Bay case study of ICM planning to address pollution issues.

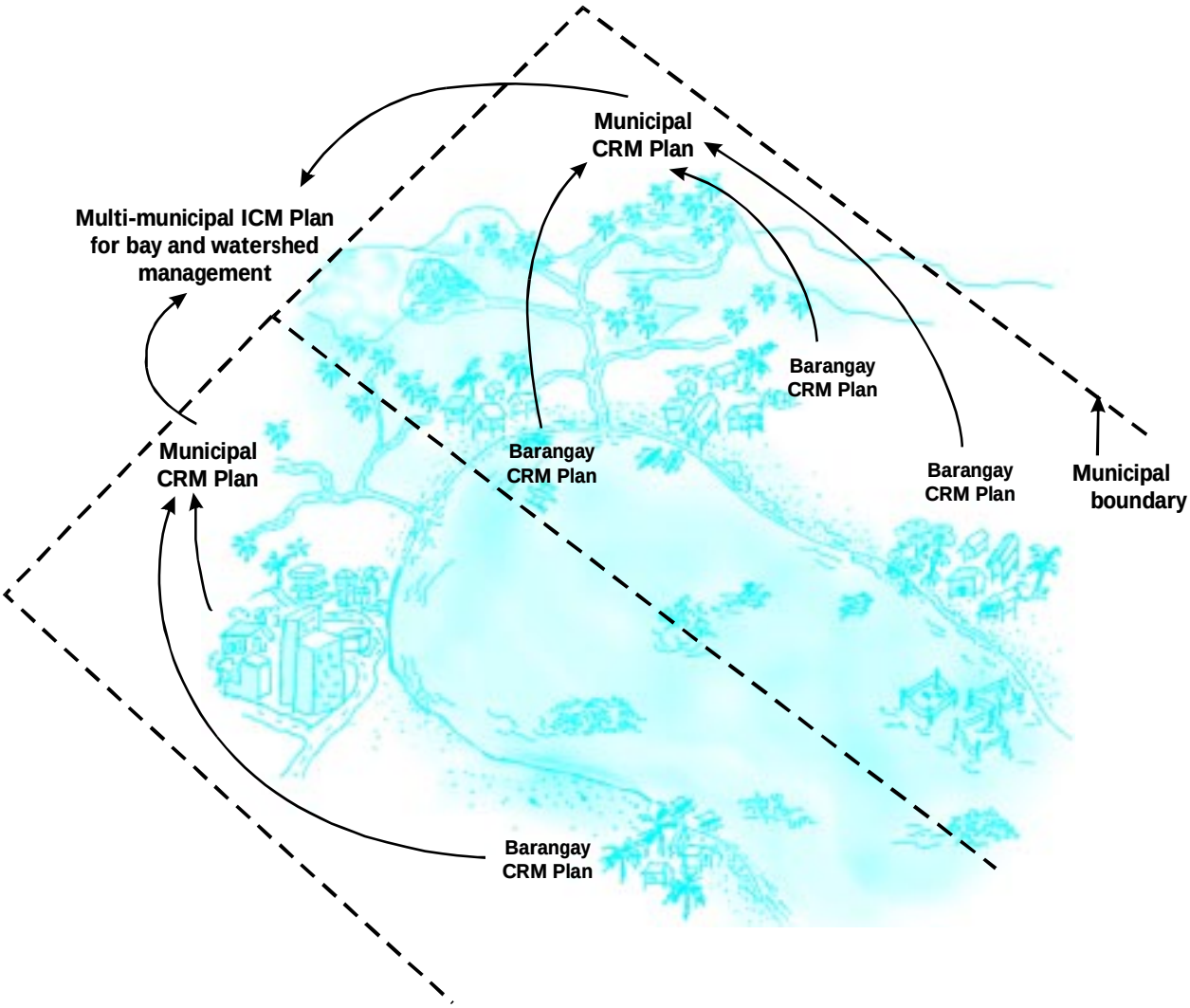


Figure 34. Watershed level planning framework .

Table 31. Batangas Bay case study.

The Marine Pollution Prevention for the East Asian Seas Project (MPP-EAS) is an example of an ICM program in Batangas Bay directed at preventing and managing pollution (Chua *et al*. 1999). The MPP-EAS joined with the Batangas Coastal Resources Management Foundation (private sector), DENR, and the provincial and local government units to facilitate development of a Strategic Environmental Management Plan that included an integrated industrial waste management plan. Twelve industries and nine shipping companies signed voluntary agreements with government agencies at the national and local level to reduce waste generation and participate in integrated waste management. These agreements included specific short-term and long-term goals, designation of responsibilities, system for tracking progress, and integration of activities. The types of waste covered included municipal solid waste, municipal sewage, industrial waste, port and ship waste.

MPP-EAS conducted feasibility studies to identify funding mechanisms, such as public-private partnerships, to fund pollution management systems. The Batangas Bay Water Use Zonation Scheme was created to guide development activities and to develop a vessel traffic separation scheme for shipping activities in the bay. A public-private partnership was formed to conduct water quality monitoring (Figure 35). A "Batangas Bay Watch" movement was organized to increase public awareness, especially among the youth, and to create active public partners in monitoring and reporting of pollution in Batangas Bay. Weekly radio programs and "cleanest village" contests help to maintain environmental awareness. The Bay Watch program was officially launched in 1998 by the Provincial Governor Hermilando I. Mandanas.

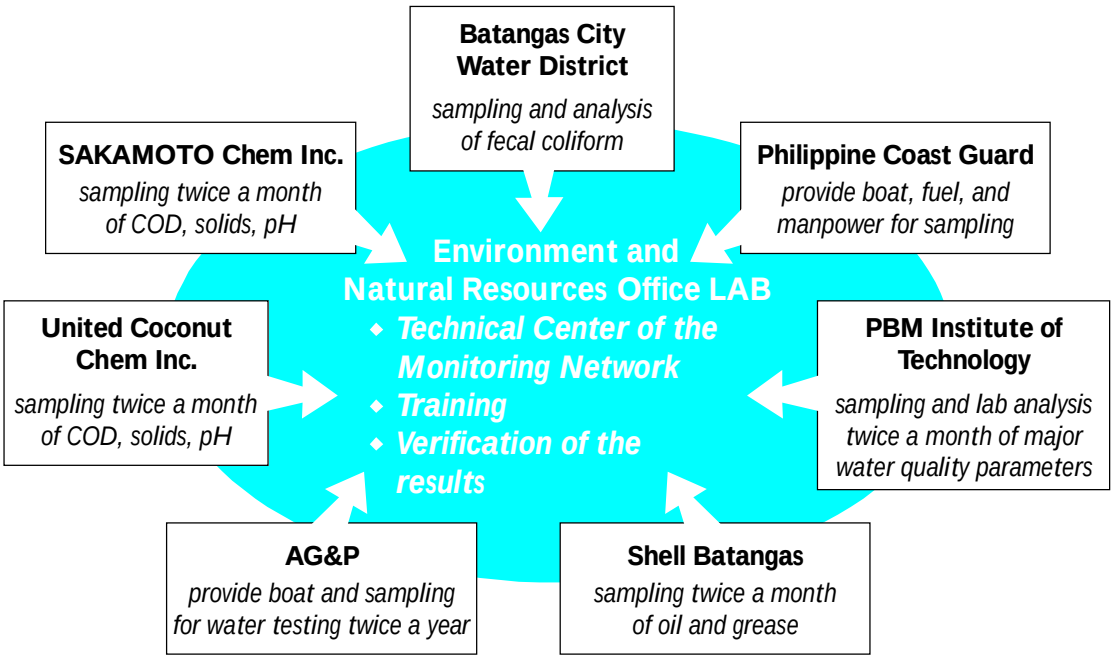


Figure 35. Partnerships in Batangas Bay ambient water quality monitoring *(Chua* et al. *1999)*.

POLLUTION MANAGEMENT STRATEGIES

Proper planning to avoid and prevent pollution is the most cost-effective form of management. Once pollution occurs, it is very expensive and difficult (sometimes impossible) to clean up. Both planning and assessment to prevent future pollution, and management of existing pollution are needed. General categories of pollution management strategies are presented below while the major types of pollution, their sources, and examples of specific management methods are summarized in Table 32.

Table 32. Major sources of pollution and selected management methods.

Sources	Pollutants	Management strategies
Industrial waste and emissions	Inorganic chemicals	Appropriate siting and EIA compliance Regulatory control of discharges and enforcement of standards Pollution prevention technology Recycling / materials recovery / waste minimization programs
Vehicular emissions	Lead and other inorganics, petroleum, particulates, and gases	Community monitoring programs Reducing use of leaded gasoline and two-stroke engines Emission standards on automobiles and trucks Expanding public transport with clean-fuel vehicles
Urban runoff	Inorganic and organic toxic chemicals, solid waste, petroleum	Community education programs Community monitoring of waterways Street/community cleanup programs Reduction in use of leaded gasoline
Agricultural runoff	Pesticides, herbicides, nutrients, sediment	Enforcement of pesticide and herbicide regulations Farmworker education programs Erosion control practices around agricultural fields Use of integrated pest management approaches instead of pesticides
Domestic sewage Livestock production	Nutrients, organic loading, toxic chemicals, pathogens Nutrients, pathogens, organic loading	Investment in sewage treatment infrastructure Appropriate siting of septic tanks Deep ocean outfalls for sewage Waste management and composting Control of polluted runoff
Land clearing/ Logging	Sediment, nutrients, and organic loading	Best management practices in erosion control Selective logging rather than clear cutting Land use planning and enforcement of zoning laws
Landfills/Solid waste	Debris, leachate contaminated with inorganics, and persistent organic pollutants	Appropriate siting and design of landfills Recycling / materials recovery programs Community education
Oil spills	Petroleum, polycyclic aromatic hydrocarbons	Development of oil spill contingency plan Preparation, training, and equipment for emergency response teams Volunteer cleanup crews Enforcement of shipping and navigation rules

Planning and EIA

Good planning is the first tool for managing pollution and integrating environmental consequences of a specific project or development activity with economic and social objectives. Pollution management objectives, policies, and actions can be formalized in development plans or ICM plans; some examples are provided in Table 33. Appropriate siting within the watershed and consistency with existing land use and development plans should be considered as strategies to minimize pollution impact. The EIA process described in Chapter 2 provides a means to ensure proper siting of potential sources of pollution and identifies ways to mitigate or minimize adverse effects of pollution. Regulatory oversight and monitoring should be used to ensure that conditions for project approval are carried out and adequately implemented.

Table 33. Examples of pollution management objectives, policies, and actions *(adapted from Coast Conservation Department 1997)***.**

Objective: Minimize effluent discharges and impacts in the coastal zone to prevent further degradation of coastal water quality and coastal habitats

Policy 1: Require all development activities in the watershed to comply with standards for coastal and marine water quality.

Actions:

- Impose standards for discharges on all new developments subject to permits;
- Impose a compliance program for existing developers violating standards;
- Implement best management guidelines for all aquaculture activities;
- Initiate a public awareness campaign;
- Implement a water quality monitoring program

Policy 2: Cooperate with other agencies in developing strategies for providing economic incentives to developers to minimize untreated waste discharge into coastal waters

Actions:

- Collaborate to develop tax incentive program, expedited permitting, or other incentives to encourage private development of waste treatment systems;
- Actively participate with other agencies to establish waste treatment facilities.

Objective: Improve the coastal environment by reducing the types and volume of solid waste disposal in the coastal zone

Policy 1: Commit to solid waste management program for identified coastal urban centers, harbors, and tourism areas to miminize impacts to the coastal zone

Actions:

- Identify appropriate urban centers, harbors, or tourism areas;
- Prepare solid waste management plan; and
- Relocate solid waste dumpsites in coastal areas to less sensitive areas.

Policy 2: Collaborate in public education and awareness programs and join with other agencies in promoting public participation in solid waste management

Actions:

- Facilitate public participation in preparation, implementation, and monitoring of solid waste programs;
- Update public education programs addressing the issues of solid waste and discharges to coastal environments; and
- Initiate program to involve communities in designing pollution abatement programs.

Pollution Prevention

Preventing pollution is more cost-effective than trying to clean up pollution once it is in the environment. Cleanup is often not technically or financially feasible. Pollution prevention is an approach to eliminate or reduce the volume or concentration of wastes in the waste stream by source reduction or recycling (Figure 36).

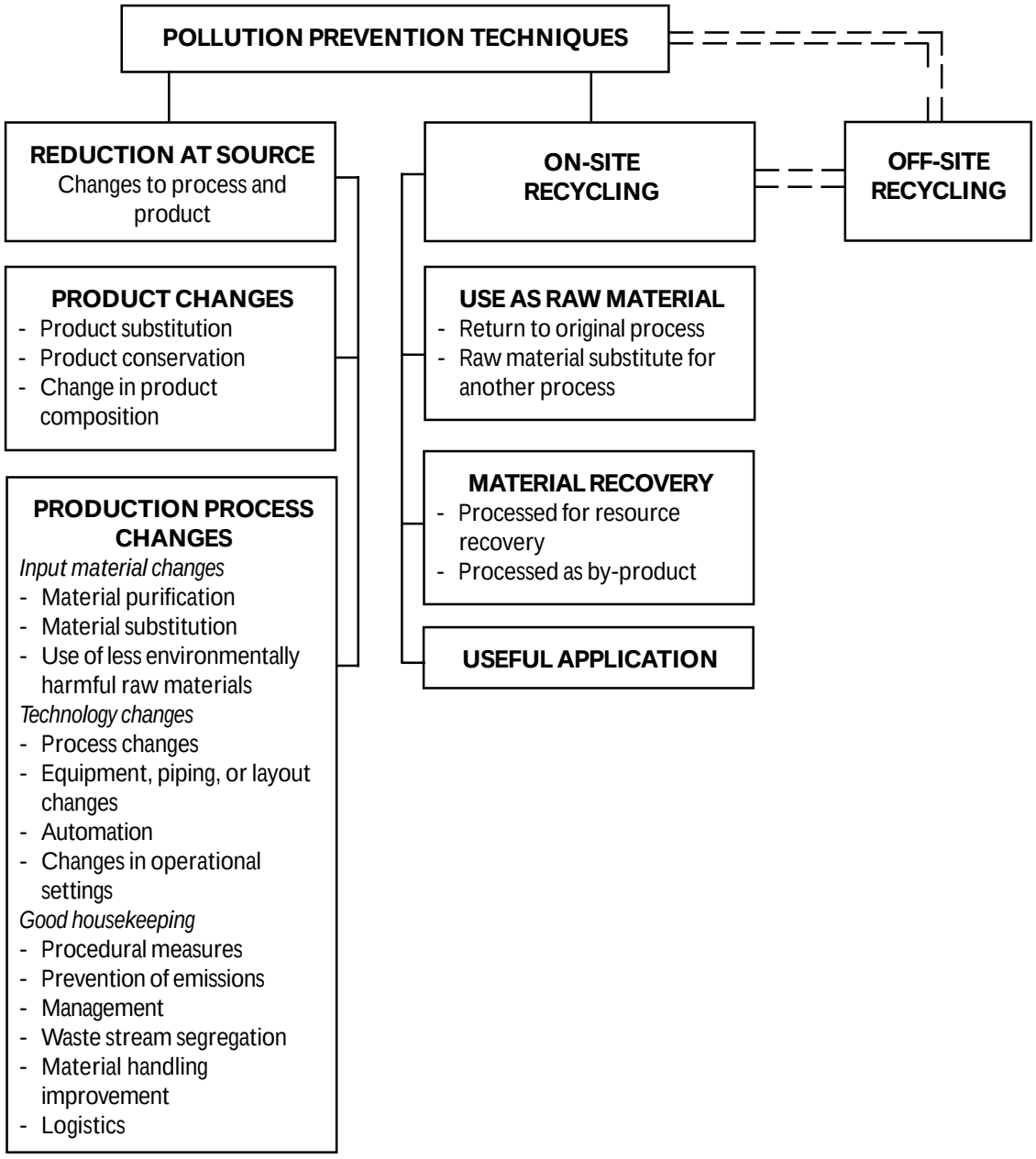


Figure 36. Techniques for the prevention of wastes and emissions *(adapted from De Hoo and Dieleman 1992)*.

Source reduction includes actions that reduce the volume of waste generated or the concentration of the polluting components (such as toxic chemicals) of the waste stream. The four main source reduction techniques include:

- **Operating practice changes** – By changing what facility operators do and how they perform their jobs, waste generated through spills, improper handling, lack of maintenance, and other operation procedures can be reduced.
- **Input material changes** – Material substitution can accomplish waste reduction by reducing or eliminating hazardous materials entering the production process and replacing them with less toxic alternatives.
- **Technology changes** – Modifications to equipment, equipment layout, automation, and operating procedures can also reduce the waste generated.
- **Product changes** – The product or output can be redesigned, changed, or substituted to achieve waste reduction.

Recycling involves returning wastes to the generating process or another process as input material. This use and reuse can be accomplished on-site at the site of generation or off-site by a commercial recycler or another industrial operation. Reduction of the materials in the waste stream through waste separation, recovery, and trading of waste for reuse can be encouraged through life cycle assessment and evaluation of economic uses for waste materials. Reclamation or recovery of valuable materials from wastes also provides economic opportunities.

The Industrial Environmental Management Project (IEMP) promoted waste minimization as a way for industries to reduce pollution. Currently, the Industrial Initiative for Sustainable Environment (IISE) is promoting ISO 14000 certification as a way to promote pollution control; this project also encourages NGO participation as monitors of pollution of IISE volunteer firms. Table 34 provides examples of some tools for municipalities to promote waste reduction.

Table 34. Primary tools for municipalities to promote waste reduction and materials recovery.

- Promote educational campaigns for public support of waste reduction and recycling; reduce stigma attached to waste workers;
- Study waste streams, recovery and recycling systems, and markets for recyclable materials to foster reuse of waste materials;
- Support source separation, recovery and trading networks with information sharing and incentives;
- Facilitate public-private partnerships and small enterprises conducting recycling through municipal regulations, loans, tax incentives, and zoning;
- Subsidize sorting and redemption centers and training for waste workers; and
- Promote innovation to create new uses for waste materials.

Waste Treatment and Best Management Practices

Investment in pollution control infrastructure, such as sewage and wastewater treatment plants, and implementation of best management practices are two additional approaches to managing existing pollution sources. Wastewater treatment plants, if properly managed, enable industries to comply with existing effluent discharge standards. Regardless of the source of wastewater, the basic methods used in treatment are physical, chemical, and biological in nature and include:

- Separation of solids from liquids;
- Oxidation of organic and oxygen demanding materials;
- Neutralization;
- Removal of toxic substances through precipitation, adsorption, disinfection, dechlorination, or other treatment of effluent; and
- Disposal of residues.

Best management practices are operational procedures that result in the least amount of pollution being generated. Most development activities and industries have identified and described best management practices; the problem is that they are often not implemented.

For solid waste management, an example of a best management practice is the proper siting and design of solid waste landfills. Landfills should not be placed near the coast or drinking water supplies. A sanitary landfill approach should be used instead of an open dump (Figure 37). Proper landfill design and operation require:

- Proper siting so that contamination of groundwater does not occur;
- Proper daily compaction of waste and placement in impervious cells;
- Daily cover with impervious materials to reduce leaching, fire, and vermin problems; and
- Prevention of methane gas buildup, windblown trash, and fires.

This should be combined with programs to reduce trash volume, recycling and composting, and programs for employment of populations whose livelihood comes from open dumps.

Implementation of erosion control practices during construction, logging, and agricultural activities can significantly reduce the volume of soil lost through surface water runoff. Best management practices to reduce erosion during construction or other development include:

- Limit clearing on slopes – Steep slopes erode quickly and should not be cleared of vegetation.
- Protect bare surfaces – Exposed soil should be covered by planting fast growing vegetation and spreading straw or mulch.

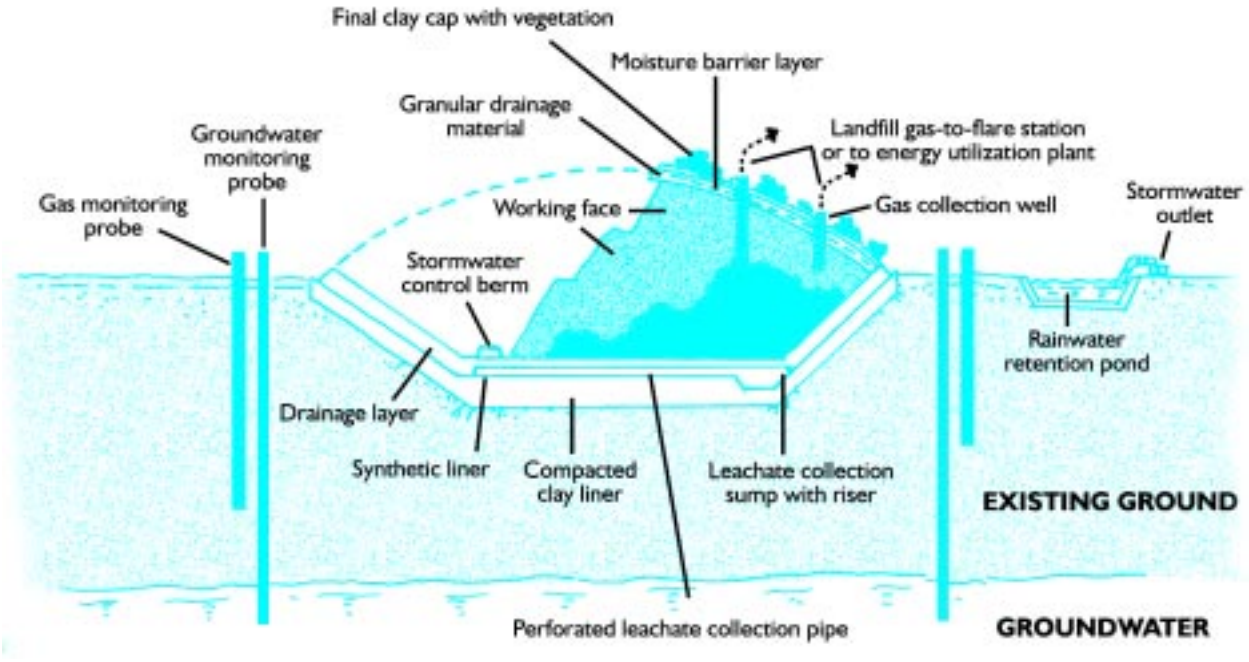


Figure 37. Cross-section of a typical modern sanitary landfill *(adapted from Portney and Stavins 2000)*.

- Do not concentrate water flow unless absolutely necessary – Allow water to percolate through soil by leaving undisturbed surfaces. If focusing runoff into a culvert or gutter is necessary, protect the outflow area with rock or brush to reduce erosion.
- Disturb existing vegetation as little as possible – Limit the extent of land clearing, prevent livestock access, and leave as much native vegetation as possible.

Regulation and enforcement

Regulations and standards exist to protect coastal waters, but laws alone are ineffective in curbing environmental degradation. In the Philippines, the major problem for pollution management is effective implementation and enforcement of existing laws and regulations. Enforcement of water quality standards listed in Tables 29 and 30 should be a focus of DENR and of the LGUs. Other government agencies and NGOs can offer technical assistance to LGUs in the monitoring of pollution and enforcement of standards (Table 35); the LGU has a key role in strengthening the political will for serious enforcement of pollution regulations at the local level.

Table 35. Local level enforcement of pollution laws.

Effluents: DENR, through the Pollution Adjudication Board (PAB) and the LGU, may penalize industrial owners who discharge untreated or insufficiently treated industrial effluents into coastal waters. DENR's authority stems from PD 984, the National Pollution Control Decree of 1976. The LGU would have authority to penalize polluters through an enabling ordinance, or through assisting PAB, or through abatement of nuisance. Cease-and-desist orders issued by the PAB have been devolved to the LGUs as a result of DAO 30 of 1992, Section 3.3. The Local Government Code, Sections 447, 458, and 465 may also provide additional authority for municipalities, city councils, and provinces respectively to penalize for untreated or insufficiently treated effluents. Local communities and governments need to be aware of enforcement options and report possible violations to the proper authorities.

Siltation and Eutrophication: Section 17 of the Local Government Code tasks provinces with enforcing pollution control laws, small-scale mining laws, and other laws on the protection of the environment, pursuant to national policies. Section 447 (a)(1)(vi) empowers the *Sangguniang Bayan* to impose penalties for endangering the environment, including pollution, acceleration of eutrophication of rivers or lakes, or of ecological imbalance, such as siltation problems caused by development (e.g. mining, dredging, agricultural runoff, deforestation, sludge disposal, etc.). Under RA 7942, the Regional Director of Mines, within the Bureau of Mines may issue cease-and-desist orders or suspend mining or quarrying operations in case of imminent danger to the environment until the danger is removed, and may require operators to remedy practices in violation of pollution control laws and regulations. Again, locals should be aware of enforcement options and report violations to the proper authorities.

Water Quality Monitoring

Establishing a local water quality monitoring program to assess the condition of coastal waters and to provide baseline information in the case of future spills or impairment of the water body is a good investment on the part of the LGU. A simple monitoring program with a volunteer community component can also be an effective public education tool. Monitoring should be focused on parameters that present the greatest risk and are feasible to measure (Figure 38).

Emergency Response Plans

The LGUs should ensure that there are emergency response plans and teams prepared to deal with oil spills and hazardous material incidences within the municipality. For example, while the PCG has jurisdiction and equipment for containment and cleanup of oil spills, the LGU should ensure that appropriate preparation has been made and responsibilities have been discussed with PCG to protect its municipality from potential spills. Clarifying responsibilities and jurisdictions for oil spills and hazardous waste spills, training response teams, and making sure equipment is ready and available to clean up spills will help to minimize impacts if a spill does occur.

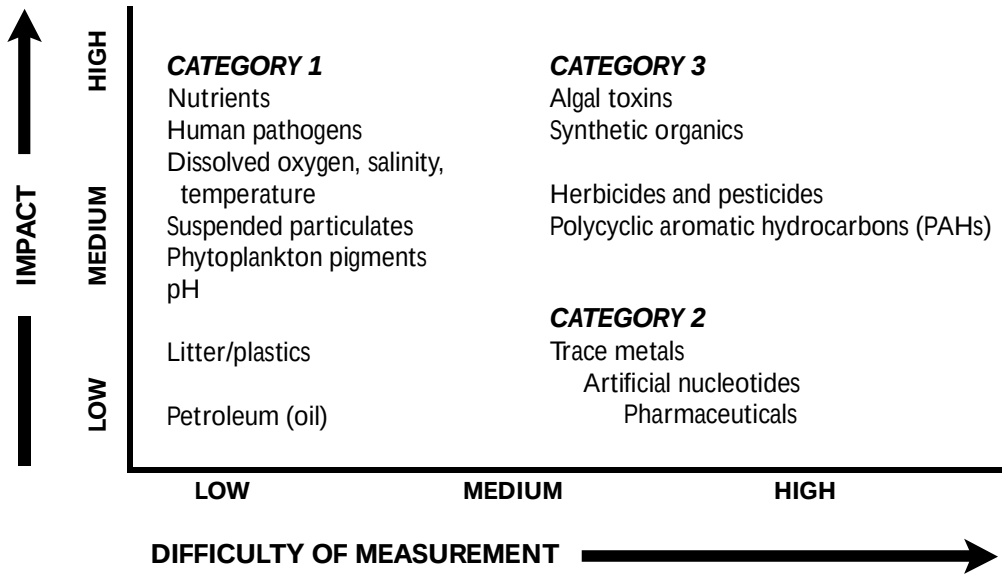


Figure 38. Pollution monitoring framework for East Asian seas *(adapted from Chua* et al. *1999)***.**

Public Awareness and Community Participation

The Philippine Agenda 21 has specifically included strengthening community participation in environmental management as a goal. The public has a key role in pollution prevention and regulation, and the LGU should develop education campaigns to inform the public of their rights and responsibilities. The LGU and national agencies should identify opportunities in pollution management where the community can play a major role. Some examples of community participation opportunities include:

- The annual coastal cleanup of solid waste along beaches and harbors;
- Educating the community about how to initiate and follow up on complaints about pollution release;
- Community pollution watch groups; and
- Community water quality monitoring programs.

Controlling non-point source pollution requires an integrated program that attacks the root causes. Education and awareness-building are often the main tools used to affect changes in people's behavior toward common non-point source pollutants like domestic sewage, fertilizer, pesticides, and cleaning compounds.

In summary, most development activities cause some form of pollution. Major types of pollution include chemical (inorganic and organic), nutrient, sedimentation, solid waste, pathogens, thermal, and radiological. Since pollution moves through the environment, and does not respect political, administrative, or ecological boundaries, it can be very difficult to manage. The Philippines has a strong legal and jurisdictional mandate for pollution control; however, better enforcement is needed. Many types of point and non-point pollution are best managed using a watershed approach that requires inter-LGU collaboration and public participation. In addition to regulatory controls, pollution management requires a combination of creative strategies including planning and EIA, pollution prevention and waste minimization, waste treatment and best management practices, and public awareness and participation. The following chapter summarizes guiding principles and specific actions the LGU can take to minimize pollution and other adverse impacts of development.

ALAN WHITE

Solid waste dumped in the coastal zone leaches contaminants in drinking water supplies and coastal waters, resulting in adverse impacts to human health.

ALAN WHITE

All pollutants generated in the watershed from agriculture, industry, logging, and other activities eventually reach the sea through surface water runoff or groundwater movement.

chapter 5

Local level actions for managing impacts of coastal development

Decentralization, formalized in the LGC, puts local governments and cities at the forefront of responsibility for sustainable resource management. Sustainable resource management requires careful and purposeful management impacts of development. Unmanaged impacts of development, including habitat degradation and loss, pollution, and human and environmental hazards comprise the long-term economic and human benefits that can be derived from natural resources.

Successful implementation of development and CRM planning procedures, the environmental review of development projects, and strategies to manage pollution will lead to a resolution of many environmental and development-related issues in the Philippine coastal zone. Local governments and communities have the authority to manage impacts at the local level and have the most to gain from the effort. This chapter provides guiding principles and reviews important actions that the LGU should strive to implement as part of their environmental management mandate under the LGC. Local governments will have to work closely with national government agencies, such as DENR, and local communities to successfully implement these actions. Table 36 summarizes guiding principles and specific actions the LGU can take to minimize development impacts.

Table 36. Guiding principles and specific actions LGUs should employ to minimize development impacts in the coastal zone.

- **Planning, in advance of development, provides a vision for community development and a framework for decision-making**
  - Use the planning framework to develop comprehensive land use plans, development plans, investment plans, watershed and CRM plans
  - Use a participatory consultative process in all planning efforts to promote a shared vision of community goals and objectives

- **Environmental review of development projects prevents unnecessary impacts**
  - Identify an LGU liaison to DENR to ensure local level review of all development projects, including those requiring an IEE and those requiring an EIS
  - Provide capacity building, particularly training in EIA, at the local level
  - Review proposed projects in the context of existing development, CRM, or other plans
  - Notify DENR, in writing, of any concerns about the adequacy or completeness of the environmental review of proposed projects
  - Post public notices of environmental reviews of development projects to notify local stakeholders

(continued)

Table 36. (continued)

- Ensure that a no-action alternative is considered for every project
- Require mitigation for project impacts, such as protection of additional habitat in exchange for habitat lost to development

- **Special protection is needed for the shoreline and sensitive coastal habitats to ensure sustainable resource use**
  - Require setbacks for coastal development to protect shoreline
  - Ensure that access rights of local fisherfolk are not impacted by development
  - Ensure special protection of coral reefs, seagrass beds, and mangrove habitats for sustainability of fishery resources

- **A watershed level approach is needed to address cumulative impacts of development**
  - Use inter-LGU collaboration to develop a watershed management plan to address point and non-point sources of pollution
  - Enforce existing pollution laws and regulations at the local level
  - Provide incentives for industry to employ pollution prevention and waste minimization measures

- **People are the key to managing development impacts and a participatory process should be a central component of any management effort**
  - Use capacity building and networking to create a core group of local experts and concerned citizens
  - Involve local stakeholders in scoping meetings and environmental reviews by providing public notice and community meetings
  - Create a public education and outreach program to reduce pollution

- **A precautionary approach should be used in the face of uncertainty about environmental impacts**
  - Use a conservative and precautionary approach if there is any doubt about potential impacts of development
  - Move slowly and cautiously in development efforts

COMPLETE LAND USE, DEVELOPMENT, AND CRM PLANS

Planning and land use zoning are effective tools for managing development. The LGU should, as a first step, complete comprehensive land use, development, and CRM plans to provide the planning framework for project evaluation. A participatory and consultative process should be used to involve stakeholders in the development of local plans. The planning process described in *Guidebook 3: Coastal Resource Management Planning* can be generalized to all types of spatial plans. Proposed development projects should first be reviewed in the context of the existing plans, or plans currently being prepared. The LGU staff responsible for project evaluation should be aware of and familiar with existing plans.

An appropriate planning framework for developing CRM plans, development plans, and watershed management plans is shown in Figure 39. This planning framework has evolved from the experiences of local government planning in the Philippines. The phases of the planning cycle should be followed in all planning efforts.

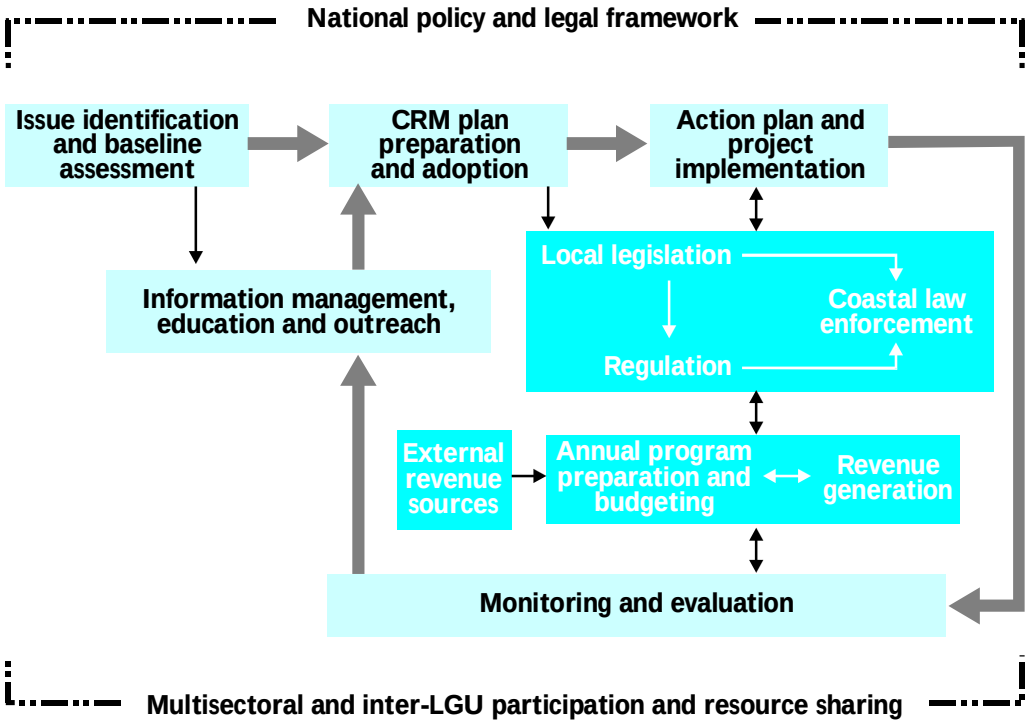


Figure 39. The coastal management planning process adapted for the Philippine local government.

IMPLEMENT LOCAL LEVEL ENVIRONMENTAL REVIEW OF ALL DEVELOPMENT PROJECTS

Local governments and communities have, in the past, relied substantially on national government agencies such as DENR to conduct environmental review of projects under the national EIS System. However, the LGU has a very important role in reviewing projects as partners to DENR to ensure that local concerns are addressed. All development projects that may impact the coastal zone should be subject to some environmental review. Capacity-building is needed to improve the ability of LGUs and local communities to address environmental issues from development activities more effectively. Encouraging LGU and community involvement in the review process would help ensure that local environmental impacts of proposed development activities are addressed.

The EIS System administered by DENR's EMB provides a framework for managing impacts of certain types of coastal development projects. This framework could be strengthened by DENR and the LGUs working together to (Welles 1995):

- **Enhance the utility of EIA as a management tool** – EIA has to be applied at the beginning of the project cycle to be a successful management tool. If decisions on design or location are made before an EIA is completed and without appropriate review, then serious impacts cannot be avoided.

- **Streamline the current EIS System and procedures** – Institutional restructuring, increased staffing, additional allocation of budget, and providing clearer guidelines are steps needed to make the system more efficient and responsive.
- **Support EIA capacity-building programs** – Lack of human and physical resources limits EIA implementation and should be addressed by training programs and coordinated data collection.
- **Strengthen public participation mechanisms** – Facilitating public participation at the scoping, review, and monitoring steps would strengthen the EIA process.

Table 37 describes the essential ingredients of successful EIAs that provide a target for future efforts on the part of the LGU and DENR.

Table 37. Essential ingredients of successful EIAs *(after Gilpin 1995)**.***

- A legislative basis, such as already exists with DENR's EIS System, and clear support at the national and regional level;
- Initiation of the EIA process at the beginning of the project cycle, before sites are selected or any decisions have been made;
- Enforcement and penalties for breaking environmental laws;
- Human resources and capacity in EIA and ERA (competent multi-disciplinary teams to prepare and review EIA or EIS documents);
- Active participation by LGU and communities in a consultative process;
- Integrity in participants;
- Avenues of appeal against decisions;
- Clear allocation of responsibility for enforcement of conditions attached to development consent; and
- Project and post-project monitoring and auditing.

REQUIRE SETBACKS AND PROTECT FORESHORE RIGHTS AND PUBLIC ACCESS

An emerging theme in development along the coastline is the importance of setbacks in project design and the protection of the rights of the public and resource users in the foreshore area. Development in the foreshore area often results in environmental degradation, erosion of the shoreline, and loss of aesthetic values. Best management practices require setbacks from the shoreline to minimize impacts in the foreshore areas. Local CRM plans, EIA, and enforcement are the best tools to manage these types of adverse impacts. Development projects often limit access to the foreshore by local fishers and recreational users resulting in resource conflicts after development projects are implemented (Mayo-Anda 1998). In many areas of tourism development, for example, local fisherfolk are excluded from access to fishery resources in beach areas and there are no public beaches for local use as the land has been appropriated by the private sector.

MANAGE WATERSHEDS THROUGH INTER-LGU COLLABORATION

Pollution fate and transport is tied closely to the hydrological cycle and does not follow administrative boundaries. Therefore, a watershed approach to managing point and non-point source pollution is the only comprehensive way to address the numerous sources of pollution that affect coastal waters. A watershed-level planning framework built through inter-LGU collaboration is required to address pollution impacts, as well as other important environmental concerns in the coastal zone.

ENFORCE POLLUTION LAWS

More effective enforcement of existing pollution laws at the local level is needed to prevent environmental damage. Management strategies should include enforcement of existing regulations, public education and outreach, and pollution prevention. The LGU should identify appropriate staff and resources to conduct inspections and ensure compliance in partnership with DENR. DENR has a key role in assisting the LGU in enforcement of pollution regulations. Failure to address this management problem will hamper LGUs in other resource management efforts such as CRM.

ENCOURAGE PUBLIC PARTICIPATION

Local stakeholders are best able to anticipate benefits and adverse impacts from development activities due to their knowledge of the local environment and their vision for their future. Unwanted or unauthorized development and unmanaged pollution precludes opportunities for resource use and future development for the community. The best defense against unwanted development is public consultation and an active community that seeks out information on proposed development activities, attends scoping meetings, makes community concerns heard, reviews EISs, and petitions DENR when unauthorized development is taking place. In reviewing proposed shoreline development projects, FARMCs can play a crucial role to highlight potential negative impacts on fisheries and coastal resources in general.

Local governments and communities should study and understand the requirements of ECCs and monitor the progress and details of approved projects during construction and operational phases. Aside from "red-flagging" any potential violations of a project's approved ECC, local monitoring efforts can help raise public awareness and document changes to coastal resources that might be unnecessarily degraded by either authorized or unauthorized project activities. Community vigilance can detect projects lacking ECCs and lead to sanctions against the responsible violators and corrective actions (possibly funded by the violators themselves) that restore coastal environments damaged by the illegal development. Continued vigilance could also compel DENR to conduct thorough environmental audits of completed or abandoned projects for the purpose of planning more comprehensive restoration of degraded coastal resources and ecosystems.

TAKE A PRECAUTIONARY APPROACH

Understanding and predicting environmental impacts of development activities is an inexact science and the underlying issues are very complex. Uncertainty and lack of information can limit the ability to make decisions about the potential impacts of projects. An evaluation of sources of uncertainty and the possible necessity for an additional study that may reduce the level of uncertainty are important components of ERA, EIA, and decision-making. The precautionary principle is a "guiding rule in EIA to protect people and the environment against future risks, hazards, and adverse impacts, tending to emphasize safety considerations in the occasional absence of clear evidence" (Gilpin 1995). Taking a precautionary and conservative approach in the face of uncertainty is a good management strategy to ensure that serious impacts will not occur!

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Decisions on coastal development activities need to be made wisely because they can result in irreversible impacts to natural resources and foreclose a variety of economic, social, cultural and environmental benefits, functions, and opportunities.

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The Coastal Resource Management Project, 5/F Cebu International Finance Corporation Towers
J. Luna Ave. cor. J.L. Briones St., North Reclamation Area 6000 Cebu City, Philippines
Tels.: (63-32) 232-1821 to 22, 412-0487 to 89 Fax: (63-32) 232-1825 Hotline: 1-800-1888-1823
E-mail: crmp@oneocean.org or crmhot@mozcom.com Website: www.oneocean.org