PN-ABH-551
70716

AGENCY FOR INTERNATIONAL DEVELOPMENT
PPC/CDIE/DI REPORT PROCESSING FORM

ENTER INFORMATION ONLY IF NOT INCLUDED ON COVER OR TITLE PAGE OF DOCUMENT

1. Project/Subproject Number:
2. Contract/Grant Number:
3. Publication Date: January '91

4. Document Title/Translated Title:
Urban Impacts on Coastal Zones of Developing Countries: Problem Identification and Recommendations for Mitigations.

5. Author(s)
1. Matthew Auer
2.
3.

6. Contributing Organization(s)

7. Pagination: 21 pp
8. Report Number:
9. Sponsoring A.I.D. Office: APRE/H

10. Abstract (optional - 250 word limit)
See attached

11. Subject Keywords (optional)
1. Environmental Management
2. Environmental Degradation
3. Coastal Pollution
4. Coasts
5. Urban planning
6. Land use

12. Supplementary Notes

13. Submitting Official: Larry Birch
14. Telephone Number: 3-2556
15. Today's Date: 4/16/91

DO NOT write below this line

16. DOCID
17. Document Disposition: DOCRD [ ] INV [ ] DUPLICATE [ ]

AID 590-7 (10/88)

Urban Impacts of Coastal Zones of Developing Countries: Problem Identification and Recommendations for Mitigations

Coastal zones represent sensitive ecological areas and serve critical economic and subsistence functions for local, national and regional economies in the developing world. Increasingly, coastal zone resources are degraded by unsustainable or destructive fishing practices, improper land uses, poorly designed and managed tourist facilities and uncontrolled urban expansion. The purpose of these guidelines is three-fold: 1) to identify the adverse impacts that ensue from poorly planned urban and tourist developments in coastal zones, 2) to assist technical staff in RHUDOs and Missions to design more environmentally sustainable urban projects in such zones, and 3) to provide RHUDOs and Missions with a reference document on environmental aspects of coastal zone development in their dealing with host country counterparts.

Urban Impacts on Coastal Zones of Developing Countries

Problem Identification and Recommendations for Mitigations

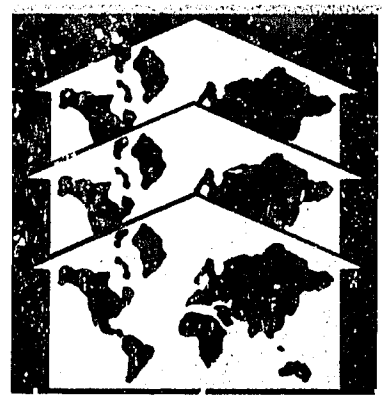
January 1991

OFFICE OF

HOUSING AND URBAN

PROGRAMS

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT



W O R K I N G P A P E R

This working paper represents a non-official publication of the Office of Housing and Urban Programs.
Working Papers are distributed unedited in order to ensure their timely availability.

PN-ABH-556

Urban Impacts on the Coastal Zones of Developing Countries: Problem Identification and Recommendations for Mitigations

January 1991

Prepared by:

Matthew R. Auer
U.S. Agency for International Development
Office of Housing and Urban Programs
Washington, D.C.

The views expressed in this report are those of the author and do not necessarily reflect those of the Agency sponsoring this work.

Table of Contents

I. Statement of the Problem..... 1

II. Background and Definitions.....3

III. Informal Land Development in Coastal Zones.....4

IV. Urban Impacts on Coastal Zones:
Problem Identification and
Recommendations for Mitigations.....6

V. General Institutional Management Issues.....15

VI. Concluding Remarks.....16

Appendix I: Development in Coastal Zones:
Potential Environmental Impacts.....18

Endnotes.....19

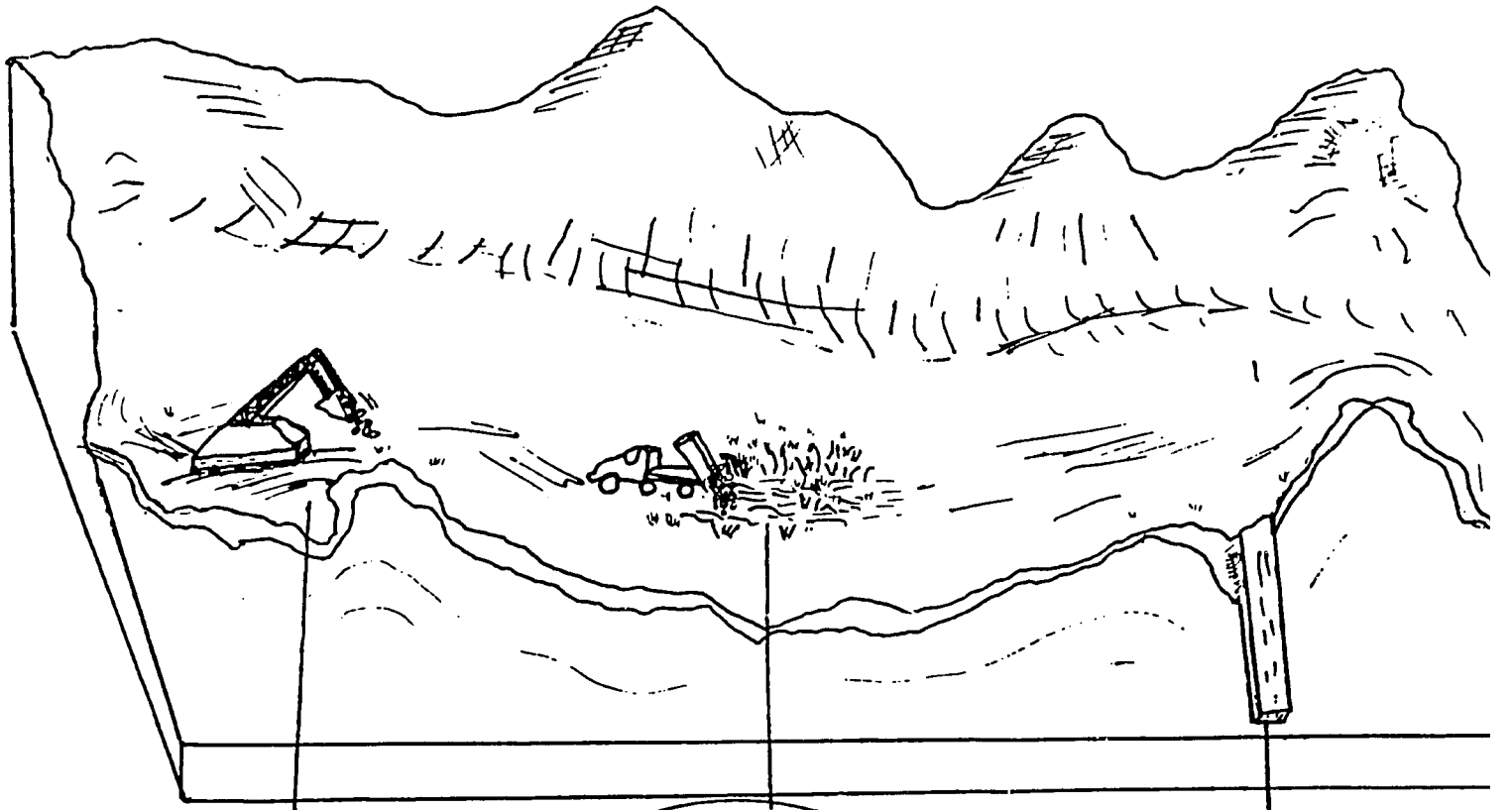
Urban Impacts on the Coastal Zones of Developing Countries: Problem Identification and Recommendations for Mitigations

I. Statement of Problem

Coastal zones represent sensitive ecological areas and serve critical economic and subsistence functions for local, national and regional economies in the developing world. Increasingly, coastal zone resources are degraded by unsustainable or destructive fishing practices, improper land uses, poorly designed and managed tourist facilities and uncontrolled urban expansion. The purpose of these guidelines is three-fold: 1) to identify the adverse impacts that ensue from poorly planned urban and tourist developments in coastal zones, 2) to assist technical staff in RHUDOs and Missions to design more environmentally sustainable urban projects in such zones, and 3) to provide RHUDOs and Missions with a reference document on environmental aspects of coastal zone development in their dealings with host country counterparts.

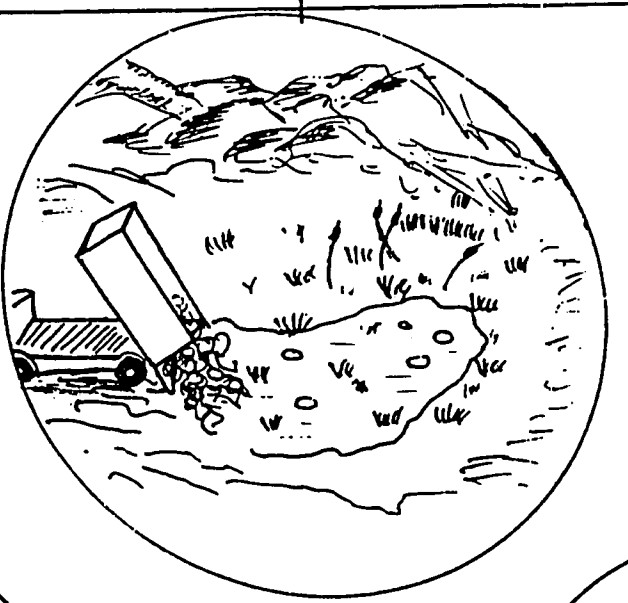
At the outset, it should be recognized that many urban impacts are related to land and property development issues. As a first step, then, this document identifies the environmental issues related to land in coastal zones, with prescriptions for environmentally sound land management and development. With the overall issue of land and property as a framework, three major categories of urban impacts on coastal areas are identified: 1) erosion generated by excavation/construction activities, 2) contamination by wastewater and solid waste inputs, and 3) pollution generation and direct physical impacts from tourism activities. (Figure 1 presents a sampling of human impacts on coastal zones). The document identifies a series of potential problems and issues which refer to each of these three areas. Potential actions and interventions are prescribed. Finally, a discussion of issues related to institutional management in coastal zones, (as opposed to purely technical considerations) is provided.

Figure 1: A Sampling of Human Activities that Impact on Coastal Zones



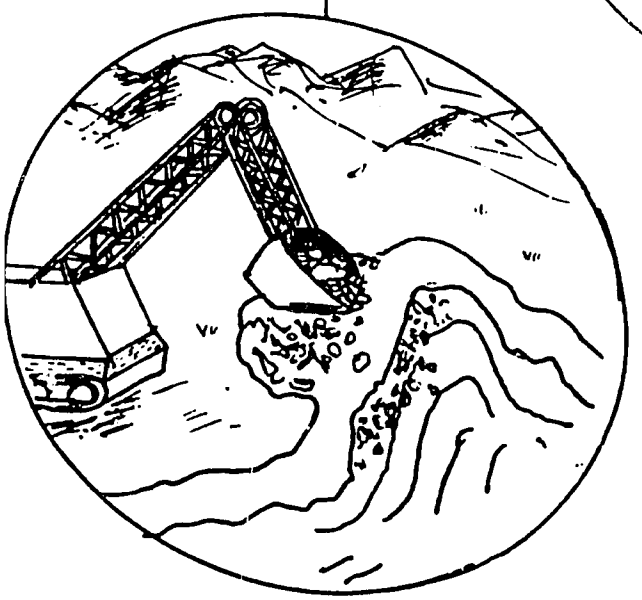
Excavation and Dredging

- accelerates erosion along shoreline
- causes siltation in coastal waters
- destroys coastal habitats



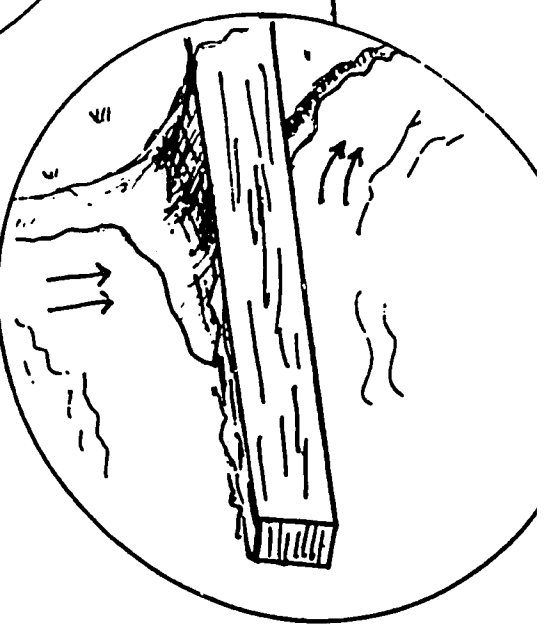
Construction on Beaches (piers, groins, etc.)

- interferes with natural processes of beach building and erosion
- alters features of of the shoreline
- destroys coastal habitats



Dumping of Wastes

- contaminates wetlands, estuaries and coastal waters
- impacts health of consumers of fish and seafood
- destroys coastal habitats



AMET

II. Background and Definitions

* Coastal Zones. The coastal zone is the interface between land and sea where processes of biological exchange, production and consumption occur at high intensity. Coastal zones include all shore lands, beaches, bays, sounds, estuaries, nearshore islands, and adjacent intertidal habitats including salt marshes, wetlands, tidal flats and dunes. The World Resources Institute identifies most coastal zones as extending less than 20 kilometers inland. Some definitions of coastal zones include all areas where land based activities have significant impacts upon coastal waters or vice versa.

Unlike other, "heartier" ecosystems, coastal zones are at particular risk of damage or destruction due to natural and manmade impacts. Coastal zones represent the terminuses or many natural processes, e.g. where rivers meet the sea, where fresh water meets salt water, and where land meets ocean. Large storms and floods may disturb fragile coastal habitats and permanently alter major features of the shore. Manmade impacts can be equally destructive: urban wastes dumped into streams and rivers eventually find their way to the sea, accumulating in and damaging coastal and nearshore habitats. Coastal excavation/construction activities impose barriers to natural processes of beach building and erosion.

In general, coastal resources are common resources, and are vulnerable to overuse or misuse.

* Percentage of Urban Areas near Coastal Zones. Approximately eighty-two percent of the world's nations border on the oceans or on ocean-linked seas (e.g., the Mediterranean Sea).[1] Many inhabitants of these countries live in urban areas near the ocean. Indeed, coastal urban areas are among some of the fastest growing population centers in the world. Developing countries with large urban populations (cities with 100,000 or more inhabitants) along

the coasts include, among others, Haiti, the Dominican Republic, Jamaica, Panama, Chile, Ecuador, Uruguay, Senegal, Cote d'Ivoire, Guinea, Ghana, Togo, Tunisia, Egypt, Bangladesh, Indonesia, Malaysia, Thailand, the Philippines and China.

III. Informal Land Development in Coastal Zones

Along the shores of many developing countries, rapid and uncontrolled urbanization is destroying coastal waters and habitats. The problem of unmanaged urban growth is often rooted in informal land development. During the 1970s and 1980s, inflationary pressures and an influx of expatriate and new middle class wealth drove land prices to unprecedented heights in many developing countries. As the price of land rose, costs surged for servicing properties built on such lands.[2] Informal land markets mushroomed as landowners bypassed formal regulations for land entitlement, transfer and development and as many low income families failed to gain access to land and shelter due to exorbitant prices for property. Haphazard and poorly planned land and housing development affects coastal areas in many regions of the world. It is particularly acute in the Caribbean where informal property development adversely impacts beaches, coral reefs, mangroves and swamps.[3]

* Erosion from Land Development. Excavation of shore areas for construction of housing units and other facilities accelerates erosion and destroys coastal habitats.

* Risks from Climatic Events. Squatter settlements within coastal zones are susceptible to damages from storms and natural tidal and shoreline changes.

* Lack of Water and Sanitation Services. Housing units on informal lands lack service link-ups including sewerage and site drainage.

Inadequate off-site services force residents to dispose of domestic wastes directly into bays, shores and nearshore areas.

* Disincentives to Servicing Informal Lands. Renters and squatters in informal settlements may have less incentive to care for such properties, as land tenure is uncertain. Likewise, the actual land owners fail to invest in water and sanitation facilities because the ultimate fate of the land (i.e., whether it will be resold, developed, rented) remains in question.

General Recommendations for Mitigating Adverse Impacts from Informal Land Development

1) In many countries, public lands in or near urban areas remain closed to development, forcing the poor to invade lands in marginal and environmentally sensitive areas. The opening of publicly owned but undeveloped land in urban or periurban areas will protect against invasion and unplanned development of more environmentally sensitive areas.

2) Many of the environmental problems related to informal land development in coastal areas stem from the cumbersome bureaucratic arrangements that regulate property registration, transfer and development. In those instances where simple dwellings are proposed, housing construction applications can be simplified. The process of application review can be streamlined by eliminating the overlapping functions of different review authorities. On-site environmental examinations can be incorporated into formal review procedures.

3) Public investments in water and sanitation services for existing homes are often more cost effective than investments for the construction of new homes. At least part of the revenues for investment in off-site services may be generated by more efficient and regularized tax programs.

4) Occupants of dwellings in informal lands can be encouraged to function as a community and to make legal demands for reform of land entitlement, servicing and environmental provisions. Community participation is cultivated by public awareness campaigns and environmental curricula in schools.

IV. Urban Impacts on Coastal Zones: Problem Identification and Recommendations for Mitigations

A) Coastal Erosion and other Disturbances from Urban Development. Disturbances in the normal interchange between land and sea, e.g., through poorly planned construction projects, can interrupt natural cycles of erosion, sediment transport and deposition. Wind and water move sediment along coasts and to and from shore areas; in any given coastal region, processes of erosion and deposition occur continuously and the intensity of changes in beach erosion and accretion vary with the seasons.

Poorly conceived though perhaps well-intentioned construction projects can destabilize shores and lead to the disruption of land/sea interactions.

Sand mining and upstream excavation and construction activities cause siltation in ocean-bound rivers and streams, reducing water quality in riverine and coastal zone habitats and adversely impacting biological populations.

* Dredging. Dredging projects that remove sand from shore areas interfere with the natural movement of sand, denying downstream coastal areas of beach sediment.[4] Dredging also changes water circulation and salinity and disturbs tidal and nearshore habitats.

* Breakwaters. Breakwaters are designed to absorb the energy of incoming waves before the waves reach shore. They may protect

beaches from wave erosion, but they also change the direction and intensity of longshore currents thereby altering depositional patterns in beach and nearshore areas. In some instances, these disruptions lead to undesired accumulations of sediments.

* Piers. Piers, while providing moorings for vessels, disrupt longshore sediment transport; pier construction may lead to sand deposits on one side of the pier and erosion on the other side.

* Ports and Harbors. Ports and harbors, if developed in areas where land/sea interactions are particularly sensitive, can lead to shoreline erosion and damage to the port or harbor itself. Inhabitants of coastal areas in Brunei, Benin and Togo have suffered the consequences of massive erosion and siltation due to poorly designed port construction.[5]

* Depletion of Aquifers. Excessive pumping of aquifers (for drinking water) near coastal zones may lead to land subsidence and contamination of the groundwater supply by saltwater intrusion.

General Recommendations to Avoid Erosion and other Disturbances in Coastal Zones.[6]

To avoid disruptions of the natural cycles of beach erosion and deposition:

1) Excavation and dredging of sand and other sediments in coastal zones should be avoided, and along land/water margins in particular.

2) In those instances where it is deemed necessary to build artificial structures such as breakwaters or seawalls, the structures must be designed so as to avoid disruption of natural erosional/depositional cycles.

3) In general, buildings and other facilities that do not require

a coastal location should be built inland. Setback lines should be established for all coastal developments. Set back lines must leave ample space between the shore and the facility; a thorough understanding of the natural evolution of the relevant coast (i.e., erosional/depositional trends) is necessary for the proper location of such lines.

4) Dunes are dynamic features of the shore; they move with wind currents and are affected by rain and other climatic phenomenon. Construction around sand dunes must be minimized, as the dunes represent natural transport mechanisms for sand as well as provide storm protection for coastal and nearshore areas.

5) Excessive devegetation should be avoided as plants prevent erosion.

6) Construction of large infrastructure projects such as roads must respect coastal topography: roads should be setback and built parallel to the contours of the land. Care must be exercised to channel run-off waters away from roads. Run-off waters with large mineral/contaminant loadings must be treated or directed to natural or man-made settling/oxidation lagoons before such waters are released into coastal waters. The use of natural lagoons and ponds to temporarily contain and purify run-off water discharges (and the mineral and contaminant loadings therein) entail an assessment of the water body's capacity to assimilate pollutant inputs.

7) Care must be exercised to avoid over-depletion of groundwater aquifers near coastal zones. Aquifers must be allowed to replenish naturally to avoid land subsidence and saltwater intrusion. In growing urban areas, water authorities may have to seek alternative drinking water sources or improve water treatment (and thereby increase useable quantities of existing water sources).

B) <u>Wastewater, Sewage and Solid Waste Disposal in Coastal Zones</u>.

For decades, coastal waters have been used as dumps for urban and industrial waste streams. Residential, commercial and industrial pollution loadings continue to increase along the coasts of urban centers around the world.

* Sewage. Municipalities have dumped raw sewage into the ocean under the assumption that pathogens and bacteria from human wastes quickly dissipate and die in salt water. Recent studies now suggest that pathogens in sewage can tolerate salt water conditions for months.[7]

The World Resources Institute claims that sewage is the greatest single pollutant in the coastal waters of the greater Caribbean.[8] Sewage discharges from municipalities and squatter settlements in Central and South America have led to intestinal infections and related health problems among coastal dwellers. Wastewater discharges have damaged shellfish nurseries and the health of consumers of seafood in Thailand and Malaysia.

* Eutrophication. Eutrophication or "algal bloom" occurs naturally in coastal waters, but is made more severe by human activities, including the dumping of sewage, fertilizer and livestock wastes. Eutrophication adversely affects water quality by reducing dissolved oxygen in water. Levels of dissolved oxygen often fall to the point where fish and other sea life can not survive. Severe eutrophication has taken place in parts of the Mediterranean Sea and Persian Gulf, and the coastal waters of Pakistan, India, Indonesia, Malaysia, Mexico, Argentina and Brazil.[9] The World Resources Institute states that incidences of eutrophication have become more frequent in the past decade and have occurred in more regions of the world.[10]

* Red Tides. Red tides contaminate and kill fish and shellfish and can be toxic to their human consumers. Red tides are composed of a plankton whose dominant species is toxic. These blooms occur

naturally but may be exacerbated by sewage and other organic waste inputs. Red tides tend to deplete the oxygen in marine water as red tide microorganisms die and decompose. Without an adequate supply of dissolved oxygen, marine plants and animals suffer.

* Solid Waste. Throughout the developing world, municipalities dispose of solid wastes along coastal or nearshore areas. Tides pull garbage into coastal water. Poorly designed or managed landfills leach contaminants into marine habitats.

* Industrial Waste. The effects of industrial wastes on the flora and fauna of coastal zones are less well understood. However, in the 1950s, the tragic methyl mercury poisoning experience in Minamata Bay, Japan signaled to the world that industries are capable of profoundly impacting human health and the environment.[11] High levels of heavy metals derived from pesticides and industrial effluents have been measured in the coastal waters of several developing countries, including the Gulf of Thailand and Manila Bay, and the coastal waters of Jamaica and other parts of the Caribbean.[12]

General Recommendations to Avoid Adverse Environmental Impacts from Wastewater, Sewage and Solid Waste in Coastal Zones.[13]

1) In those countries where municipal sewage and industrial waste treatment methods are too expensive, natural wastewater treatment systems and/or artificial oxidation lagoons for the temporary containment and purification of liquid wastes may suffice. Artificial lagoons operate most effectively when wastes contain no pathogens, heavy metals or toxic compounds. Waste sites should be located away from human settlements and groundwater sources. The use of natural lagoons or marshes for wastewater is only permissible for non-toxic, inorganic wastewaters that are devoid of bacterial or other pathogenic organisms. Waste settling/oxidation lagoons may be unrealistic for large municipal pollution loadings. Certain domestic, commercial and industrial waste loadings can be

reduced at their source or through more efficient processing.

With regard to sewage, a comprehensive sewage treatment plan is the best of all options for the environment, but is the most expensive. Filtering of suspended solids, (e.g. by screens), aeration, anaerobic digestion of sludges on sand beds and subsequent disposal of sludges in sanitary land fills represents a relatively less expensive method of sewage treatment. Even less expensive are those options that avoid piped sewage conveyance and multi-step treatment altogether. The World Bank describes relatively low cost systems of single homesite facilities, including pour-flush toilets, composting toilets, septic tanks, and sand and mound filtration systems.[14] Single units can be grouped together with other housing units to form cluster systems.

While septic tanks and single unit pit latrines are among some of the least expensive mechanisms to manage sewage, over the long term they may pose environmental health risks as well as cause damage to natural habitats and biological populations. For example, in many Caribbean islands, the proliferation of septic tanks and pit latrines is polluting precious groundwater supplies.[15]

In developing countries, large sanitation projects can be realized when implemented in increments; a sequential process of sewage conveyance/treatment may begin at the "low end," e.g. single or clustered latrines, to be replaced over time with higher volume capacity, more expensive and more environmentally sound options such as piped sewage leading to oxidation/settling lagoons or, in the best case, piped sewage leading to conventional treatment plants. The threshold for upgrading sanitation facilities should be determined by such issues as cost recovery, public awareness and will, identification of sources to make initial investments, and the condition of the natural environment.

2) Many coastal zones represent the meeting place of freshwater and

salt water sources. These areas are called estuaries and may extend many miles inland of shoreline and nearshore areas. Estuaries contain habitats for many species of aquatic plants, fish, amphibians, reptiles, waterfowl and various other flora and fauna that are adapted to this ecosystem. Because of their fragility, estuaries must be managed with special care. Alternative sites for the dumping of sewage and other liquid and solid wastes must be determined. The dumping of sewage and other liquid and solid wastes into estuaries is strongly dissuaded.

3) Industries that traditionally use coastal zones as dumping sites should practice pollution prevention/waste minimization techniques to reduce pollution loadings on the environment. In many cases, wash-water and other liquid waste streams can be recycled; certain byproducts of metal-working and metal-finishing industries can be reused or sold to other industries. Often, waste minimization techniques can be implemented by public and private companies and industries at considerable cost savings. Thus, there are economic incentives for compliance. Wastewaters and toxic wastes should be confined at their source and treated before being discharged.

4) In general, there must be an appreciation of the relationship between upstream activities and downstream impacts. A thorough valuation of coastal resources as well as a comprehensive environmental assessment are necessary when projects or activities are proposed that are likely to have adverse impacts on coastal zones. Diversion of sea-bound rivers and streams or the use of freshwater sources or wetlands for the dumping of untreated sewage and other wastes can have catastrophic effects on downstream coastal habitats. Whenever feasible, large infrastructure projects and new industries should be sited away from freshwater sea-bound tributaries. In those instances where it is considered critical to build structures near or on such rivers and streams, an environmental plan is required that will provide for proper management and disposal of the wastes produced by excavation and

construction activities. Also, once operational, the domestic, commercial or industrial facilities must attempt to minimize pollution at their source so as to reduce waste loadings on the environment.

5) Public lands within coastal zones must not become unregulated dumping sites for sewage and solid waste. Host country counterparts must reappraise and reformulate national and local policies regarding land tenure, housing finance and the provision of social services in many coastal zones, particularly in those areas where informal settlements and land uses remain unserviced and unregulated. In general, home owners with secure property rights tend to maintain these properties more actively, reducing adverse impacts on coastal resources.

C) Tourism Activities in Coastal Zones.

Tourism, while a critical foreign exchange earner in many developing countries, is also a perpetrator of environmental degradation in coastal zones. The spoiling of coastal regions by hastily constructed or poorly managed tourist facilities, destructive recreational activities and waste inputs threaten not only the ecology of coastal zones and the health of human inhabitants, but can lead to long term adverse economic impacts on the tourist industry itself.

* Coastal Pollution from Tourism. Montego Bay in Jamaica, beaches along Rio de Janeiro in Brazil and certain coastal areas in Africa and Southeast Asia are suffering from the impacts of tourist generated pollution, including the influx of large quantities of solid wastes, oil and fecal coliform bacteria in shore waters and natural habitats. Many cruise ships, large hotels, restaurants and small businesses dump raw sewage into coastal waters, destroying coral reefs and killing fish.

* Physical Destruction of Coastal Areas. Fragile marine and

estuarine ecosystems are imperiled by destructive tourist activities, e.g., suspended solids from tourist construction, swimmers and divers disturbing tidal pool habitats or extracting coral from reefs, boat anchoring on top of reefs, cruise ships releasing bilge waters into coastal habitats or motor boats contaminating waters with waste oil.

General Recommendations to Avoid the Negative Impacts of Tourism in Coastal Zones.[16]

1) Zoning should be implemented and enforced with attention paid to the size of tourist facilities, e.g. height, space and rooming capacity of hotels and condominiums. The human "carrying capacity" of coastal zones should be assessed to prevent the overcrowding and overexploitation of such areas. Surveys must determine municipal capacity to collect and dispose of tourist-generated solid waste. Hotels in high income generating coastal zones should pool resources for pollution control purposes, e.g., for shared sewage treatment facilities. Short and medium-term pollution abatement costs must be weighed against long-run ecological costs.

2) Nature tourism, e.g., guided nature tours and shore walks are encouraged over unsupervised or destructive recreational activities, such as motor-boating, particularly in unusually sensitive habitats or areas of great aesthetic value.

3) National and municipal regulatory authorities should strengthen the capacity of coast guard units to patrol coastal areas. Coast guards and maritime police must enforce laws to eliminate the dumping practices by boats and the physical destruction of coastal zone ecosystems by marine vessels. Host country counterparts may wish to consider user fees attached to licensing fees for boaters.

4) Unusually sensitive or unspoiled coastal areas should be identified and managed in a user-fee supported national park system and should remain off-limits to or cordoned off from

hotel/condominium construction.

5) Clearing of coastal zones for tourist facilities should be minimized. Tourist accommodations must be set back from the beach. (Snedaker et al. use examples of set back lines of 100 to 300 meters, but each potential site requires a separate assessment).[17]

6) Untreated liquid wastes generated by coastal tourist communities must not be dumped into coastal areas, e.g., along beaches and coral reefs. Disposal of solid wastes in sanitary landfills and non-hazardous liquid wastes in oxidation lagoons is recommended. Use of nearby municipal waste sites may be necessary.

V. General Institutional Management Issues

1) In many countries, coastal zones are transformed without proper consideration for the value of coastal resources. Properties are developed without formal land use planning exercises. National authorities and municipalities should make natural resource inventories within coastal public lands, and must become familiar with the fragile nature of these areas. Municipalities must develop an environmental capacity within their own ranks or through the establishment or transformation of scientific, research and/or engineering firms or other intermediate institutions whose environmental expertise can be tapped for advice and technical assistance related to coastal zone development and preservation.

2) The dissemination of basic information concerning urban impacts on coastal zones is critical to the ultimate "environmental fate" of development activities in such areas. Training can be provided by universities or preferably, by community-based organizations whose members have been trained by professionals. Community action to care for and oversee coastal zones is stimulated when individuals and families are well informed. Public awareness campaigns (e.g., through radio, postering, town meetings, etc.,)

and the introduction of formal environmental curricula in public schools can inspire greater public awareness of environmental problems and encourage public demands for investment in sanitation facilities and services.

3) In many LDC cities, municipal authorities are unable to provide all variety of social services on a regular basis. Studies indicate that privatization of certain municipal operations such as garbage collection can be more cost effective than public provision of the same services. A study of several cities found that public sector solid waste management operations were 50 percent more expensive than equivalent services provided by private companies. Also, private solid waste collectors were 95 percent more productive than their public counterparts.[18] Municipalities that are struggling with the burden of social service provision should enter into public-private ventures to more efficiently and effectively deliver such services.

4) Environmental problems related to urban development in coastal zones is exacerbated by bureaucratic inefficiencies that hamper the transfer and registration of properties and indirectly push poor families onto unsuitable or environmentally sensitive lands. Municipalities should extricate themselves from certain aspects of land management and development. In many instances, municipalities function better as brokers between land owners, developers and renters. Municipalities can exert control over these bodies by various fiscal measures including the provision of incentives for environmentally sound facility development, subsidies for sanitation and water extension projects and improved property tax assessment and collection.

VI. Concluding Remarks

Of course, any uniform check-list of potential environmental impacts is insufficient to the task of providing adequate

environmental protection for specific sites. The recommendations above represent only a sample of some of the more important problems that emerge when human activities take place in the vicinity of coastal zones. This check-list can not serve as a substitute for on-site investigation of coastal areas where urban-related projects are proposed. For all proposed projects that have potential impacts on coastal zones, consultation with environmentalists, engineers and relevant municipal officials is requisite.

The Coastal Resources Center at the University of Rhode Island has agreed to share an annotated bibliographical list of references of other coastal zone guidelines, case studies and sourcebooks with APRE/H and RHUDOs. The bibliography will be available in mid-January and copies will be distributed on request.

The Office of Housing and Urban Programs would like to acknowledge the assistance of Lynne Hale, Gordon Foer, Antoinette Sebastian, Nora Berwick, Blair Bower, and various RHUDO and Mission staff who provided comments and recommendations for these guidelines.

APPENDIX I: Development of Coastal Zones: Potential Environmental Impacts

DEVELOPMENT ACTIVITIES* / ENVIRONMENTAL IMPACTS	Erosion	Interference with Longshore Currents and Beach Building	Changes in Shoreline Features	Destruction of Dunes	Destruction of Beach Stabilizing Vegetation	Siltation	Salinization	Subsidence	Destruction of Wildlife Habitats	Algal Bloom	Adverse Impacts on Human Health
Informal Property Development	●	●	●	●	●	●			●	●	●
Construction of Roads	●			●	●	●			●		
Tourism Facilities, Activities	●	●	●	●	●	●			●	●	
Dredging, Excavation	●	●	●	●	●	●			●		
Breakwaters		●	●								
Piers, Groins, Seawalls	●	●	●	●	●	●			●		
Ports, Harbors	●	●	●	●	●	●			●		
Groundwater Pumping							●	●			
Dumping of Sewage						●			●	●	●
Dumping of Solid, Liquid & Hazardous Wastes						●			●	●	●

* The development activities cited above are not destructive in and of themselves; they generate negative environmental impacts when poorly designed, improperly constructed or mismanaged.

ENDNOTES

1. Sorensen, Jens C. McCreary, Scott J., and Marc J. Hershman, Institutional Arrangements for Management of Coastal Resources: Renewable Resources Information Series, Coastal Management Publication No. 1, Columbia, South Carolina: Research Planning Institute, Inc., 1984: 4.

2. Serageldin, Mona, "Regularizing the Informal Land Development Process," paper prepared for the Office of Housing and Urban Programs, USAID, Cambridge, MA: Unit for Housing and Urbanization, Harvard University Graduate School of Design, 1990: 2.

3. Kingsley, G. Thomas, Telgarsky, Jeffrey P., Jackson, Ivor, and Milagros Nanita-Kennet, Urbanization in the Caribbean: Prospects and Management Priorities, report prepared for the Regional Housing and Urban Development Office for the Caribbean, USAID, Washington, D.C.: the Urban Institute, 1990: viii.

4. Snedaker, Samuel C., and Charles D. Getter, Coastal Resources Management Guidelines: Renewable Resources Information Series Coastal Management Publication No. 2, Columbia, South Carolina: Research Planning Institute, Inc., 1985: 157-160.

5. Snedaker, et al., 160.

6. Sources for Erosion Guidelines: Snedaker et al., 163-165 and National Research Council, Coastal Resource Development and Management Needs of Developing Countries, Washington, D.C.: National Academy Press, 1982: 2.

7. World Resources Institute, World Resources: 1990-91, Washington, D.C.: The World Resources Institute, 1990: 183.

8. Ibid.

9. National Research Council, 17.

10. World Resources Institute, 182 and 197.

11. For a brief summary of the Minamata mercury poisoning incident, refer to Charles G. Gunnerson, ed., Wastewater Management for Coastal Cities: the Ocean Disposal Option, World Bank Technical Paper Number 77, Washington, D.C.: the World Bank, 1988: 318-323.

12. National Research Council, 59.

13. Recommendations for wastewater/sewage guidelines from National Research Council, 55-58; Snedaker, et al., 169-170.

14. Palange, Ralph C., and Alfonso Zavala, Water Pollution Control: Guidelines for Project Planning and Financing, World Bank Technical Paper Number 73, Washington, D.C.: the World Bank, 1987: 140-141.

15. Kingsley, et al: ix, xv-xvi.

16. Recommendations for tourism guidelines, in part, from Snedaker et al.

17. Snedaker et al. recommend a set back line of at least 100 to 300 meters (p. 175).

18. Reprinted in: Cobb, J. Michael, Oxman, Boris and Milagros Nanita-Kennett, "Urban Environmental Strategy: Preliminary Draft Report," prepared for the USAID Mission in Santo Domingo and the Regional Housing and Urban Development Office for the Caribbean in Jamaica, Washington, D.C.: The Urban Institute, 1990: II-21.