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Philippines ENVIRONMENT MONITOR 2003

water quality

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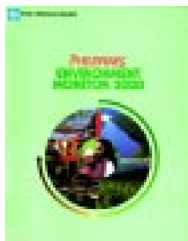
December 2003



The Philippines Environment Monitor 2000 presented snapshots of the general environmental trends in the country.

The Philippines Environment Monitor 2001 focused on solid waste management.

The Philippines Environment Monitor 2002 focused on air quality.

This document was prepared by a Team composed of Mdmes./Messrs., Christopher Ancheta, Masuomi Hiroyama, Patchamuthu Illangovan, Juergen Lorenz, Yolanda Mingoa, Arlene Porras, Jitendra Shah (Task Team Leader), Jema Sy, Luiz Claudio Tavares, Josefo Tuyor, Elizabeth Verzola, Divina Gracia Verzosa, and Maya G. Villaluz. The document was peer reviewed by Messrs. David A. Howarth, Keith Robert A. Oblitas, L. Panneer Selvam, and David R. Wheeler of The World Bank. Comments and information provided by the World Bank staff including Mdmes./Messrs., Bhuvan Bhatnagar, Chris Hoban, Magda Lovei, and Robert Vance Pulley along with inputs from Honorable Secretary Environment Elisea (Bebet) Gozun are gratefully acknowledged. Ms. Lourdes Anducta coordinated the cover design, layout, and production. Mr. Jeffrey Lecksell prepared the map. Photographs, including the cover page, were obtained from LLDA, USAID, and Christopher Ancheta are acknowledged. The document was printed at CGKformaprint, Inc., Metro Manila, Philippines. Mdmes./Messrs. Jose Eric Maglanque, Leonora Gonzales, Anissa Tria, and Charito Cabalang are responsible for dissemination.

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PREFACE

The Philippines Environment Monitor series has been providing a snapshot of key environmental trends and indicators in the country for the past four years. Its aim is to inform stakeholders of key environmental changes and challenges in a simple and easy-to-understand format. The 2000 Monitor was the first attempt at benchmarking general environmental indicators and subsequent Environment Monitors addressed solid waste management (2001) and air quality (2002). The 2003 Monitor focuses on water quality.

The Philippines Environment Monitor 2003 is the result of a joint exercise involving national agencies, academia, civil society, and researchers. The concept of the 2003 Monitor was discussed at a consultation workshop on November 21, 2002, and a draft was discussed at various forums between June and August 2003. Information contained in this Monitor has been obtained from published and unpublished data, reports of government agencies, universities, non-governmental organizations, individuals, and the World Bank and its international partners.

Population growth, urbanization, and industrialization reduce the quality of Philippine waters, especially in densely populated areas and regions of industrial and agricultural activities. The discharge of domestic and industrial wastewater and agricultural runoff has caused extensive pollution of the receiving water-bodies. This effluent is in the form of raw sewage, detergents, fertilizer, heavy metals, chemical products, oils, and even solid waste. Each of these pollutants has a different noxious effect that influences human livelihood and translates into economic costs. The adverse impact of water pollution costs the economy an estimated PhP 67 billion annually (more than US $ 1.3 billion). The Government continues its fight against worsening water pollution by espousing and including among its priorities, environment policies, legislation, and decrees that address the growing need to control water pollution. In the last few years, the Government has also employed economic instruments such as pollution fines and environmental taxes.

The pending Clean Water Act proposes an integrated, holistic, decentralized and participatory approach to abating, preventing and controlling water pollution in the country. This monumental step, taken collectively by various stakeholders, is the first attempt to consolidate different fragmented laws and provide a unified direction and focus to fighting water pollution.

The Philippines Environment Monitor 2003 comprises eight sections: (i) an overview of the country's water quality and availability status, and water pollution conditions of surface, ground and coastal waters by region; (ii) the sources of water pollution, including various types of effluents, their generation, and the effects of wastewater discharges to human health and the environment; (iii) the four critical regions that were found to have unsatisfactory rating for water quality and quantity; (iv) the effects and economic losses due to polluted waters, health cost, and costs to fishery and tourism sectors; (v) a description of the water policies, institutional arrangements in water resources management, and enforcement of standards and economic instruments; (vi) urban sanitation and sewerage program and performance; (vii) investment requirements in water pollution control; and (viii) the challenges in implementing an integrated water resources management program.

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ABBREVIATIONS AND ACRONYMS

ADB Asian Development Bank
BFAR Bureau of Fisheries and Aquatic Resources
BOD Biochemical Oxygen Demand
BRL Bureau of Research and Laboratories
BRS Bureau of Research and Standards
BSWM Bureau of Soils and Water Management
BWSA Barangay Waterworks and Sanitation Association
CAR Cordillera Autonomous Region
CHED Commission on Higher Education
CRMP Coastal Resource Management Project
DA Department of Agriculture
DAO Department Administrative Order
DENR Department of Environment and Natural Resources
DILG Department of Interior and Local Government
DO Dissolved Oxygen
DOH Department of Health
DOST Department of Science and Technology
DOT Department of Tourism
DWF Dry-Weather Flow
DPWH Department of Public Works and Highways
EGF Environmental Guarantee Fund
EHS Environmental Health Services
EMB Environmental Management Bureau
EO Executive Order
EUFS Environmental User Fee System
GDP Gross Domestic Product
GRDP Gross Regional Domestic Product
GVA Gross Value Added
HABs Harmful Algal Blooms
HBP Haul Back Plan
IEC Information, Education and Communication
JBIC Japan Bank for International Cooperation
JICA Japan International Cooperation Agency
Km^2 Square kilometers
LGU Local Government Unit
LLDA Laguna Lake Development Authority
Lpcd Liters per capita per day
LWUA Local Water Utilities Administration
m^3 Cubic meter
MBI Market Based Instrument
MCM Million Cubic Meters
MDG Millennium Development Goals
Mfg Manufacturing
MGB Mines and Geosciences Bureau
mg/l Milligrams per liter
MMC Metro Manila Commission
MPN Most Probable Number
MSSP Manila Second Sewerage Project
MTDP Medium Term Philippine Development Plan
MTPIP Medium Term Philippine Investment Plan
MWCI Manila Water Company, Inc.
MWSI Maynilad Water Services, Inc.
MWSS Metropolitan Waterworks and Sewerage System
NCR National Capital Region
NDHS National Domestic and Housing Survey
NEDA National Economic and Development Authority
NEUF National Environmental User Fee
NIA National Irrigation Administration
NMTT Navotas-Malabon-Tenejeros-Tullahan
NPC National Power Corporation
NRW Non-revenue waters
NSCB National Statistical Coordination Board
NTU Nephelometric Turbidity Unit
NWRB National Water Resources Board
PAB Pollution Adjudication Board
PAGASA Philippine Atmospheric, Geophysical and Astronomical Services Administration
PD Presidential Decree
PDTS Placer Dome Technical Services
PhP Philippines Peso
PIA Philippine Information Agency
PNSDW Philippine National Standards for Drinking Water
PPP Polluters Pay Principle
PRRC Pasig River Rehabilitation Commission
PSP Private Sector Participation
PTA Philippine Tourism Authority
Phil USS-NASAP Philippines Urban Sewerage and Sanitation - National Strategy and Action Plan
RWSA Rural Waterworks and Sanitation Association
SMICZMP Southern Mindanao Integrated Coastal Zone Management Project
SS Suspended Solid
STD Submarine Tailings Disposal
STP Sewage Treatment Plant
TDS Total Dissolved Solids
USAID United States Agency for International Development
USGS U.S. Geological Survey
WD Water District
WHO World Health Organization
WPCF Water Pollution Control Federation
WQAP Water Quality Association of the Philippines
WRR Water Resources Region
WTP Willingness to Pay

Exchange Rate 1 USD = 55.75 Philippine Peso, January 7, 2004

EXECUTIVE SUMMARY

Access to clean and adequate water remains an acute seasonal problem in urban and coastal areas in the Philippines. The National Capital Region (Metro Manila), Central Luzon, Southern Tagalog, and Central Visayas are the four urban critical regions in terms of water quality and quantity. The Government's monitoring data indicates:

* Just over a third or 36 percent of the country's river systems are classified as sources of public water supply;
* Up to 58 percent of groundwater sampled is contaminated with coliform and needs treatment;
* Approximately 31 percent of illnesses monitored for a five-year period were caused by water-borne sources; and
* Many areas are experiencing a shortage of water supply during the dry season.

Nearly 2.2 million metric tons of organic pollution are produced annually by domestic (48 percent), agricultural (37 percent), and industrial (15 percent) sectors. In the four water-critical regions, water pollution is dominated by domestic and industrial sources. Untreated wastewater affects health by spreading disease-causing bacteria and viruses, makes water unfit for drinking and recreational use, threatens biodiversity, and deteriorates overall quality of life. Known diseases caused by poor water include gastro-enteritis, diarrhea, typhoid, cholera, dysentery, hepatitis, and more recently, severe acute respiratory syndrome (SARS). The number of water-related health outbreaks including deaths reported in newspapers is going up. However, awareness regarding the need for improved sanitation and water pollution control, reflected by the willingness-to-pay and connection to a sewerage system where they are easily available, is very low.

The annual economic losses caused by water pollution are estimated at PhP 67 billion (US$ 1.3 billion). These include PhP 3 billion for health, PhP 17 billion for fisheries production, and PhP 47 for tourism. Losses due to environmental damage in terms of compensation and claims are on the rise in the Philippines. To guard against environmental impacts of water pollution, the Philippines has many water-related laws, but their enforcement is weak and beset with problems that include: inadequate resources, poor database, and weak cooperation among different agencies and Local Government Units (LGUs). A Clean Water Act is now being deliberated in the Congress.

There is considerable under-investment by the Government in sanitation and sewerage, indicating a low spending priority, though ranked as a high priority in the Philippines Agenda 21 of 1996. Only seven percent of the country's total population is connected to sewer systems and only a few households have acceptable effluent from on-site sanitation facilities. Estimates show that over a 10-year period, the country will need to invest PhP 250 billion (nearly US$ 5 billion) in physical infrastructure. While LGUs recognize emerging water quality problems, they are constrained by high investment and operating costs, limited willingness-to-pay, and restricted space available in the low-income urban areas where sewage is disposed of indiscriminately. Some of the Government budget, which is directed mostly towards water supply (97 percent of the total), needs to be diverted to sewerage and sanitation. Individuals are not yet aware and willing to pay for these services and Government incentives are justified in the short-term for the larger community-wide benefits.

The four main challenges faced by the Philippines to improve the quality of its surface, ground, and coastal waters and provide healthy living conditions for all Filipinos include:

- Public disclosure, raising awareness about health impacts of poor water quality, and beach eco-watch program to increase stakeholder participation;
- Investing significantly in wastewater management in urbanized and tourist centers, which is more cost effective, by expanding user base, promoting intermediate solutions and using smaller and decentralized collection and treatment systems when appropriate;
- Stimulating revenues and incentives to attract private sector participation in financing wastewater infrastructure by increasing wastewater fees, industrial pollution charges, and providing access to credit; and
- Providing effective regulations and incentives through the enactment of the Clean Water Act with clear implementing rules and regulations.

WATER QUALITY HOT SPOTS

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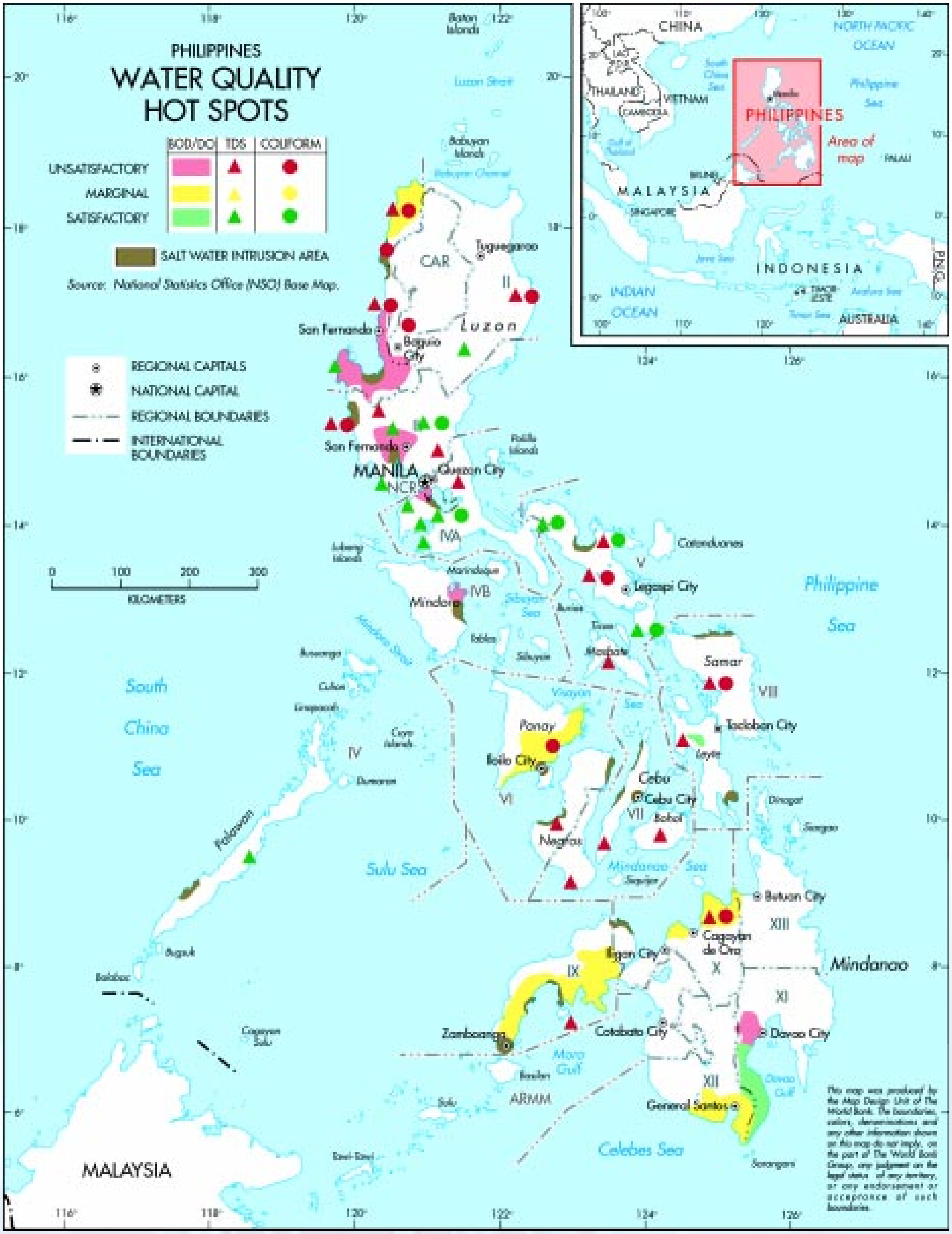

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PHILIPPINES WATER QUALITY AT A GLANCE

Issues/Topics	Status/Contribution/ Critical Areas	Priority
Pollutants / Parameters		
Biochemical Oxygen Demand (BOD)	• 64% of the river Biochemical Oxygen Demand (BOD) exceeded public water supply criterion. • Critical areas are Metro Manila, Southern Tagalog, and Central Luzon. • BOD levels of Pasig River from 1998 to 2001 show improvement. • Laguna Lake meets BOD for fishery, but half of the rivers that feed the lake have high BOD values.	High
Coliform, Heavy Metal, Pesticides, Toxics, and Others	• Development of database for most parameters needed. • Preliminary groundwater data indicate coliform contamination requiring treatment. • Heavy metals and toxic pollutants from industrial sources contribute to pollution in Metro Manila, Central Luzon, Southern Tagalog, Cebu and mining sources in Cordillera Autonomous Region and CARAGA. • Pesticide pollution in rural areas is from agricultural runoff.	Medium
Salt-Water Intrusion	• 60% of the groundwater extraction without permit resulting in indiscriminate withdrawal and salt-water intrusion in coastal areas. • Localized impacts around the coastal areas need countermeasures to limit further intrusion. • Critical areas are Cebu, Iloilo, Dagupan, Cavite, Zamboanga and coastal Metro Manila, and Luzon.	Medium
Water Quantity / Availability	• Ground and surface water resource potential is large and generally sufficient (84,734 MCM). • Basins of Agusan and Mindanao have the highest amount of water while Cebu Island has the lowest. • Water deficit would be experienced by year 2025 by some of the areas. • Critical areas are Pasig-Laguna, Pampanga and Agno, Bicol, Cagayan, Luzón, Jalaur, Ilog-Hilabangan, and island of Cebu.	Low
Sources of BOD Loading and other Pollutants		
Domestic	• Metro Manila: 58 percent; Central Luzon and Southern Tagalog: 51 percent of the total BOD for the region (330,000 metric tons). • Metro Manila, Southern Tagalog, and Central Luzon are critical areas.	High
Industrial	• Metro Manila 42 percent of the total BOD for the region. • Mining areas of CAR and CARAGA contribute pollution to the receiving bodies of water. • Toxic pollution and contributions are not monitored routinely.	High
Agricultural	• Southern Tagalog: 35 percent; Ilocos Region: 58 percent; and Central Visayas: 46 percent of the total for the region. • Contributions of pesticides and fertilizer residues need to be better quantified and controlled.	Medium
Solid Waste / Garbage	• Contribution to BOD and other pollutants not quantified or well regulated. • Open dumpsites are still operated in Metro Manila and all over the Philippines in spite of the laws. • Metro Manila: BOD contribution is over 150,000 Metric tons per year.	High
Responses		
Monitoring and Analysis	• Strategic and focused monitoring for critical areas is needed. • Monitoring and analysis of data from agencies need improvement. • Public access to information is limited and participation is generally during crisis situations only.	High
Enforcement	• Inadequate allocation of Government resources. • Weak enforcement of water-related legislation and regulations. • Constraints in capacity.	High
Policies and Interagency Coordination	• Delineation / clarification of function for many agencies. • Operation of effective regulatory framework for urban sanitation. • Clean Water Act is proposed but not passed.	Medium

High **Medium** **Low**

WATER RESOURCES, QUALITY, AND AVAILABILITY

The Philippines, an archipelago of 7,107 islands, is comprised of three major island groups: Luzon, Visayas, and Mindanao. Luzon occupies nearly 50 percent of the land area of the country, with close to 80 percent of the country's manufacturing establishments and nearly 60 percent of all its households. Luzon has the most number of regions, with seven of the 16 regions, as compared to the Visayas, which has only three regions, and Mindanao, which has six regions. Table 1 shows the region's comparative distribution of land area, households, gross regional domestic product (GRDP), manufacturing establishments, and gross value added (GVA) for manufacturing and agriculture.

WATER RESOURCES

The country is endowed with rich natural resources, including water, which are essential for the country's economic development and in meeting its Millennium Development Goals (MDGs). Water resources of the Philippines include inland freshwater (rivers, lakes, and groundwater), and marine (bay, coastal, and oceanic waters). Overall, there is sufficient water but not enough in highly populated areas, especially during dry season.

Rivers and Lakes occupy 1,830 square kilometers (0.61 percent of total area). The Philippines has 421 principal river basins in 119 proclaimed watersheds. Of these, 19 are considered major river basins and were included in the Water Quantity Scorecard (see Annex 1). The longest river is the Cagayan in Region II. Other important rivers in Luzon include the Agno and Pampanga, crossing the plains of

Table 1 Regional Demography and Economic Activities, 1999

Region	Land Area (in km^2)	No. of Households	GRDP	No. of Mfg. Establishments	GVA Mfg	Agriculture Land Area (in km^2)	GVA Agriculture
NCR-Metro Manila	636	2,132,989	279,045	7,774	87,487	-	-
CAR-Cordillera Autonomous Region	13,714	263,816	22,301	88	7,410	190,235	3,348
I - Ilocos	12,840	831,549	28,639	344	1,598	415,434	11,996
II - Cagayan Valley	26,838	554,004	21,337	146	718	709,964	11,474
III - Central Luzon	18,067	1,632,047	83,940	1,840	26,652	653,607	19,174
IV - Southern Tagalog	46,844	2,410,972	142,075	3,806	44,726	1,410,315	33,696
V - Bicol	17,633	891,541	25,811	234	381	1,004,425	8,541
VI - Western Visayas	20,011	1,211,647	65,439	580	10,223	889,549	19,661
VII - Central Visayas	14,952	1,129,317	62,952	1,432	12,863	665,446	8,183
VIII -Eastern Visayas	21,432	715,025	22,171	169	4,653	957,329	6,764
IX - Western Mindanao	15,586	595,728	25,641	238	2,239	763,796	12,862
X - Northern Mindanao	14,033	542,075	39,592	311	9,205	828,515	12,632
XI - Southern Mindanao	27,141	1,066,199	51,061	727	7,561	1,103,297	16,171
XII - Central Mindanao	14,571	501,915	24,983	186	7,118	706,472	8,762
ARMM - Autonomous Region in Muslim Mindanao	18,847	393,269	9,080	13	365	-	5,203
CARAGA	11,410	393,362	13,314	144	1,468	-	4,940

Source: Philippines Statistical Yearbook, 2000.

Central Luzon; the Pasig, a commercially important artery flowing through the center of Metro Manila, providing the main drainage outlet for most of the waterways; and the Bicol, the primary river of Region V. The principal river of Mindanao is the Rio Grande de Mindanao, which receives the waters of the Pulangi and the Agusan.

There is no updated inventory of lakes at present, but a recent study has placed the number of lakes at 72.[1] The largest lake is the Laguna de Bay, which encompasses two regions: Metro Manila and Region IV with an area of 922 km^2 (Box 1).

Lake Taal, 56 km south of Manila, occupies a huge volcanic crater and contains an island that is itself a volcano, with its own crater lake. The largest lake in Mindanao is Lake Lanao, which is a major source of hydropower.

Bays and Coastal Waters cover an area of 266,000 km^2, while oceanic waters cover 1,934,000 km^2. The total length of the coastline is 36,289 km. The Philippine coastline is irregular, with numerous bays, gulfs, and islets. Manila Bay, a sheltered harbor, is the country's busiest commercial hub. About 60 percent of Philippine municipalities and cities are coastal, with 10 of the largest cities located along the coast. These coastal cities and municipalities are inhabited by about 60 percent of the total population[2].

Box 1 - Laguna Lake, Pasig River and Manila Bay

Laguna de Bay or Laguna Lake receives water from 21 river systems that flow through five provinces (including Manila), 10 cities, and 51 municipalities. The watershed covers about 292,200 hectares and is home to a high concentration of industries (1600 estimated by Laguna Lake Development Authority - LLDA). As a result of land-use changes (deforestation, quarry activities, urban expansion), about 4 million tons of suspended solids enter the lake annually, leading to an average net accretion of 0.5 cm / yr. The present average depth of the lake is 2.5 m. The lake's only outlet is to the Pasig River.

The Pasig River which passes through the center of Metro Manila and serves as its major waterway, has become seriously polluted over time. The Pasig river discharges into the Manila Bay. Manila Bay is an important economic resource with competing uses. The surrounding catchment area covers about 17,000 km^2 and is home to an estimated 16 million people. The largest harbor in the country is located in Manila Bay with primary port services catering to both national and international maritime traffic. Increasing urbanization has damaged the coastal habitats and estuaries, which serve as spawning grounds of many economically important fishes.

Sources: DENR-EMB and LLDA, 2002.

Groundwater is replenished or recharged by rain and seepage from rivers. As noted in Table 2, the recharge or extraction potential is estimated at 20,200 MCM per year. Groundwater contributes 14 percent of the total water resource potential of the Philippines. Region X has the lowest potential source of groundwater compared to its surface water potential, while Regions I and VII have the highest potential.

Groundwater is used for drinking by about 50 percent of the people in the country. Based on the water rights granted by the National Water Resources Board (NWRB) since 2002, 49 percent of groundwater is consumed by the domestic sector, and the remaining shared by agriculture (32 percent), industry (15 percent), and other sectors (4 percent). About 60 percent of the groundwater extraction is without water- right permits, resulting in indiscriminate withdrawal[3]. A high percentage (86 percent) of piped-water supply systems uses groundwater as a source.

In terms of sectoral demand, agriculture has a high demand of 85 percent, while industry and domestic have a combined demand of only 15 percent (see Table 3).

Table 2 Groundwater Availability (in MCM)

Water Resources Region	Groundwater Potential	Surface Water Potential	Total Water Resources Potential	Percent Ground Water to Total Potential
X Northern Mindanao	2,116	29,000	31,116	6.8
VI Western Visayas	1,144	14,200	15,344	7.45
IX Western Mindanao	1,082	12,100	13,182	8.21
XII Southern Mindanao	1,758	18,700	20,458	8.59
XI Southeastern Mindanao	2,375	11,300	13,675	17.37
III Central Luzón	1,721	7,890	9,611	17.91
IV Southern Tagalog	1,410	6,370	7,780	18.12
VIII Eastern Visayas	2,557	9,350	11,907	21.47
II Cagayan Valley	2,825	8,510	11,335	24.92
V Bicol	1,085	3,060	4,145	26.18
I Ilocos	1,248	3,250	4,498	27.75
VII Central Visayas	879	2,060	2,939	29.91
Total	**20,200**	**125,790**	**145,990**	**13.84**

Source: NWRB, 2003.

Table 3 Water Demand in the Philippines (in MCM/year)

Water Demand	1996	2025		% of Total
		Low	High	(1996)
Municipalities	2,178	7,430	8,573	7.27
Industrial	2,233	3,310	4,997	7.46
Agriculture	25,533	51,920	72,973	85.27
Irrigation	18,527	38,769	53,546	61.87
Livestock	107	224	309	0.36
Fishery	6,899	14,437	19,939	23.04
Total Demand	**29,944**	**62,660**	**86,543**	**100.00**
Groundwater (GW) Recharge	20,200	20,200	20,200	
% GW Potential / Total Demand	67.46	32.24	32.24	

Sources: NWRB, 2003 and JICA, Master Plan Study on Water Resources Management in the Republic of the Philippines, 1998.

[1] SEAFDEC-PCAMRD-DA / BFAR Conversation and Ecological management of Philippine Lakes in relation to Fisheries and Aquaculture, 2001.

[2] Local Government Development Foundation (LOGODEP) and Konrad Adenaur Siftung (KAS). Instructive Guide in the Replication of the Tubigon-LOGODEP-KAS Mariculture Project (Manila, September 2001).

[3] Presentation by Engr. Jorge Estioko, Chief, Monitoring and Enforcement Division, National Water Resources Board during an NGO Consultative Workshop in 2003 at Miriam College, Philippines.

WATER QUALITY

Water pollution affects fresh, marine, and groundwater resources of the country. Details on water quality for surface water (rivers, lakes, bays) and groundwater are found in Annex 1. Surface water quality can be assessed by using Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) as parameters[4]. The environmental and public health dimensions of the water quality situation are as follows:

- 36 percent of the river sampling points have been classified as public water supply sources (Table 4 and Figure 1);
- about 60 percent of the country's population live along coastal areas and contribute to discharge of untreated domestic and industrial wastewater from inland[5];
- preliminary data indicate that up to 58 percent of groundwater intended for drinking water supplies are contaminated with total Coliform and would need treatment[6]; and
- 31 percent of illnesses for a five-year period was from water-related diseases (Figure 2) [7].

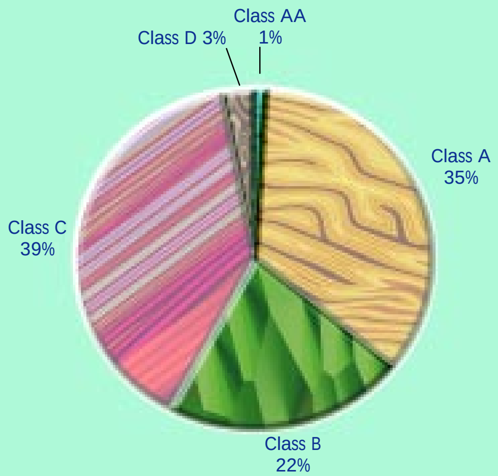
Water classification, based on "beneficial use," is outlined in Table 4. Water classifications are arranged in the order of the degree of protection required, with Classes AA and SA having generally the most stringent requirements, while Class D and SD have the least stringent water quality.

Table 4 Water Classification by Beneficial Use

Classification	Beneficial Use
For Fresh Surface Waters (rivers, lakes, reservoirs, etc.)	
Class AA: Public Water Supply	Waters that require disinfections to meet the National Standards for Drinking Water (NSDW)
Class A: Public Water Supply	Waters that require complete treatment to meet the NSDW
Class B: Recreational Water	Waters for primary contact recreation (e.g. bathing, swimming, skin diving, etc.)
Class C:	• Water for the fishery production • Recreational Water Class II (boating, etc.) • Industrial Water Supply Class I
Class D:	• For agriculture, irrigation, livestock watering • Industrial Water Supply Class II • Other inland waters
For Coastal and Marine Waters (as amended by DAO 97-23)	
Class SA	• Waters suitable for the fishery production • National marine parks and marine reserves • Coral reefs parks and reserves
Class SB	• Tourist zones and marine reserves • Recreational Water Class 1 • Fishery Water Class 1 for milk fish
Class SC	• Recreational Water Class II (e.g. boating) • Fishery Water Class II (commercial) • Marshy and/or mangrove areas declared as fish and wildlife sanctuaries
Class SD	• Industrial Water Supply Class II • Other coastal and marine waters

Sources: DENR Administrative Order No. 34 and No. 97-23.

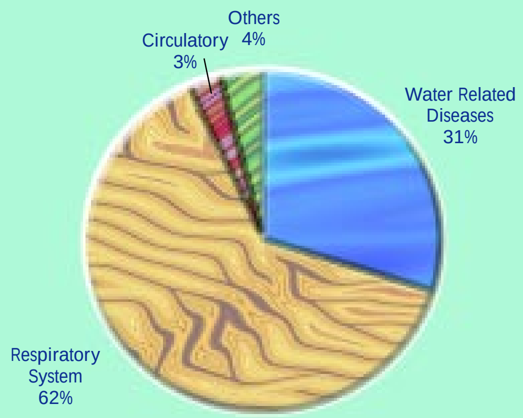
Figure 1 River Water Classification as of 2001



Total Sampling Points in Year 2001 = 445

Source: DENR-EMB, 2003.

Figure 2 Sources of Illnesses for 1996-2000



Total Number of Illnesess = 16,703,148

Source: National Epidemiology Center data, Department of Health.

[4] National standards for DO vary from 2 to 5 mg/l and for BOD from 1 to 15 mg/l based on beneficial water usage and classification.
[5] Local Government Development Foundation (LOGODEF) and Konrad Adenauer Stiftung (KAS). Instructive Guide in the Replication of the Tubigon-LOGODEF-KAS Mariculture Project. (Manila, September 2001).
[6] Compiled data from various Feasibility Studies of LWUA, 1990-1997.
[7] National Epidemiology Center data, Department of Health.

Rivers and Lakes. Between 1996-2001, the Environmental Management Bureau (EMB) monitored 141 rivers. About 41 rivers (or 29 percent) had minimum DO values of less than 5 mg/l, which affects fish; 92 rivers (or 64 percent) had maximum values of BOD that exceeded the criterion for Class A waters. These high percentages indicate organic pollution. Figure 1 illustrates the percentages for river water classification levels for 2001. Further, between 1996-2001, DO and BOD levels for Laguna de Bay, Taal Lake, and Lake Danao in Leyte meet the Class A criteria. Naujan Lake in Oriental Mindoro has DO and BOD levels that do not meet its Class B criteria.

Bays and Coastal Waters. EMB monitored a total of 39 bays and coasts in the Philippines for a long time and regularly since 1996. Manila Bay has its own monitoring program. Except for Puerto Galera Bay, which is a protected seascape, the data indicated that 64 percent had DO levels below 5 mg/l, the minimum criterion set for waters suitable as a tourist zone, fishery spawning area, and contact recreation or swimming area. In the coasts of Mandaue to Minglanilla in Cebu (Central Visayas), DO levels varied from 0 to 14 mg/l, which indicate that the ecosystem is already undergoing "stress" during certain periods.

Except in Cawacawa (Zamboanga City), the maximum values of BOD were all within the criterion set for Class SB waters of 5 mg/l. Manila Bay has BOD levels that are generally within fishery water quality criterion (Figure 3). However, seasonal high organic loadings from rivers draining into the bays and in particular, Manila Bay, also result in harmful algal blooms (HABs) that pose a continuing threat to marine resources and public health (see Box 2).

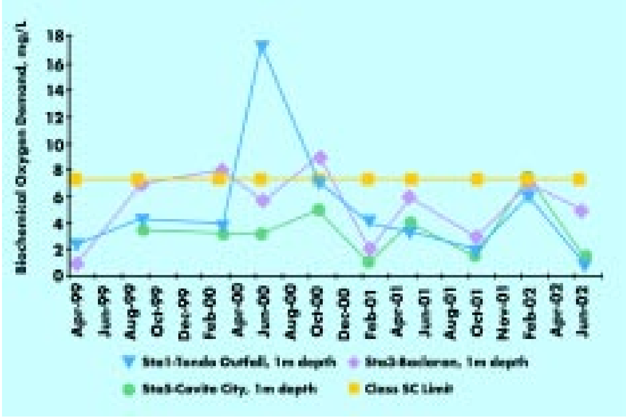
Groundwater. Pollution of groundwater may come from domestic wastewater, agricultural runoffs, and industrial effluents. This occurs when contaminants reach the aquifer or water table in the form of leachate.

Domestic wastewater is the main contributor of bacterial contamination to the groundwater supplies. The presence of coliform bacteria in drinking water supplies can cause water-borne diseases such as diarrhea, cholera, dysentery, hepatitis A, and others. Limited data on the bacteriological content of groundwater from 129 wells indicated a high level of positive coliform bacteria in 75 wells (58 percent)[8].

Another problem is saline water intrusion, which is caused by over-exploitation or excessive withdrawal of groundwater. This reduces water availability for domestic usage, including drinking and agricultural usage (See Water Quality Scorecard for groundwater).

[8] Compiled data from various Feasibility Studies of Water Districts, LWUA, 1990-1997 and NWRB-NWIN Project. Positive means the presence of total coliform bacteria in the water sample. Negative means total coliform must not be detectable in any 100 ml sample. Because of the small number of samples, the statistical reliability of this data needs to be improved.

Figure 3 Biochemical Oxygen Demand Observations for Manila Bay Area, April 1999 - June 2002



Source: DENR-EMB.

Box 2 Persistent Red Tide: A Threat to Marine Resources and Public Health

The extent of water pollution in Philippine bays can be gleaned from the frequent occurrence of red tide since it first came to the attention in 1983. Red tide usually occurs when high organic loading from rivers drain into bays resulting in harmful algal blooms (HABs).

From 1983 to 2001, a total of 42 toxic outbreaks have resulted in a total of 2,107 paralytic shellfish poisoning cases with 117 deaths. Earlier, only a few coastal areas of the country were affected in scattered locations, but today, this has grown to a total of 20 coastal areas.

For Manila Bay, during the 1992 *Pyrodinium* red tide outbreak, around 38,500 fisherfolks were displaced from their livelihood due to the red tide scare. Estimated economic losses for displaced fisherfolks was PhP 3.4 billion (in 2002 prices).

The Government has created the National Red Tide Task Force. A major activity of the Task Force is the regular issuance of Red Tide Updates.

Sources: BFAR-JICA, Guide on Paralytic Shellfish Poisoning Monitoring in the Philippines, 2002 and F.A.Bajarias, Red Tide Monitoring Program in the Philippines.

At present, the large cities and coastal areas that have serious problems of saltwater intrusion are: Metro Manila (from Malabon, Navotas, Manila, Paranaque), Cavite (from Noveleta, Rosario, Tanza, Naic), along Laguna de Bay (from Muntinlupa to Binangonan), and Cebu, Iloilo, Zamboanga, Laoag, and Dagupan[9]. One solution to arrest saltwater intrusion is groundwater recharge (see Box 3).

WATER AVAILABILITY

The amount of water availability and demand by river basin is presented in Figure 4. Water is distributed unevenly among the regions, with some areas containing more while others have limited supplies. For the low economic growth scenario[10], it is projected that by the year 2025, water availability deficit would take place in Pasig-Laguna (WRR IV), Pampanga and Agno (WRR III), Bicol (WRR V), Cagayan (WRR II), all regions in Luzon and Jalaur and Ilog-Hilabangan (WRR VI), and the island of Cebu (WRR VII) in Visayas. Cebu Island was included in the analysis due to its significant economic role, which is second to Metro Manila.

All major cities, except Angeles and Iloilo, show a water supply deficit until 2025 (Table 5). This tabulation also shows the limitations of groundwater potential and extraction in highly urbanized areas, which has to be balanced with surface water. Metro Manila is currently experiencing water deficits. Although for some cities like Baguio, which have no shortfall considering current demand, it is known that major water shortages do occur during the summer. In general, water deficits are time and site specific. Meanwhile, the basins of Agusan and Cagayan de Oro (WRR X) in Mindanao enjoy the highest surplus.

Further details on water quantity issues for major basins are found in the Water Quantity Scorecard in Annex 1.

Box 3 Groundwater Recharge … A Possible Solution to a Dwindling Resource?

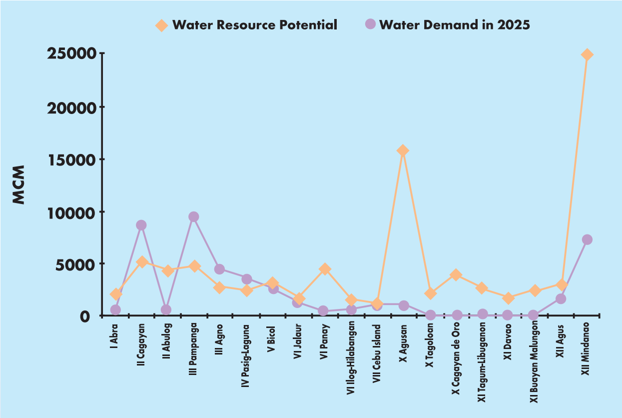
Many major coastal cities in the Philippines, like Cebu, Iloilo, Dagupan, and coastal areas of Metro Manila and Cavite, are encountering saltwater intrusion problems in their groundwater resources due to over extraction of fresh water. This phenomenon is a consequence of:

- Over utilization of groundwater by water service providers e.g., LGU, WD, Private-run, RWSA / BWSA, among others;
- Exploitation of groundwater in inland municipalities resulting in conflicts on water rights and allocation of water usage, and lack of an inter-municipal integrated water supply concept in coastal cities.

Countermeasures

Groundwater recharge in inland areas and usage of surface water are the most reliable countermeasures to limit the saltwater intrusion. Surface water requires water treatment facilities and assurance of steady water intake throughout the year. In addition, available surface water near coastal cities is usually limited. Groundwater recharge, on the other hand, helps ensure a constant supply of fresh water to coastal cities. This low-cost option needs exploration for the Philippines.

Figure 4 Water Potential and Demand by River Basin



Source: JICA Master Plan Study on Water Resources Management in the Philippines (1998). Low economic growth scenario, 80 percent surface water availability.

[9] JICA-NWRB Master Plan Study on Water Resources Management in the Republic of the Philippines, 1998.
[10] Low growth scenario 1998 JICA-NWRB Master Plan Study.

Table 5 Water Demand of Major Cities in the Philippines in MCM/year

	YEAR	TOTAL	Metro Manila	Metro Cebu	Davao	Baguio	Angeles	Bacolod	Iloilo	Cagayan de Oro	Zamboanga
Demand	1995	1,303	1,068	59	50	12	11	37	9	29	28
Demand	2025	3,955	2,883	342	153	87	31	111	47	98	203
Groundwater Availability Average		759	191	60	84	15	137	103	80	34	54
Surplus/Deficit	1995		-877	1	34	3	126	66	71	5	26
Surplus/Deficit	2025		2,692	-282	-69	-73	106	-8	33	-64	-149
Surplus/Deficit	1995		-82%	2%	69%	21%	1148%	179%	788%	18%	92%
Surplus/Deficit	2025		-93%	-82%	-45%	-83%	343%	-7%	70%	-65%	-73%

Source: JICA Master Plan on Water Resources Management in the Philippines, 1998.

Water Availability Per Capita

Among Southeast Asian countries, the Philippines ranks second from the lowest in terms of per capita water availability per year with only 1,907 cubic meters as reflected in Table 6. This is much lower than Asian and world averages[11].

Areas where the per capita water supply drops below 1,700 m^3/year experience water stress while areas with per capita water supply below 1,000 m^3/year are already experiencing water scarcity[12]. There are four river basins that belong to the latter category: Pampanga, Agno, Pasig-Laguna, and the island of Cebu (Table 7).

WATERSHED MANAGEMENT

Watersheds supply water according to the requirements of various domestic and industrial water and irrigation systems, as well as hydroelectric dams. One of the most formidable environmental challenges the Philippines faces today is its diminishing forest cover. Of the country's total forestland area of 15.88 M hectares, only 5.4 M ha are covered with forests and fewer than a million hectares of these are left with old growth forests. Over-exploitation of the forest resources and inappropriate land use practices have disrupted the hydrological condition of watersheds, resulting in accelerated soil erosion, siltation of rivers and valuable reservoirs, increased incidence and severity of flooding, and decreasing supply of potable water.

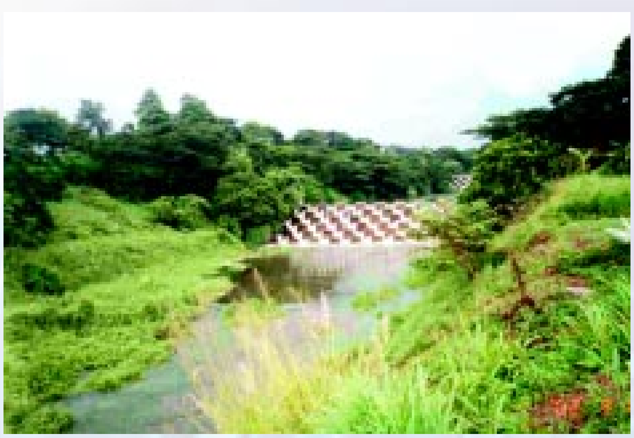


Table 6 Annual Renewable Water Resources

Country	Total Resources (km^3)	2000 (m^3/person)
World	42,655.0	7,045
Asia	13,508.0	3,668
United States of America	2,460.0	8,838
Japan	460.0	3,393
Lao People's Dem Rep	190.4	35,049
Malaysia	580.0	26,074
Myanmar	880.6	19,306
Indonesia	2,838.0	13,380
Cambodia	120.6	10,795
Vietnam	366.5	4,591
Philippines	146.0[1/]	1,907[1/]
Thailand	110.0[2/]	1,854[2/]

Source: World Resources Institute 2000-2001.
1/ JICA Master Plan on Water Resources Management in the Philippines, 1998.
2/ World Bank Thailand Environment Monitor, 2001.

Table 7 Water Availability for All Uses Per Capita by Water Resource Region

Major River Basin WRR	Total Water Resources Potential [1/] (in MCM)	Water Availability per Capita (m^3/person)
IV Pasig-Laguna	1,816	124
VII Cebu Island	708	218
III Pampanga	4,688	888
III Agno	2,275	972
V Bicol	2,138	1,533
VI Jalaur	1,150	1,657
VI Ilog-Hilabangan	1,351	1,843
II Cagayan	5,496	2,143
XI Davao	1,449	2,368
XI Tagum-Libuganon	2,504	3,449
X Tagoloan	1,476	3,646
I Abra	2,200	4,954
XII Agus	2,479	5,070
XI Buayan Malungon	1,827	5,656
VI Panay	4,340	6,782
XII Mindanao	24,854	7,027
X Cagayan de Oro	3,672	9,321
X Agusan	15,984	13,732
II Abulog	4,326	19,228
TOTAL	**84,734**	

1/ Includes groundwater and surface water at 80 percent dependability.

[11] World Resources Institute 2000-2001.
[12] Ibid

SOURCES OF WATER POLLUTION

SOURCES OF WATER POLLUTION

There are three main sources of water pollution - domestic (municipal), industrial, and agricultural. They can be classified further as either point sources, which emit harmful substances directly into a body of water, or non-point sources, which are scattered and deliver pollutants indirectly. The technology to monitor and control point sources is well developed, while non-point sources are difficult to monitor and control.

Solid waste is a major non-point source of water pollution that needs to be better controlled. Solid waste, disposed either at a dumpsite or directly into water-bodies, generates high loads of organic and inorganic pollution through biological disintegration. Leachate seeps through the ground and its aquifer and contaminates groundwater or seeps into rivers, lakes, and coastal waters directly. Despite the passage of the Ecological Solid Waste Management Act (RA 9003) into law in January 2001, open dumpsites are still operated around Metro Manila and all over the Philippines.

The major pollutants monitored for water pollution are: Biochemical Oxygen Demand (BOD) and Dissolved Oxygen (DO); Suspended Solids (SS); Total Dissolved Solids (TDS); Coliforms; Nitrates; Phosphates; heavy metals like Mercury and Chromium; toxic organics like pesticides and others. Of these pollutants, extensive data has been compiled for BOD and DO between 1995 and 2001, while data for the other highly toxic pollutants are still incomplete.

Domestic Wastewater

Domestic effluents are generated by activities such as bathing, cleaning, sanitation, laundry, cooking, washing, and other kitchen activities. Domestic wastewater contains a large amount of organic waste with suspended solids and coliforms.

Half the organic waste is from domestic sector based on the calculations as outlined in Box 4. As shown in Table 8 and Figure 5, domestic wastewater is the main contributor to BOD pollution with 1,090,000 metric tons (48 percent of the total load), followed by agricultural with 822,000 metric tons (37 percent), and industrial with 325,000 metric tons (15 percent). On a regional basis, Metro Manila has the highest total share of BOD loading (15 percent), followed by Region IV (14 percent). Meanwhile, CAR has the lowest share (1.8 percent) as shown in Table 8 and Figure 6. These estimates do not include pollution from solid waste discharge and leachate, as well as other informal non-point sources.

One-third of domestic BOD generation comes from Metro Manila and Region IV. Table 8 shows that Metro Manila and Region IV account for the highest amount of domestic BOD wastes at 18 and 15 percent, respectively, or one-third of the country's generation. This is further elaborated in the Urban Sanitation and Sewerage section.

Industrial Wastewater

The volume and characteristics of industrial effluents differ by industry and depend on the production processes and

Box 4 Computing Wastewater Generation in Table 8

Domestic Wastewater Generation. The average water consumption is 120 liters per capita per day (lpcd) in urban settings, where the water supply is piped individually into each household. Of this, 80 percent would be wastewater. In rural settings, where the water supply is rarely connected to households individually, water consumption would be, on the average, 60 lpcd, of which 80 percent would be wastewater.

Domestic BOD Generation. Calculated by multiplying the regional population of year 2000 with a BOD factor of 37grams per person per day (unit pollution load). The BOD factor is taken as the national average and was applied to all regions except Metro Manila. Depending on the income class of households, unit pollution load ranges from 26 to 53 grams per person per day for low- and high-income groups, with the latter applied to the Metro Manila area (Table 8).

Industrial Wastewater Generation. Estimated by industry type using the WHO Rapid Assessment of Sources of Air, Water, and Land Pollution. The annual amount of BOD generation was calculated by multiplying the annual volume of production output by the appropriate effluent factor.

Agricultural Wastewater Generation. The volume of wastewater generation and BOD were estimated by using animal type and the WHO Rapid Assessment Method. The method uses the annual number of heads of livestock and poultry multiplied by the appropriate effluent factor. Adjustments were made on those farm animals (e.g., chickens) with a short production cycle.

scale of production used. Industrial wastewater may be organic and / or inorganic. There are industries that are water-intensive and correspondingly discharge large amounts of wastewater such as food and dairy manufacturing; pulp, paper and paperboard products; and textile products, and others.

Other types of waste include thermal waste, created by cooling processes used by industry and thermal power stations. The increase in temperature can change the ecology of water-bodies. Additionally, hospital wastes are usually infectious and have to be controlled at the source. Thermal, health care (hospital or medical), and toxic and hazardous wastes are created by industrial sources and can pose long-term risk.

Once again, Metro Manila and Region IV account for the highest amount of industrial BOD at 43 and 14 percent, respectively, or 57 percent of the country's total (see Table 8).

Agricultural Wastewater

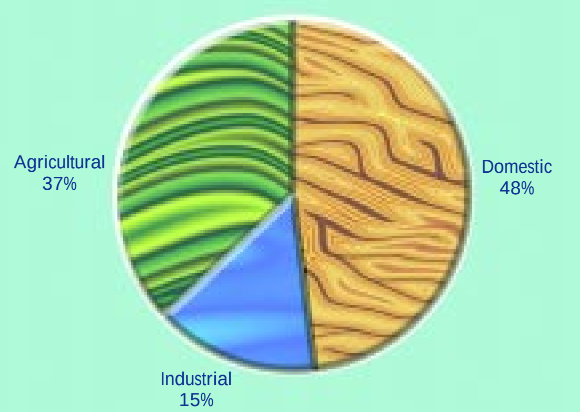
The major source of water pollution in rural areas is agricultural farms. The absence of facilities to intercept surface runoffs from agricultural farms degrades the water quality of surface and groundwater, especially in the downstream urban areas. Major sources of agricultural effluents considered in the estimates of agricultural BOD generation include livestock and poultry. Major sources of agricultural runoffs include: organic wastes such as decayed plants, livestock manure, and dead animals; soil loss in the form of suspended solids; and pesticides and fertilizer residues.

Regions IV and I generate the highest load of agricultural BOD, accounting for 13 and 12 percent of the total generation, respectively (Table 8).

Non-point Sources

Monitoring of non-point sources, including solid waste contribution, is scarce, and no attempt has been made thus far to create an inventory. The common non-point sources are urban runoff and agricultural runoff. For example, the BOD pollution reaching water-bodies, derived from solid waste of the Metro Manila area and surrounding provinces, is estimated at an additional 150,000 metric tons per year. If solid waste is not collected, treated and disposed properly, the organic and toxic components of household, industrial and hospital waste are mixed with rain and groundwater. This creates an organic and inorganic cocktail, composed of heavy metals and poly-organic and biological pathogenic toxins, which causes illness and even deaths. (See Philippines Environment Monitor 2001 for further details on solid waste issues).

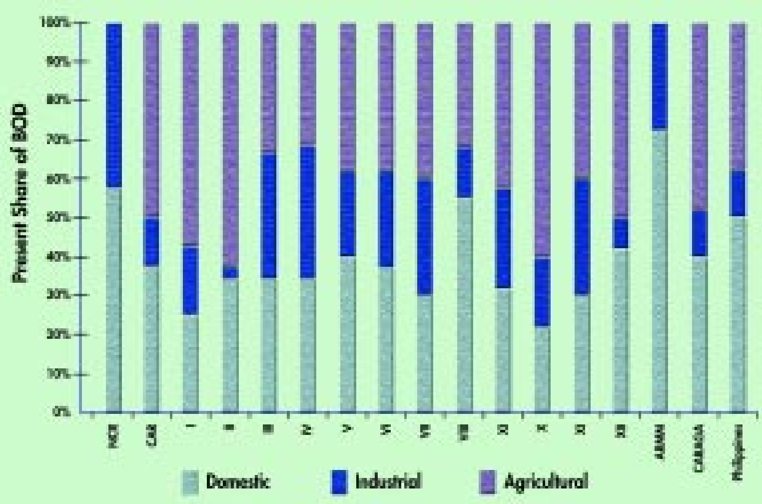
Figure 5 Share of Domestic, Industrial, and Agricultural BOD at the National Level



Total BOD Generation = 2,236,750 mt/year

Refer to Table 8 for estimated total BOD generated by source.

Figure 6 Regional Contribution of Domestic, Industrial, and Agricultural BOD



Refer to Table 8 for estimated total BOD generated by source.

Table 8 Estimated Water Effluent by Source

Region	Volume of Wastewater in Region			% Share of BOD Generation in Sector			BOD Generation in Sector			Total BOD Generation	% Share of Total BOD Generation in Sector
	Domestic 2000 (1)	Industrial 1998 (3)	Agricultural 1999 (5)	Domestic 2000	Industrial 1998	Agricultural 1999	Domestic 2000 (2)	Industrial 1998 (4)	Agricultural 1999 (6)		
	In '000 m^3 per Year			%	%	%	In '000 metric tons per Year				
NCR Metro Manila	430,046	272	-	17.6%	42.5%	0.0%	192	138	-	330	14.8%
IV Southern Tagalog	406,696	80	7,499	14.6%	14.1%	13.3%	159	46	109	314	14.0%
III Central Luzon	272,471	49	4,646	9.9%	9.0%	9.1%	108	29	75	213	9.5%
VI Western Visayas	188,042	55	4,574	7.7%	5.1%	8.1%	84	17	67	167	7.5%
VII Central Visayas	180,065	57	6,394	7.1%	7.4%	10.6%	77	24	87	189	8.4%
XI Southern Mindanao	160,025	47	4,888	6.4%	6.6%	8.6%	70	22	70	162	7.2%
V Bicol	128,849	22	3,036	5.8%	3.1%	5.4%	63	10	44	117	5.2%
I Ilocos	121,268	24	7,260	5.2%	3.3%	11.5%	57	11	95	162	7.3%
X Northern Mindanao	87,085	15	5,568	3.4%	2.2%	9.1%	37	7	75	119	5.3%
IX Western Mindanao	88,734	24	3,058	3.8%	3.3%	5.2%	42	11	43	95	4.3%
II Cagayan Valley	74,556	1	3,541	3.5%	0.2%	6.1%	38	1	50	89	4.0%
VIII Eastern Visayas	101,307	8	1,236	4.5%	1.1%	2.6%	49	4	21	73	3.3%
XII Central Mindanao	74,964	4	2,346	3.2%	0.5%	3.9%	35	2	32	69	3.1%
ARMM	64,402	0.07	1,905	3.0%	0.0%	3.0%	33	0.05	25	57	2.6%
CARAGA	62,311	6	539	2.6%	0.9%	1.2%	28	3	9	41	1.8%
CAR	40,614	4	1,379	1.7%	0.6%	2.3%	18	2	19	39	1.8%
TOTAL	**2,481,435**	**668**	**57,869**	**100%**	**100%**	**100%**	**1,091**	**325**	**821**	**2,237**	**100%**

Notes:
1/ Thousand cu.m. per year using unit volume factor of 120 lpcd for urban population and 60 lpcd for rural population.
2/ Thousand metric tons per year using BOD effluent factor of 37 grams/person/day and applied to all regions except Metro Manila where 53 grams/person/day was applied.
3/ Thousand cu.m. per year using WHO unit waste volume by type of industry taken from Rapid Assessment of Sources of Air, Water, and Land Pollution.
4/ Thousand metric tons per year using WHO effluent factor for BOD by type of industry taken from Rapid Assessment of Sources of Air, Water, and Land Pollution.
5/ Thousand cu.m. per year using WHO unit waste volume by animal type taken from Rapid Assessment of Sources of Air, Water, and Land Pollution.
6/ Thousand metric tons per year using WHO effluent factor for BOD by animal type taken from Rapid Assessment of Sources of Air, Water, and Land Pollution.

CRITICAL REGIONS

In the hot spots map, four regions were found to have an unsatisfactory (U) rating for the water quality and quantity criteria (see Annex 1 for details). These are National Capital Region (NCR) or Metro Manila, Southern Tagalog (Region IV), Central Luzon (Region III), and Central Visayas (Region VII). Other regions that are not rated as critical will not be discussed.

NATIONAL CAPITAL REGION

NCR, or Metro Manila, is the national capital and main hub of all socioeconomic, industrial, cultural, and political activities. Metro Manila is bounded on the north by the Central Luzon region, on the southeast by the Southern Tagalog region, and on the west by Manila Bay. While NCR is the smallest in terms of land area, it has the highest number of households (28 percent of the total) and manufacturing activity (Table 1). With the highest population density of 16,497 persons/km^2, it has no area for agriculture, and a limited land area for development expansions, except coastal reclamation. Metro Manila's industries, population, and development are spilling to Central Luzon and Southern Tagalog.

There is insufficient good quality water available in the region. The largest source - Laguna de Bay - is under threat with rivers discharging large amounts of pollutants. Coliform testing of deep wells shows contamination and the need for treatment facilities.

Water Resource

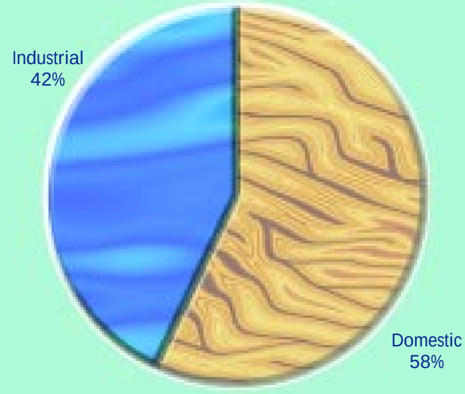
The Pasig-Laguna River Basin is the major river basin of the region. It has a drainage area of 4,678 km^2 with an annual runoff of 7,485 MCM. The Pasig River is the principal river system (see Boxes 1 and 5). Flood plains of the basin occupy 23 percent of the total area.

Since a river basin is the basis for regional water resource planning, Metro Manila is considered part of Water Resource Region IV (WRR IV). For the Pasig-Laguna Basin, the water resource potential is taken at 1,816 MCM. The projected water demand is taken at 2,977 MCM for the year 2025. The ratio between water potential and projected demand is very low at 0.61 (see Water Quantity Scorecard in Annex 1).

Water Quality

In Metro Manila, 58 percent of its BOD loading (192,000 metric tons) was generated by domestic waste, and the remaining 42 percent (138,000 metric tons) was from industries (see Figure 7 and Table 8).

Figure 7 Sector BOD Loading Metro Manila



Total BOD Generated = 330,000 mt/year

For assumption refer to Table 8.

Box 5 Improving Laguna de Bay through LISCOP

The Laguna de Bay watershed includes some of the fast growing urban and industrial centers of Luzon and doubles both as resource provider and a waste sink. The unchecked pollution continues to degrade the environmental resources of the lake and its watershed. This is caused by excessive discharge of pollutants, expanding development activities, and inefficient institutional arrangements and capacity constraints. A strategic change in the management of the lake and its watershed is needed.

The Laguna de Bay Institutional Strengthening and Community Participation Project (LISCOP) is a five-year project of the Government. Laguna Lake Development Authority (LLDA) will begin implementation in 2004. The envisioned change in the management of the Laguna de Bay Region is two-fold: (1) co-managed micro-watershed environmental interventions, which will support demand-driven LGU investments focusing on four sector issues (waste management and sanitation, natural resources management, soil erosion and localized flood prevention, and eco-tourism); and (2) strengthening institutions and instruments, which will strengthen LLDA, LGUs, RCs and communities and develop/expand regulatory and market-based instruments. The implementation of these components is expected to reduce pollution loading of the lake and erosion of the watershed; mainstream watershed concerns in LGU planning and investments; increase the involvement of communities in watershed management; and develop mechanisms for planning, development and financing of environmental investments. The goal of the project is to reduce organic pollution loading of regulated parameters from sources by 10 percent in five years.

Sources: LISCOP and World Bank Reports.

Rivers and Lakes

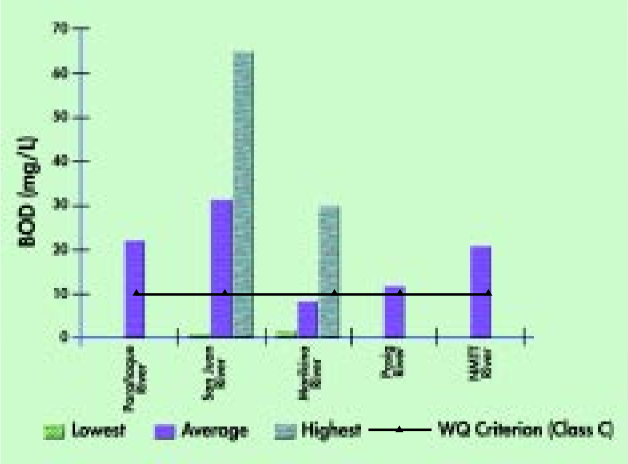
The EMB sampled five rivers for the period 1996 to 2001: Parañaque, San Juan, Marikina, Pasig, and Navotas-Malabon-Tenejeros-Tullahan (NMTT). The San Juan River exhibited the highest average of BOD (32.5 mg/l) and the lowest average DO content (less than 2 mg/l), which did not meet criterion for Class C waters. Marikina River had the lowest BOD average of 8.1 mg/l, which met the quality criterion set for its beneficial use (Figures 8 and 9).

All these rivers, at one point during the sampling period, exhibited a zero reading for DO, indicating that these rivers were "biologically dead" during certain periods. Through the rehabilitation effort of the Government, the water quality of the Pasig River showed improvement over the last five years (see Box 6).

Laguna de Bay is estimated to receive approximately 74,300 tons per year of BOD pollution. Domestic sources contribute 69 percent while the remaining 31 percent is from industrial and agricultural sources. Additionally, with the sedimentation rate of 0.5 centimeters per year, an estimated 66 percent of the land area in the watershed is vulnerable to erosion.

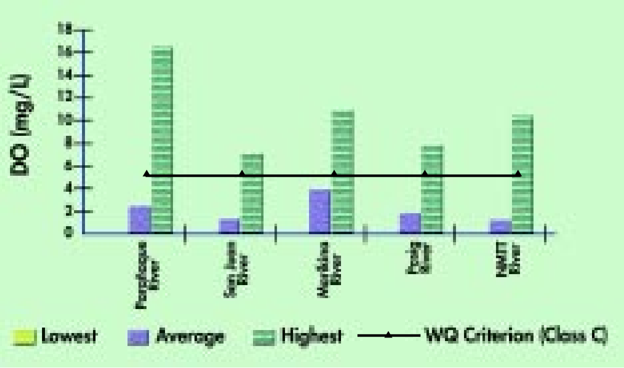
Routine monitoring of BOD in Laguna Lake shows that it meets the Class C water quality criterion (Figure 10). This indicates that BOD is not an issue, but siltation may be the main problem. While the lake water exhibited a good quality, half of the rivers (four) that fed the lake had high BOD values (Figure 11). To improve the management of the lake and its watershed, the government is implementing the Laguna de Bay Institutional Strengthening and Community Participation Project (LISCOP Box 5).

Figure 8 BOD Level in NCR, 1996 - 2001



Source: DENR-EMB, 2003.

Figure 9 DO Level in NCR, 1996 - 2001



Source: DENR-EMB, 2003.

Box 6 Cleaning up the Pasig River

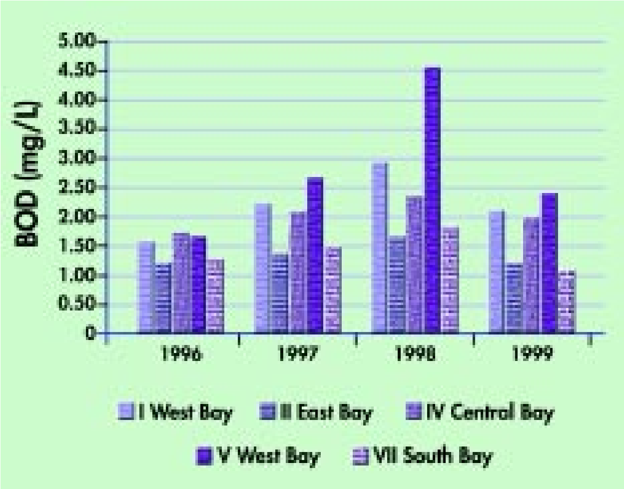
The Pasig River Rehabilitation Program aims to attain minimum Class C conditions by 2014. Infrastructure and municipal services in urban renewal areas adjacent to the riverbank are to be upgraded, septic tank maintenance service and a septage treatment facility provided, and illegal dumping of municipal solid waste into the river system eliminated.

Water quality changes for the past four years include:

- Improvement of the DO levels from 1998 to 2001 in nearly all stations;
- Increasing number of stations is passing ambient WQ criteria;
- Improvement of the BOD levels from 1998 to 2001 in nearly all stations;
- Odor of the river is reduced; and
- BOD load (from domestic sewage, solid waste, and commercial and industrial liquid wastes) and floating solid wastes have been reduced which shows the importance of solid waste as a source.

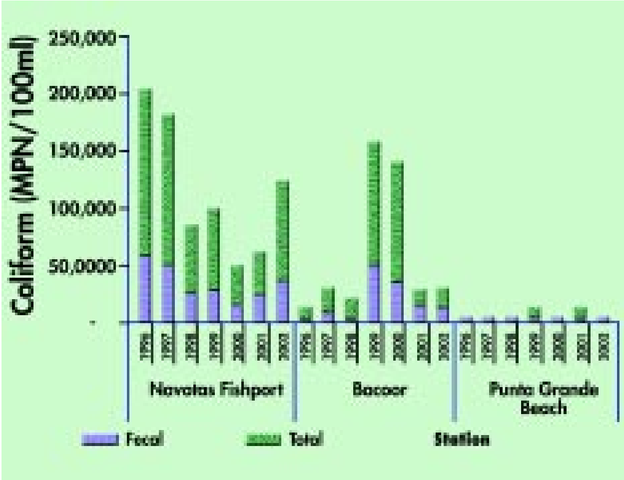
Sources: DENR-EMB, 2003 and ADB, 2003.

Figure 10 Annual Average BOD, Laguna de Bay, Monitoring Period, 1996 - 1999



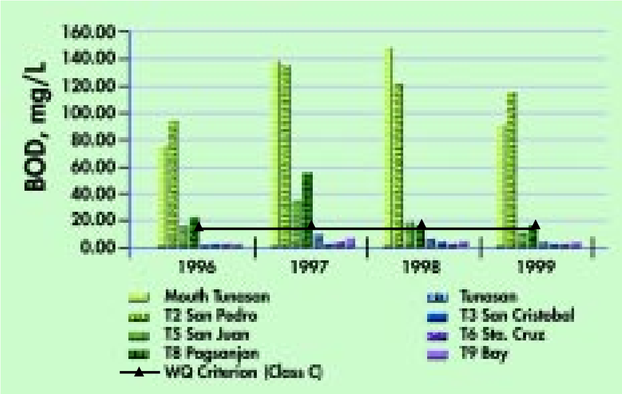
Source: LLDA, 2003.

Figure 12 Total and Fecal Coliform for Selected Coastal Areas and Beaches in Manila Bay, 1996 - 2002



Source: DENR-EMB, 2003.

Figure 11 Annual Average BOD, Tributary Rivers in Laguna Province, 1996 - 1999



Source: LLDA, 2003.

Bays and Coastal Waters

The annual geometric mean for fecal coliform in the Eastern Manila coastal area was 15,545 MPN / 100 ml in 1999, higher than the 11,103 MPN / 100 ml in 1996 (Figure 12). This alarming bacterial load was attributed mainly to the voluminous untreated sewage and waste from households and commercial establishments. Except for some values in 2002, all the values exceeded the criterion for Class SB waters for contact recreation, e.g., swimming (see Box 7 for the program being undertaken to clean up Manila Bay). A major contributor to bay and coastal water pollution is solid waste. For example, dumpsites such as Navotas, Pier 18 in Manila, and Cavite City discharge untreated leachate directly into Manila Bay.

Box 7 Manila Bay – A Challenge

Domestic wastewater discharge is the highest contributor to Manila Bay's organic pollution. Only 18 percent of the wastewater generated in Metro Manila households was collected by localized separate sewerage systems. Nearly all of this was discharged through an outfall into Manila Bay. Most residential wastewater (82 percent, or around 7.5 million people) was discharged into the public drainage system either directly or through one million septic tanks. These septic tanks were not desludged and the effluent poured into the water-bodies was essentially untreated, causing heavy pollution everywhere in Metro Manila, and particularly in high density areas.

Industrial waste water also contributes to the pollution of the Manila Bay as indicated in the analysis of the sediments containing high levels of Metal pollutants.

Through its Manila Second Sewerage Project (MSSP), Metropolitan Waterworks and Sewerage System (MWSS) aims to expand its septage management program to provide low-cost improvement of sewerage services. Further, it will reduce pollution in waterways and in Manila Bay, thus reducing the health hazards. The project includes construction of a pilot septage treatment plant; rehabilitation of the Central and the Ayala Sewerage Systems, the Ayala and the Dagat-Dagatan sewage treatment plants, and individual sewer connections; and provision of on-site treatment community sanitation.

Sources: http://www.worldbank.org.ph *and MWSS, 2003.*

Groundwater

The average turbidity level of groundwater in Metro Manila is above the drinking water standard (Nephelometric Turbidity Unit - NTU 5). Some of the wells tested exhibited values higher than the standards for conductivity, hardness, manganese, iron, and sodium.

REGION IV - SOUTHERN TAGALOG

Bounded on the northwest by Metro Manila, Regions II and III, and on the southeast by Region V and Visayas, Region IV is comprised of 11 provinces, six of which are on mainland Luzon and five are island provinces. It has the largest land area for a region. Three of its provinces are located on mainland Luzon and have special economic and industrial zones. The island provinces of Region IV are coastal tourist destinations.

Water Resource

Three of the six largest lakes of the country are located in the region: Laguna de Bay, Lake Taal in Batangas (with an area of 266.77 km^2), and Lake Naujan in Oriental Mindoro (69.93 km^2).

The total water resources potential in the region is estimated as 7,780 MCM at 80% dependability. The annual amount of water use is 3,636 MCM with agriculture the largest consumer, followed by industrial uses and domestic demand.

Sharing the same water resources with Metro Manila, it is projected that by 2025, there will be a shortfall of water supply if no water management program is in place. The basin occupies the major part of Metro Manila and of Rizal, Laguna, and Cavite provinces, which are the most populated areas in the Philippines.

Water Quality

The estimated contribution of domestic, agricultural, and industrial sources to BOD loading are 51 percent (159,000 metric tons), 35 percent (109,000 metric tons), and 14 percent (46,000 metric tons), respectively (see Table 8 and Figure 13).

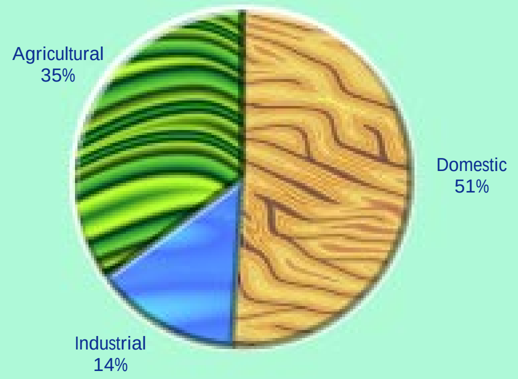
Rivers and Lakes

Rivers were not monitored for BOD and DO from 1996 to 2001. However, Taal Lake and Naujan Lake were sampled. Taal Lake met the Class C criterion for BOD, while Naujan Lake exhibited higher average value than the Class C criterion (see Figure 14).

Bays and Coastal Waters

Four bays were monitored from 1996 to 2001: Cajimos Bay in Romblon, Calancan Bay in Marinduque, Puerto Galera Bay in Oriental Mindoro, and Pagbilao Bay in Quezon. The minimum values of DO in the bays did not pass the Class SC criterion (see Figure 15).

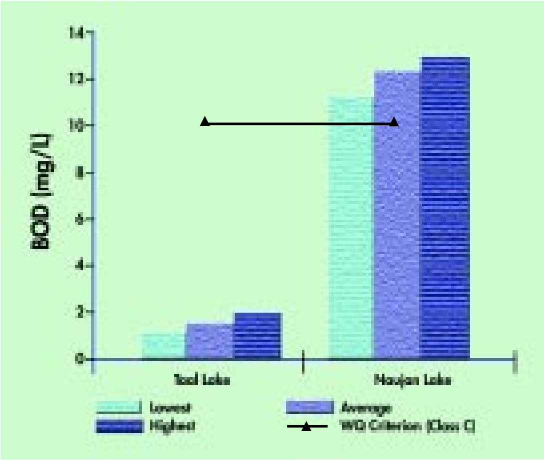
Figure 13 Sector BOD Loading Southern Tagalog



Total BOD Generation = 314,100 mt/year

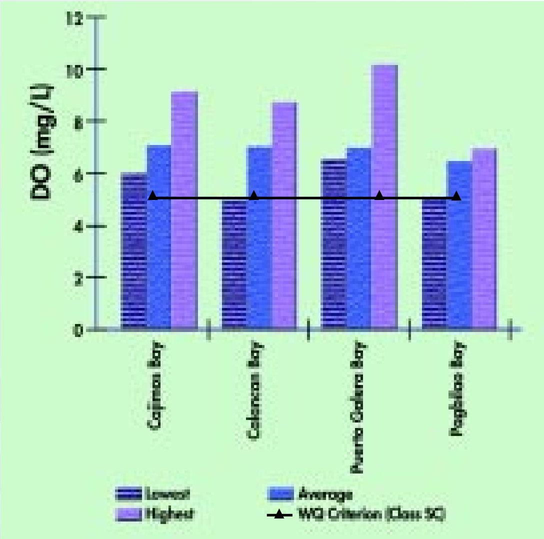
For assumptions refer to Table 8.

Figure 14 BOD Level, Southern Tagalog, 1996-2001



Source: DENR-EMB, 2003.

Figure 15 DO Level , Southern Tagalog Monitoring Period, 1996-2001



Source: DENR-EMB, 2003.

Groundwater

Only a small number of the wells in the Laguna province tested passed the drinking water criterion for total dissolved solids and coliform content (see Water Quality Scorecard).

REGION III - CENTRAL LUZON

Region III, bounded by Metro Manila on the south, is the gateway to northern Luzon. Although one of the regions with small land area, it has the third highest numbers for manufacturing establishments and households and is the third highest contributor to the country's income from manufacturing and agriculture sectors and other economic activities (see Table 1).

Water Resource

Region III principally consists of the Agno and Pampanga River Basins and covers an aggregate area of 23,600 km^2. The combined drainage area of the two rivers is 15,704 km^2 with annual runoffs of a total of 17,584 MCM. Floodplains area is 8,543 km^2.

The annual groundwater and surface water resources potential in Pampanga River Basin is estimated at 4,688 MCM. The annual water demand for 2025 is estimated at 9,015 MCM or a potential to demand ratio of 0.52, the lowest in the country. This means the demand may be two times higher than the water potential.

The same occurs in the Agno River Basin where the water resource potential is 2,275 MCM. The projected annual water demand for 2025 is 4,063 MCM or a potential to demand ratio of 0.56, the second lowest in the country.

Water Quality

At the regional level, 51 percent of the BOD loading (108,000 metric tons) is generated by domestic sources. Only 14 percent (29,000 tons) is contributed by the industrial sector and 35 percent (75,000 metric tons) by the agricultural sector (see Table 8 and Figure 16).

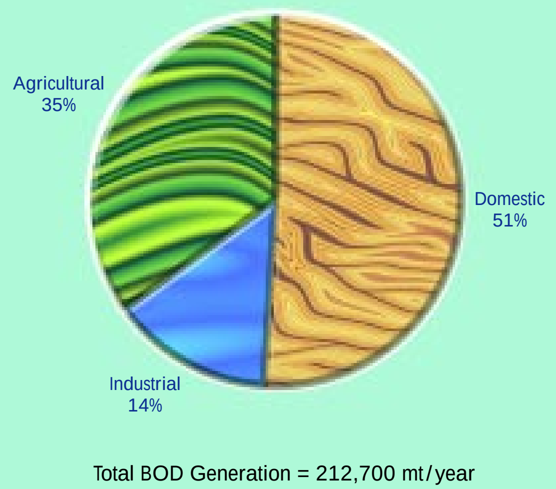
Rivers and Lakes

From the EMB monitoring, the rivers of Marilao, Meycauayan, Sta. Maria, Guiguinto in Bulacan, and San Fernando in Pampanga province had showed zero DO levels and high BOD levels, indicative of high organic pollution (see Figure 17). Based on the river classification, 60 percent of the rivers in the region fall under Class C waters.

Bays and Coastal Water

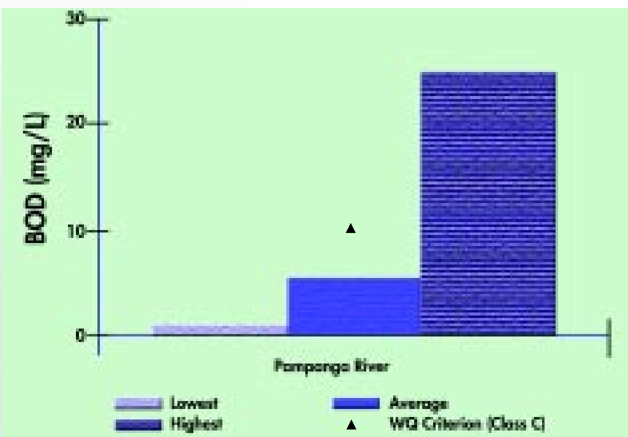
Monitoring in the Bataan coastal area at Matell, Villa Carmen, Villa Leonora, and Barangay Wawa stations show total coliform count above the water quality criterion of 5,000 MPN/100ml for coastal and marine water (Class SC). Suitability of these waters for recreational use is thus questionable (see Figure 18). An eco-watch program, similar to the one for industries, where beaches are flagged according to their water quality and suitability should be initiated to bring attention to the poor quality water (e.g., Beach Eco-watch program called Blue Flag System in Turkey and other Mediterranean countries).

Figure 16 Sector BOD Loading Central Luzon Region



For assumptions refer to Table 8.

Figure 17 BOD Level in Central Luzon, 1996-2001



Source: DENR-EMB, 2003.

Groundwater

A high percentage of the wells tested by NWRB and Local Water Utilities Administration (LWUA) were positive for coliform bacteria. The total and fecal coliform levels for selected beaches in the Bataan coastal area for April to October 2003 are shown in Figure 18. All four beaches fail the total coliform criteria while one does not pass the criteria for fecal coliform. Additionally, total dissolved solids found in most tested wells were higher than the drinking water criterion in Bulacan, Tarlac, and Zambales provinces.

REGION VII - CENTRAL VISAYAS

Central Visayas has a small land area and the fourth highest number of manufacturing establishments. Cebu, a province in this region, is a known international commercial and business hub. Cebu City, which is its capital, is the second largest metropolis in the country.

Water Resource

The region as a whole has no large rivers. The estimated water resource potential is 2,939 MCM at 80% dependability. The water demand for 2025 is estimated at 2,226 MCM, with a potential to demand ratio of 1.32. The island of Cebu has a drainage area of 5,088 km^2 with a water resource potential of 708 MCM. The projected water demand for year 2025 is taken at 932 MCM with a potential to demand ratio of only 0.76 (See Annex 1). Because of its significant role in the Visayas area, there is an urgent need to address the water shortage problem in Cebu.

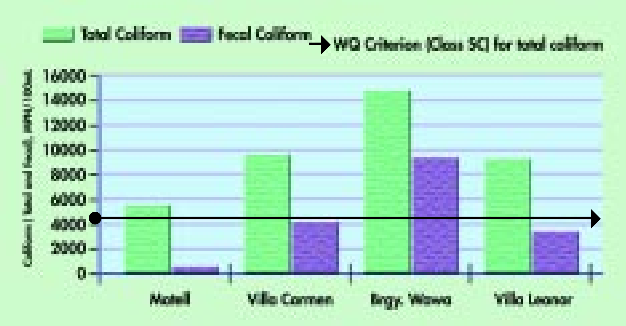
Water Quality

In the region, 41 percent of the BOD loading (77,000 metric tons) is generated by domestic waste, while the remaining 46 percent (87,000 metric tons) and 13 percent (24,000 metric tons) are from agricultural and industrial activities, respectively (see Table 8 and Figure 19).

Rivers and Lakes

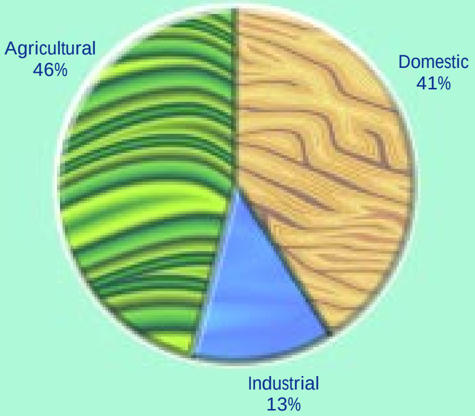
Except in rivers that traverse the urban areas of Cebu, such as Guadalupe and Cotcot, the water quality of the rivers in the region are considered satisfactory (see Water Quality Scorecard Annex 1).

Figure 18 Total and Fecal Coliform for Selected Beaches in Bataan Coastal Area (April to October 2003)



Source: DENR-EMB, 2003.

Figure 19 Sector BOD Loading, Central Visayas Region



Total BOD Generation = 188,500 mt/year

For assumptions refer to Table 8.

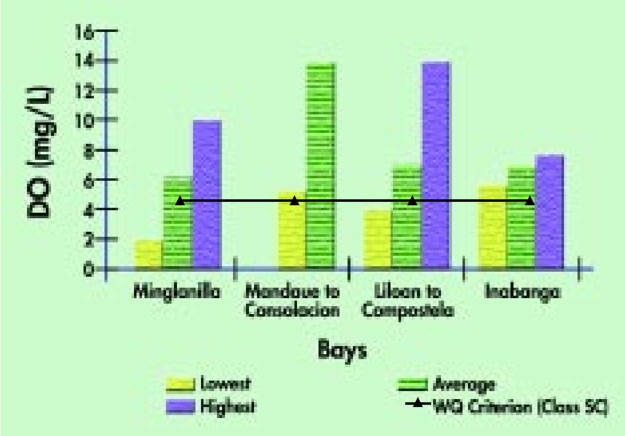
Bays and Coastal Waters

Four bays were sampled in the region from 1996 to 2001, including Minglanilla, Mandaue to Consolacion, and Liloan to Compostela in Cebu, and Inabanga in Bohol. Only DO levels were tested, and the results showed that the average readings did not pass the Class SC criterion (see Figure 20).

Groundwater

Total dissolved solids in many of the wells tested in the provinces of Cebu, Bohol, and Negros Oriental were found to be very high, higher than the criterion set for drinking water (see Water Quality Scorecard Annex 1).

Figure 20 DO Level in Central Visayas, 1996- 2001



Source: DENR-EMB, 2003.

EFFECTS AND ECONOMIC LOSSES

EFFECTS

Untreated wastewater threatens the health of people and the environment. Unsightly color, reduced clarity, and obnoxious odor of the receiving waters also make it unfit for recreation and other productive uses.

Effects On Human Health

Untreated wastewater discharges affect human health through the spread of disease-causing bacteria and viruses. Some known examples of diseases that may be spread through wastewater discharge are gastro-enteritis, diarrhea, typhoid, cholera, dysentery, hepatitis, and, recently, Severe Acute Respiratory Syndrome (SARS) (see Box 8).

Effects On Aquatic Ecosystem

As organic wastes are added into the receiving waters, the bacteria reproduce rapidly and may use the entire supply of oxygen, leading to the death of fish and other living organisms. When there are excessive nutrients such as nitrogen and phosphorus, aquatic plants and algae proliferate triggering euthrophication, especially in closed bodies of water. Waste discharges may also contain toxic substances such as lead, mercury, cadmium, and chromium or cyanide, which may affect the use of the receiving water for domestic use or for aquatic life. In addition, paralytic shellfish poisoning occurs during the "red tide" phenomenon when there are toxic phytoplankton blooms (Box 2).

Effects On Aesthetics

Large amounts of solids from inadequately treated domestic and other wastewater containing organic material accumulate on the banks of the receiving waters, settle at the bottom to form sludge deposits, or float on the surface to form scum. Sludge deposits and scum are not only unsightly but may also cause oxygen depletion and are sources of foul odors and gases.

When the DO level of the receiving waters drops to zero due to aerobic bacteria activity, anaerobic bacteria take over and decompose the organic load by producing odorous gases and methane.

ECONOMIC LOSSES

Adverse effects of water pollution lead to economic losses that could be avoided. Studies and research show that improving water quality results in improved health, agricultural productivity, and high-quality tourism. However, not all economic losses or benefits can be quantified.

Box 8 SARS Outbreak in Hong Kong: A Case of Sewage Contamination

In March 2003, an outbreak of an unknown disease, later identified as Severe Acute Respiratory Syndrome (SARS), captured the attention of the world. In less than a month, there were 321 cases among residents of the Amoy Gardens housing estate block in Hong Kong.

The findings of the Government's investigation indicated that the outbreak was likely due to a combination of factors, including contamination and transmission of a virus via the sewage system. Laboratory studies and scientific evidence have shown that many SARS-infected patients excrete the corona virus in their feces, where it may survive for longer periods in the presence of organic materials.

In the case of the Amoy outbreak, the bathroom floor drains provided a way in which the residents came into contact with the virus. Small droplets, containing highly infectious virus from contaminated sewage, formed and were on the bathroom floor due to improper functioning of the drainage outlets and cracked sewer vent pipes.

Although the outbreak has been contained, economic losses in the retail sector, airlines, hotels and restaurants ranged from an estimated HK$33 billion to HK$46 billion or PhP235 billion to PhP328 billion (at PhP7.12=HK$1).

Sources: http://www.info.gov.hk *and* http://www.mft.govt.nz.

Costs to Health

Improved health of the population is a critical factor in high productivity. Keeping the workforce and society healthy would eliminate income losses due to sickness and medical expenses. One of the most prevalent causes of health decline of a population is contaminated drinking water.

Estimates of water-borne diseases with reported cases of diarrhea, cholera, typhoid and paratyphoid, and hepatitis A were made by DOH. More than 500,000 morbidity cases and 4,200 mortality cases are very significant (see Table 9). Avoidable health costs due to losses in direct income and medical expenses for in-patients and outpatients are estimated at PhP 3.3 billion in a year (Tables 9 and 10; GDP was used to estimate per capita income).

Costs to Fishery Production

When water is polluted, fish and other aquatic resources can perish, which leads to a decline in fisheries production. Erosion from degraded uplands and pollution from silt and sedimentation, as well as untreated sewerage, cause productivity losses in fisheries dependent on coral reefs. The ENRAP report showed a decline in yields of municipal and commercial fisheries, due to sedimentation and silt pollution, by 30 and 5 percent, respectively[13]. Other causes of fish habitat destruction include dynamite fishing, use of cyanide and "muro-ami", etc.

Commercial fishing grounds are now located beyond 15 km from shore. Municipal fishing waters are within 15 km from the shore but local governments may allow commercial fishing in municipal waters. Although production is increasing, the annual rate of increase is declining over time. The value of fisheries production would have been higher than the present levels if water pollution had been contained. Silt and sedimentation are major causes for losses in fishery production.

The Philippine economy loses an average of PhP 17 billion annually due to the degradation of the fisheries environment (see Tables 11 and 12).

Table 9 Direct Income Losses

Water-Related Diseases	Morbidity Cases (15-65 years old) [1/]	Mortality Cases (15-65 years old) [1/]	Losses in GDP (PhP million)
Diarrhea	512,527	2,978	1,649.23
Cholera	179	-	0.04
Typhoid and Paratyphoid	7,710	663	348.53
Hepatitis A	-	571	296.01
Total			**2,293.81**

[1/] Dept. of Health, 2000.
GDP per annum/ capita (2000 prices): PhP 43,167 NEDA, 2000.
GDP per day/ capita (2000 prices): PhP 69 NEDA, 2000.
Morbidity cases: 10 days for typhoid and 3 days for other water-borne diseases Final Report, First Stage Priority Projects for Sanitation and Sewerage, Gen. Santos City, Philippines, DMJM International, December 1995.
Mortality cases: income loss to economy estimated at 12 years.

Table 10 Medical Expenses and Hospitalization Costs

Particulars	Diarrheal Diseases	Typhoid Fever	Total
Reported Cases [1/]	871,446	14,154	885,600
Medical Expenses (Out-Patient) per reported case [2/]	632	-	632
Medical Expenses (Out-Patient) (PhP million)	440	-	440
Cost of Hospitalization per reported case (In-Patient) [2/]	3,284	12,436	15,720
Cost of Hospitalization (In-Patient) (PhP million)	572	35	607
Total Costs (PhP million)[3/]	**1,012**	**35**	**1,047**

[1/] Dept. of Health, 2000. Diarrheal disease include Enteritis and others.
[2/] Final Report, First Stage Priority Projects for Sanitation and Sewerage, Gen.Santos City, Philippines, DMJM International, December 1995.
[3/] Assumptions used in the Final Report of 20% hospitalized and 80% mild cases/ non-hospitalized were adopted. Estimates in constant 2000 prices.

Table 11 Economic Cost to Municipal Fishery Production, 1997-2004

Year	Prod'n (in MT) [1/]	Change In Prod'n (%)	change (%)	Ave. Unit Prod'n Value P/MT [1/]	Prod'n Value (PhP B)	Losses (PhPB) [1/]
1997	924,466	-	-	29,631	27.4	11.7
1998	891,146	-3.6	-	32,504	29.0	12.4
1999	924,693	3.8	204	33,561	31.0	13.3
2000	945,945	2.3	-39	34,459	32.6	14.0
2001	969,535	2.5	9	35,297	34.2	4.7
2002	988,938	2.0	-20	36,432	36.0	15.4
2003	998,665	1.0	-51	37,807	37.8	16.2
2004	1,015,202	1.7	68	38,895	39.5	17.0
Ave.	924,466	1.4	-	34,298	31.7	14.7

Source: BFAR, Philippine Fisheries Profile, 2002.

Table 12 Cost to Commercial Fishery Production, 1997-2004

Yr	Prod'n (in MT) [1/]	Change In Prod'n (%)	Direction of change (%)	Ave. Unit Prod'n Value P/MT [1/]	Prod'n Value (PhP B)	Losses (PhP B) [2/]
1997	884,651	-	-	29,317	25.9	1.4
1998	940,533	6.3		31,617	29.7	1.6
1999	948,754	0.9	-86	33,984	32.2	1.7
2000	946,485	-0.2	-127	35,795	33.9	1.8
2001	976,539	3.2	1428	36,956	36.1	1.9
2002	1,041,360	6.6	109	37,366	38.9	2.0
2003	1,045,316	0.4	-94	39,563	41.4	2.2
2004	1,070,725	2.4	540	40,908	43.8	2.3
Ave.	956,387	2.8		34,295	32.8	2.0

[1/] BFAR, Philippine Fisheries Profile, 2002.
[2/] Losses: due to siltation and sedimentation. Municipal: 30%; Commercial: 5%.

[13] DENR-USAID, ENRAP-Phase II, 1994.

Costs to Tourism

Tourism increases the country's income receipts, generates employment, and creates business opportunities. A clean and healthy environment is a prerequisite to tourism. The Philippines, an archipelago, has a long coastline endowed with beautiful beaches, which are the main tourist attraction. Yet, there is more to attracting tourism than just the recreational use of beaches. Other activities that draw tourists are coral reef diving and whale watching. Good coastal zone water quality is important to the health of bathers, as well as coral reefs and other living species in the coastal waters.

The key words for Philippine tourism promotion are: crystal-clear waters free from pollution. Tourism has been generally promoted with "three S's" - sun, sea, and sand. Recently a more disturbing and possibly dangerous "S" has emerged that can make or break the tourism industry in an area - sewage. Sewage released directly into the sea, carried via rivers and gullies, or drains into groundwater from septic tanks and pit latrines, which then flows into the sea through sand and limestone, would degrade the water quality of the coastal waters[14].

In 1997, the pristine waters of Boracay Island, an international tourist destination in Region VI and the "world's most beautiful beach," experienced a 60 percent decline in occupancy rate because of the news of high levels of coliform (see Box 9).

Most islands in the Philippines are less than 50,000 hectares, which is considered by the DENR as ecologically fragile. The DOT prioritizes tourist destinations that are 50,000 hectares or less, including Bohol, Camiguin, Samal, Boracay (1,000 hectares), among others. The Boracay experience, where the negative effects of untreated sewage on the beaches caused a decline in tourism, could easily be replicated in these other equally fragile islands of the country.

Table 13 Cost to the Tourism Industry, 2001-2004

Year	Tourist (M)[1/]	Tourist Receipts (PhP B)[1/]	Employment (M)[2/]	Losses in Receipts (PhP B)	Losses in Wages (PhPB)[2/]
2001	8.7	422	4.7	5.1	2.3
2002	8.5	411	4.9	4.9	2.4
2003	9.3	451	5.3	5.4	2.6
2004	10.2	495	5.8	5.9	2.8

[1/] Sources: Department of Tourism for 2001 and 2002 data for Regions I, IV to XI and CARAGA; average growth rate of 5.8% from 1992-2002 for 2003-2004 estimates.

[2/] Phil. Statistical Yearbook, 2002 for base data (2001) and growth rate for estimates. Considered only 20% of total labor force for Regions I, IV to XI and CARAGA. Estimated at average legislated non-agricultural in daily wage rate of P183/ day Regions I, IV to XI and CARAGA.

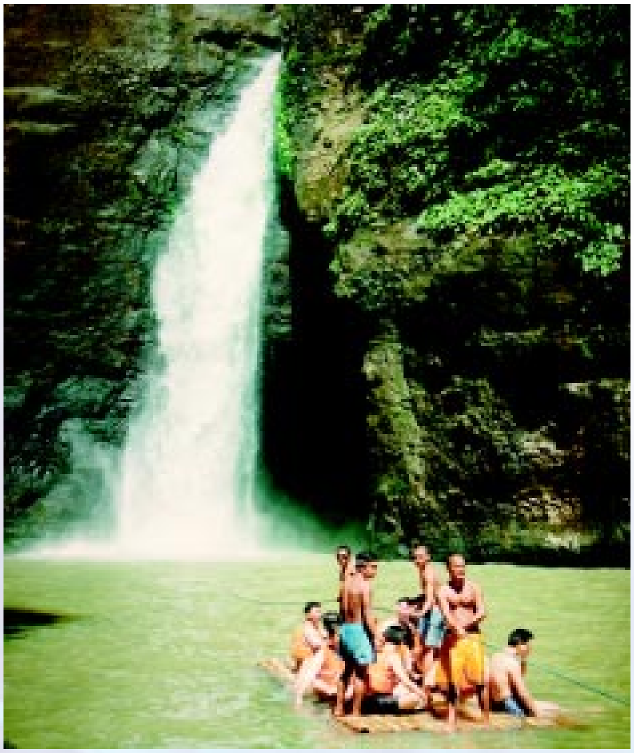
In 2002, tourism in the Philippines reached 8.5 million visitors, generated PhP 411 million tourist receipts, and employed 4.9 million people. A study on the contribution of tourism to the economy revealed that a significant number of people are employed in tourism-related businesses. An estimated 20 percent of the total labor force (4.9 million people) and 22 percent (6.2 million people) were employed in 1994 and 1998, respectively[15].

Box 9 The Boracay Island Coliform Controversy and the Impacts of Public Disclosure

A 1997 DENR water quality monitoring report showing high levels of coliform in the waters of the Boracay Island was the basis for declaring the resort island unsafe for recreational activities. This disclosure caused a drastic drop in tourism and drew the outrage of the locals. In response, a Boracay Task Force was formed comprising congressional and local government officials, the DENR, DOT, and the private sector. The Task Force concluded that the DENR disclosure with three months data was premature because a minimum of one year of monitoring should be required. Four independent tests conducted later showed that Boracay waters were safe.

Public disclosure of beach water quality can attract attention and mobilize people. After the controversy stakeholders joined hands in cleaning Boracay and also implemented a PhP450 million project through DOT/PTA, to provide potable water, sewerage, and solid waste management.

Source: Department of Tourism, 2003.



[14] Global Coral Reef Alliance, Water Quality and Coral Reef Health in Boracay, El Nido, Isla Verde, and Balicasag, Philippines, 1997.

[15] Dept. of Tourism, Invest Tourism Brochure, 2001.

Tourist receipts and tourist-related employment were used as the bases to estimate economic losses due to polluted beach waters. The tourist receipt per visitor is estimated at PhP 45,000 (US$900), based on the DOT's figures on visitor arrivals and receipts for 2002. This is multiplied by the number of foreign and domestic travelers and overseas Filipinos who travel to Regions I, IV to XI, and CARAGA, which are all coastal tourist destinations that are promoted. The decline in occupancy rate experienced during the coliform scare in Boracay is used as the opportunity loss factor for benefits lost, multiplied by the market share of Region VI where the scare occurred.

Benefits generated from employment in tourism are estimated by multiplying the average daily wage rate of selected regional tourist destinations by 20 percent of the total labor force employed in the service sector. Pollution of beach waters was estimated as the cause of annual losses of PhP 5.3 billion from direct tourist receipts, as well as an additional PhP 2.5 billion from tourism-related activities (see Table 13).

Another way of estimating the avoidable cost to tourism is as follows: 8.5 million tourists annually at an average US$900 would generate potential revenue of US$7.65 billion. Assuming an estimated income multiplier effect of 20 percent and probable cancellation of tourists due to water pollution-related causes, losses could be approximately US $0.92 billion (12 percent of the total revenue). At PhP 51.60 per US Dollar (year 2002 exchange rate), this amounts to PhP 47 billion per year.

In summary, economic losses due to water pollution amount to an annual average of PhP 3 billion for avoidable health costs, PhP 17 billion for avoidable costs to fisheries production, and up to PhP 47 billion for avoidable losses to tourism.

Other Economic Losses

Economic losses due to damage to the environment may be quantified in terms of damage claims. Damage claims were estimated to compensate for the losses experienced by affected communities, particularly for losses in income and livelihood (see Box 10).

Economic losses to family income due to the desire for safe bottled water are not insignificant. According to the Water Quality Association of the Philippines (WQAP), almost 45 percent of people in Metro Manila (or 4.8 million people) are willing to buy bottled water. The cost for bottled water is PhP 50 for 5 gallons (or PhP 2,642 per m^3), yet the average tap water provided by MWSS is PhP 10 to 19 per m^3, which is more than 100 times cheaper[16].

At one liter of drinking water per person per day, 4.8 million people are spending about PhP 2.6 per day per capita or a total of approximately PhP 12.7 million per day (or PhP 4.6 billion per year) in Metro Manila. People are willing to pay this high cost for bottled water to ensure safe drinking water despite the drain of savings to pay for it.

Box 10 Examples of Damage Claims
Oil Spill Incident in Bolinao

On its way to deliver coal to the Sual Power Plant in 2001, the cargo vessel M/V Nol Schedar ran around on Bolinao's Pudoc reef spilling, some 10,000 liters of bunker oil in Bolinao waters. The assessment of the accident site at Pudoc reef and the sea grass beds revealed that: (a) a 90m long by 30m wide area of coral reef was damaged; (b) a 12-ha mangrove reforestation project in Brgy. Pilar with 12,000-16,000 mangrove stands of one to three years growth was heavily covered by bunker oil; (c) a pilot sea urchin grow-out culture in Victory with approximately 3,000 sea urchins was destroyed; and (d) fish pens with milkfish grow-out culture were damaged.

The Philippine Government valued damages at PhP 165 million (about US$3.2 million), which included damages to reforested areas and fishing grounds, foregone income (fishing and gleaning), and private claims. The shipping line valued the damages at PhP 442,573 (about US$9,000), which covered only foregone fishing revenues. More than two years after the incident nothing has been resolved on the suits filed by the Philippine LGU and Coast Guard against the owner.

Marinduque Island Mining Disaster

In 1996, an accident at the mining operation site of Tapian Drain Tunnel released 1.6 million cubic meters of mine tailings into the Makulapnit and Boac Rivers. (About 703,228 m^3 of tailings still remain in these rivers, of which 526,000 m^3 are deposited in the dredge channel and 177,228 m^3 are scattered throughout the river.) The incident destroyed crops, clogged irrigation waterways, damaged roads, dislodged communities, and disrupted livelihoods. Marcopper Mining Corporation (MMC) has paid PhP 61 million as damage compensation to 6,930 claimants. Yet remaining claims of PhP 41 million are still under deliberation and other claims filed from 1999-2001 are still being processed.

Sources: DENR-MGB, 2003; DENR-EMB, SEECCTA Project Report, March 2003.

[16] Source: http://wpep.org, 2002.

POLICIES AND INSTITUTIONS

POLICIES

The Philippine Constitution (Article II Section 16) of 1986 stipulates that the State shall protect and advance the people's right to a balanced and healthy ecology. While the current Constitution was only adopted in 1986, statutory provisions on environmental issues in the Philippine legal system date back more than a century. The Philippines has an extensive body of water and water-related legislation and regulations that provide the legal bases for policies and programs related to water management (see Table 14).

A proposed bill on Clean Water is now being deliberated in Congress (see Table 15 for important provisions). The bill provides for comprehensive water-quality management, specifically for the abatement and control of pollution from land-based sources.

Table 14 Legislation and Policies

Legislation	Description	Responsible Agencies E - Enforcer I - Implementer	Findings and Analysis
Commonwealth Act 383, Anti-Dumping Law (1938)	Prohibits dumping of refuse, waste matter, or other substances into rivers		Not fully enforced
Republic Act 4850 (1966), Laguna Lake Development Authority Act; as amended by Presidential Decree 813 (1975)	Regulates and controls the pollution of the Laguna de Bay Region, including sewage works and industrial waste disposal systems	LLDA (E/I)	Strictly enforcing but not to domestic wastewater
Republic Act 6234, Creation of MetroWaterworks and Sewerage System (1971)	Constructs, operates and maintains water systems, sewerage and sanitation facilities in the Metro Manila area	MWSS (E) Concessionaires (I)	Limited sewerage and sanitation service coverage
Presidential Decree 198, Creation of Provincial Water Utilities (1973)	Authorizes the creation of water districts to operate and administer water supply and wastewater disposal systems in the provincial areas	LWUA (E) Water District (I)	Operation and management of wastewater disposal system not implemented
Presidential Decree 281, Creation of Pasig River Development Council (1973)	Regulates and controls the pollution of the Pasig River	PRRC (E/I)	Not fully enforced
Presidential Decree 856, Sanitation Code (1975)	Requires cities and municipalities to provide an adequate and efficient system for sewage collection, transport and disposal in their areas of jurisdiction	DOH (E) DPW (I) now DPWH	Not enforced and monitored, e.g., connection to sewer system by houses in areas where sewerage system is available
Presidential Decree 600; as amended by PD 979, Marine Pollution Control Decree (1976)	Regulates and controls the pollution of seas	PCG (E/I)	Coverage is not efficiently monitored due to limited resources
Presidential Decree 984, Pollution Control Law (1976)	Provides guidelines for the control of water pollution from industrial sources and sets penalties for violations; requires all polluters to secure permits	EMB (E/I) now DENR	Not strictly enforced; compliance on the provision of sanitation and sewerage are not met
Presidential Decree 1067, Water Code (1976)	Consolidates legislations relating to ownership, development, exploitation and conservation of water resources	NWRB (E/I)	Not fully enforced
Presidential Decree 1096, National Building Code (1977)	Requires connection of new buildings to a waterborne sewerage system	DPWH (E) LGU (I)	Wastewater or sewage disposal are not fully enforced
Presidential Decree 1151, Environmental Policy (1978)	Recognizes the right of the people to a healthy environment	DENR (E/I)	EA system not strict on enforcement of sanitation and sewerage provisions
Presidential Decree 1152, Philippine Environmental Code (1978)	Provides guidelines to protect and improve the quality of water resources and defines responsibilities for surveillance and mitigation of pollution incidents	DENR (E/I)	Only enforced on big polluters (i.e., industries)
Presidential Decree 1586, Environmental Impact Statement System (1978)	Mandates the conduct of environmental impact assessment studies for all investments undertaken by the government and private sector	DENR (E/I)	Project review is not strict on sanitation and sewerage provisions
Republic Act 7160, Local Government Code (1991)	Devolves enforcement of laws on sanitation to LGUs and the provision of basic services such as water supply, sanitation and flood control	DILG (E) LGU (I)	Not strictly enforced due to budgetary constraints and low priority for sanitation and sewerage projects

Table 15 Summary of Provisions in the Proposed Clean Water Act of 2002

PROVISION	LEAD OFFICE AND OTHER STAKEHOLDERS
National Water Quality Status Report	Lead: DENR Others: NWRB, PCG and other appropriate agencies & entities
Integrated Water Quality Improvement Framework	Lead: DENR Others: LGUs, concerned government agencies
Water Quality Management Area Action Plan	Lead: DENR Regional Offices Others: NWRB, member LGUs, civil society, other concerned stakeholder sectors
Local Government Unit Water Quality Compliance Scheme	Lead: LGUs in consultation with concerned stakeholder
Water Quality Management Area	Lead: DENR Others: NWRB in consultation with key stakeholders
Management of Non-attainment Areas	Lead: DENR Others: NWRB , DOH, DAO, Governing Board, other concerned agencies, private sector, LGUs
National Groundwater Vulnerability Mapping	Lead: DENR - MGB
Water Pollution Management Practices and Technologies	Lead: DOST Others: DENR, other concerned agencies or organizations
Guidelines for Test Procedures	Lead: DENR Others: DOST, DOH, and other concerned agencies
Water Quality Monitoring and Surveillance	Lead: DENR with multi-sectoral group
National Sewerage and Septage Management Program	Lead: DENR Others: DOH, LWUA, NWRB, MWSS, other concerned agencies
Domestic Sewage Collection, Treatment and Disposal	Lead: LGUs and/or agency vested to provide water supply and sewerage facilities, concessionaires Others: DENR, DOH, DPWH, other concerned agencies
National Water Quality Management Fund	Lead: DENR Others: DOST and PCG
Area Water Quality Management Fund	Lead: Water Quality Management Board in each water quality management area
Water Quality and Effluent Standards and Regulations	Lead: DENR Others: DOH, DA, private sectors, other government agencies
Water Pollution Permits and Charges	Lead: DENR Others: Project Proponents, other government agencies, LGUs
Institutional Mechanism	Lead: DENR Others: LGUs (ENRO), Governing Board, concerned stakeholders, NWRB, PAB, LLDA, PCG, DA, MWSS, LWUA, BFAR, DOH
Incentives and Rewards (Rewards, Incentives Scheme)	
Civil Liability/Penal Provisions	Lead: PAB
Actions (Administrative, Citizen's Suit, Legal Actions Against Public Participation and Enforcement of this Act, Lien Upon Personal and Immovable Properties of Violators)	Lead: DENR, affected persons, Courts

INSTITUTIONS

About 30 government agencies are involved in water resources management[17]. Their mandates include water resources planning, assessment, water quality, sanitation, pollution control, and watershed management. Some of the agencies have unclear and overlapping mandates, and cooperation among them remains low. In brief, some of these agencies include:

Department of Environment and Natural Resources (DENR). Principal environment and watershed agency.

Environmental Management Bureau (EMB). Sets and enforces water quality (excluding drinking water) and effluent standards, criteria and guidelines for all aspects of water quality management. Also classifies and monitors quality of surface water-bodies.

Department of Health (DOH). Sets and monitors drinking water standards. Formulates and implements sanitation programs to address environmental and water-related diseases.

Department of Science and Technology (DOST). Conducts research and development programs with DENR for the prevention and abatement of water pollution.

National Water Resources Board (NWRB). Administers and enforces the Water Code. Assesses water resources and does overall coordination of water resources management and development in the country.

Bureau of Fisheries and Aquatic Resources (BFAR). Regulates and enforces fishery policies and laws.

Philippine Coast Guard (PCG). Responsible for preventing ocean dumping of water pollutants.

Local Water Utilities (LWUA). Promotes and oversees the development of provincial waterworks.

Metropolitan Waterworks and Sewerage System (MWSS). Constructs, operates, maintains and manages water supply, sewerage and sanitation facilities in the Metro Manila area; also regulates construction of privately owned sewerage systems.

[17] Assessment of Water Resources and Water Demand by User Sectors in the Philippines, United Nations, 1999.

Manila Water Company, Inc. (MWCI). Private firm serving the waterworks and sewerage systems of the eastern part of Metro Manila.

Maynilad Water Services, Inc. (MWSI). Private firm serving the waterworks and sewerage systems of the western part of Metro Manila.

Laguna Lake Development Authority (LLDA). Regulates and controls the pollution of the Laguna de Bay Region, including sewage works and industrial waste disposal systems.

National Irrigation Administration (NIA). Develops and manages irrigation systems.

Local Government Units (LGUs). Share responsibility in providing basic services such as water supply, sanitation, and flood control, including enforcement of sanitation laws.

Enforcement

The Philippines has environmental laws and regulations but enforcement is poor and beset with several problems. Among the reasons cited for poor enforcement include:

1. Inadequate government resources (i.e., budget, manpower, and facilities). For example, EMB has not received additional budget and continues to receive a small percentage of DENR's annual budget despite passage of additional laws it is mandated to enforce.

2. Incomplete database. EMB only has 25,000 (3 percent) of the 826,783 firms registered in the country entered into its database. Of the 25,000 firms, only 14,111 (46 percent) were inspected in 2001.

3. Inadequate guidelines. Formal guidelines and plans to enforce laws are inadequate and sometimes absent.

4. Lack of coordination among various agencies.

5. Limited access to information due to lack of comprehensive, long-term environmental quality monitoring programs.

Public Disclosure and Participation

Public participation in water quality management is low. Lack of awareness regarding the health and economic impact of poor water is a major deterrent to public participation. However, after a major crisis like the Boracay Island Coliform scare, stakeholders do come together to solve the problem. Instead of such crisis management, if Filipinos were made aware of the importance of clean water and requested their input on forming priorities, they would demand actions that would generate the political will needed for policy and investment. For water and sanitation users, sustained community involvement should begin at the initial planning phase and should continue through implementation, monitoring, and evaluation.

Economic Instruments

Economic or market-based instruments (MBIs) are complementary measures to the existing system for environmental management. In the Philippines, these are in the form of resource rent and effluent charges. In 1997, the Environmental User Fee System (EUFS), an effluent tax based on presumptive discharges, was pilot-tested in the Laguna Lake Region (see Box 11). Based on LLDA's success and the relevance and importance of the EUFS, the National Government implemented EUFS on a national basis in 2003. The national implementation of the EUFS is also espoused by the proposed Clean Water Act.

Box 11 A Successful Pilot Testing of the Environmental User Fee System

LLDA pilot-tested and pioneered the Environmental User Fee System (EUFS) in the Laguna de Bay Region to reduce pollution loading by charging user fees to industrial waste dischargers of the lake. The user charge comprises a fixed fee based on the volume of discharge and a variable fee based on the unit load pollution. Five years after its implementation, the EUFS became an essential part of LLDA's Environmental Management Program. The LLDA experience has shown that a market-based instrument can be successfully combined with existing command and control measures to achieve the desired goal. It also gives the government an opportunity and a challenge to spread such experience throughout the country, across sectors and media.

Learning from LLDA's experience, DENR issued an Administrative Order (DAO 2002-16) expanding the coverage of the EUFS in the entire country to include all establishments and installations that discharge industrial and commercial wastewater into Philippine water and / or land resources. This is to be accomplished through DENR's wastewater permitting system. The objectives of the EUFS are to: (a) reduce water pollution and improve the ambient quality of water bodies; and (b) encourage firms to pursue the least-cost means of pollution reduction and internalize the philosophy of self-regulation.

Sources: Laguna Lake Development Authority, 2003 and World Bank-EMB/ DENR, SEECCTA Project, March 2002.

URBAN SANITATION AND SEWERAGE

SANITATION AND SEWERAGE

The indiscriminate disposal of domestic wastewater is the main reason for degradation of water quality in urban areas. Unlike the agricultural and industrial sources, where the cost of water pollution control may be passed on to the owners, the off-site domestic wastewater collection, treatment and disposal system is considered a basic service and is a major investment.

Infrastructure development for sanitation and sewerage in the Philippines began more than a century ago (see Table 16). In the early 1980s, Metro Manila provided sewerage collection and treatment facilities in a few areas through MWSS. While there were programs to upgrade sewerage and sanitation facilities, its implementation was postponed due to a lack of funds. Privatization in the 1990s further delayed the implementation of sewerage and sanitation projects for Metro Manila. Only the Makati Sewage Treatment Plant (STP) has been upgraded and the proposed six to eight STPs are in the bidding process. Each STP will have a capacity of .002 to .004 MCM / day or a total of .012 to 0.048 MCM. To date, about 0.06 - 0.08 MCM / day is covered by the existing facilities of MWCI and MWSI. To cover the MWSS area, a capacity of more than 2.4 MCM / day is necessary.

Table 16 Inventory of Domestic Sewerage Experiences and Practices

Location / Age of the System	Population Served	Technology Legend: STP- sewage treatment plant CST- communal septic tank	Performance Legend: M - Manage O- Oversight
Metro Manila 100 + years (undergoing rehabilitation in the '80s up to the present)	1,010,000 (8% of the system coverage)	Collection- conventional Treatment- several levels (STP) / partial treatment (CST / Imhoff tank) Disposal- Marine Outfall (Box 11)	Environmental Performance: On-going rehabilitation & meeting the standards for effluent quality; CSTs being upgraded to STPs. Institutional Performance: O & M by private concessionaires (MWCI & MWSI); collection rate is about 97% (50% of the water bill).
Baguio City 75 years (rehabilitated in 1994)	5,300 (2% of the system coverage)	Collection- conventional Treatment- STP (oxidation ditch & sludge drying beds) Effluent Disposal- River Outfall (Balili River); sludge disposal- agricultural use	Environmental Performance: Treatment- 94% BOD removal (but with low load), with effluent testing prior to discharge. Institutional Performance: LGU (M / O); 45 staff; collection rate = 22% of the connected households (flat rate).
Zamboanga City 70 years (not much improvements)	3,700 (1% of the system coverage1)	Collection- conventional Treatment- None Disposal- effluent by marine outfall (Basilan Strait); sludge- none	Environmental Performance: Raw sewage discharged 40 m. offshore & no effluent testing. Institutional Performance: Water District (M) / LWUA (O); 14 staff; collection rate= 99% of the connected households (50% of the water bill).
Vigan City 70 + years (not many improvements)	1,360 (3% of the system coverage)	Collection - conventional Treatment- 5 CSTs Disposal- effluent to rivers / fields; sludge is not collected	Environmental Performance: Partially treated effluent prior to river / field disposal & no sludge treatment & disposal (No effluent testing). Institutional Performance: Water District (M) / LWUA (O); no devoted staff; collection rate= 96% of the connected households (percentage billed to water supply varies according to category).
Bacolod City 39 years in Brgys. 29 & 20 years in Montevista (built by National Health Administration)	2,020 (less than 1% of the system coverage)	Collection- conventional Treatment- individual CSTs Disposal- effluent to public drain (Brgy. 29) & creek (Montevista)	Environmental Performance: Partially treated effluent prior to creek / public drain & no sludge treatment & disposal (No effluent testing). Institutional Performance: Brgy. LGU (M) / City LGU(O); no devoted staff; collection rate= no user's fee.
Cauayan, Isabela 14 years (built by DPWH)	4,000 (2% of the system coverage)	Collection- small bore sewer Treatment- stabilization pond Disposal-effluent to field	Non-operational. System failed due to lack of funds for operation and maintenance.
Davao City 29 years	1,161 (less than 1% of the system coverage)	Collection- conventional Treatment- STP Disposal- unknown	Non-operational. System failed due to lack of funds for operation and maintenance.

Sources: 1. A. Robinson/EDCOP, Water and Sanitation Program's WPEP: Urban Sewerage and Sanitation in the Philippines, March 2003.
2. C. Ancheta, Water and Sanitation Program's WPEP: Urban Sewerage & Sanitation, 30 years of experience and lessons, September 2000.

Most water supply and sanitation systems outside Metro Manila were given the option to form semi-autonomous water districts in 1973. Authority was granted to the water district to operate and administer water supply and wastewater disposal systems in the local communities, with support and financing from LWUA. More than 200 water districts are operational, but their focus is water supply, with no provision for sanitation services. This leaves Local Government Units (LGUs) to provide for sanitation services.

Some attempts to provide low-cost technologies in the LGUs were initiated as early as the '70s, through clustered household and low-cost collection systems, which led to a communal septic tank for partial treatment. Most of these facilities have fallen into disrepair. The 1998 National Domestic and Housing Survey (NDHS) estimated that only about 7 percent of the country's total population is connected to sewers, out of which very few households actually maintain adequate on-site sanitation facilities. Due to insufficient sewage treatment and disposal, more than 90 percent of the sewage generated in the Philippines is not disposed or treated in an environmentally acceptable manner.

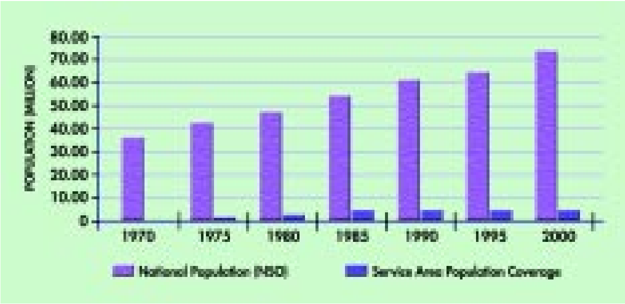
Domestic Wastewater Treatment Today

At LGUs, investments in sewerage collection and treatment facilities receive low priority compared to income-generating projects such as water supply. This is due to the high cost of constructing sewer networks, poor technical capacity, and low demand or willingness-to-pay (WTP) for sanitation services (see Figure 21). The problem has been further exacerbated by the restricted space available for such facilities in the low-income urban areas, where most of the generated sewage is disposed of indiscriminately.

Wastewater generation based on the water demand shows that of the total of 7.2 MCM generated daily, 5.2 MCM/day is from the urbanized areas (2.4 MCM/day from Metro Manila alone) (see Table 17).

Based on the LGUs limited financial resources, low-cost sewerage alternatives are being explored. Technical alternatives with costs comparable to individual on-site systems are available. Among others, the experiences in Pakistan, Indonesia, Brazil, and Bolivia in reducing the cost of the sewer network through simplified sewerage (small-bore and/or condominial systems) reveal that cost of the collection pipes is 40-74 percent less than the conventional system. The Palawan experience in Table 18, which using these technologies, is under construction. Likewise, a participatory approach in implementing demand-driven pollution control sub-projects was found to have worked in several areas. Most of the projects developed under these innovative approaches are presently under construction (see Table 18). To date, other LGUs are duplicating the same approach, i.e., seven barangays in Panabo City. Yet compared with its neighboring cities, Metro Manila is seriously behind in providing piped sewerage systems (Figure 22).

Figure 21 Population Growth and Sewerage Service Coverage



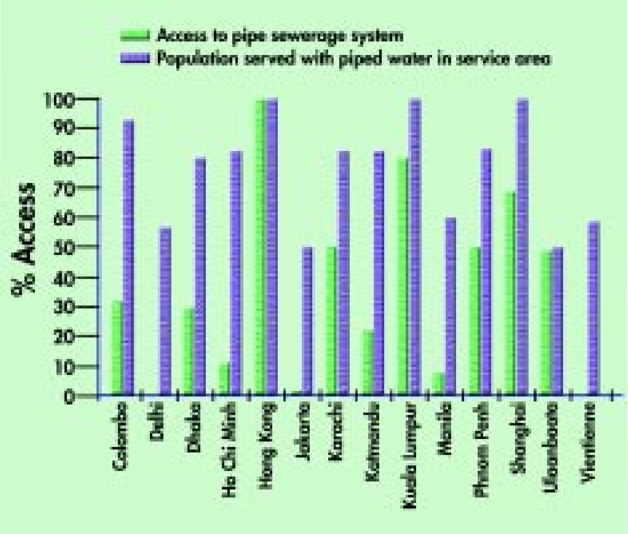
Source: National Statistics Office.

Table 17 Domestic Water Demand and Wastewater Generated

Items	Urban	Rural	Total
	(in million)		
Population[1]	43.6 (57%)	32.9 (43%)	76.5 (100%)
Per capita Water Consumption[2], l/d	150	75	-
Water Demand, m^3/d	6.54	2.47	9.0
Wastewater Generated3, m^3/d	5.2	2.0	7.2

1/ 2000 NSO ; 2/ LWUA Methodology Manual ; 3/ 80% of water demand.

Figure 22 Sewerage Coverage Around the World



Sources: Various World Bank and other reports.

Available and Adaptable Technologies

Scaling-up of sanitation facilities or phased implementation strategies could be adopted to reduce the lag in developing pollution control facilities (Box 12).

Even with highly urbanized cities, the implementation of a conventional sewerage project cannot be realized in the short term because of other environmental concerns facing the LGUs such as solid waste management, drainage, water supply, etc. An example is the proposed Cabanatuan City's storm drainage project in Table 18, which replaces the earthquake-damaged system in order to eliminate the flooding and stagnating wastewater problems in the central business district. Realizing the implication of the transfer of wastewater, including septic tank effluent into the Pampanga River, the city included a dry-weather flow interceptor at the outfalls that will be connected to a sewage treatment plant (Step 2 in Box 12). The cost per capita of the combined system is relatively high. Yet through this phased system, the city is able to address the perennial flooding problem and improve the quality of effluent through its dry weather flow interceptor system and sewage treatment plant.

Another example is the Palawan Province Barangay Environmental Sanitation Project (BESP) which provides low-cost sanitation facilities to 4th to 6th class municipalities. The sub-projects include a simplified sewer network among clustered houses, which conveys the sewage through combination of small-bore and a condominial sewer system into a communal septic tank with sand filter beds or soak-a-way pits.

Both communities participated in the planning and agreed on the type of sewerage system based on their WTP for its operation and maintenance. This shows that there is a real demand for appropriate sanitation services in poor and middle-income communities. The estimated capital cost of sewerage and sanitation is presented in Table 19.

In the semi-urban areas in low-income countries, conventional centralized approaches to wastewater management have generally failed to address the needs of the communities in collecting and disposing of domestic wastewater and fecal sludges from on-site sanitation. Implementation based on a decentralized approach may offer opportunities for wastewater reuse and resource recovery, as well as improvements in local environmental health conditions[18]. This approach could ease the implementation barrier due to the unavailability of land for the sewer network and treatment facilities, as well as socio-political conflicts. The concept also encourages more community participation that would allow the selection of low-cost sewer networks and treatment alternatives according to their WTP. Experience in Indonesia and Palawan reveals that this approach allowed connection of sewage at the nearest connection point (backyards), which reduced the cost of connection by 20 percent from that of the conventional system.

In Japan, nightsoil treatment plants have been introduced in many cities, whereas piped sewerage systems are not yet implemented. Septage collection from individual households or buildings is collected by vacuum tankers and disposed into the treatment plants for appropriate treatment. This option can be considered as an intermediate measure between on-site treatment and a piped system in a high-density area.

Table 19 Capital Cost per Beneficiary (in PhP)

Item	1994 NUSSBP 1/		Projected 2003 Prices 2/	
	Capital Cost	Annual Operating Cost	Capital Cost	Annual Operating Cost
Sanitation Facilities	1,370	173	2,850	355
Piped Sewerage	2,760	195	5,700	400

1/ 1994 National Urban Sanitation and Sewerage Strategy Plan (NUSSSP), prices in 5 highly urban cities. The base unit cost was also used in the Provincial Water Supply, Sewerage and Sanitation Sector Plan (August 2000) by JICA in 30 provinces.
2/ Adjusted rates by inflation factor of 1.08.
3/ MWSS (MWCI) figures (2002) are within the projected 2003 capital cost at PhP 4,950 for piped sewerage and PhP 1,043 for sanitation facilities.

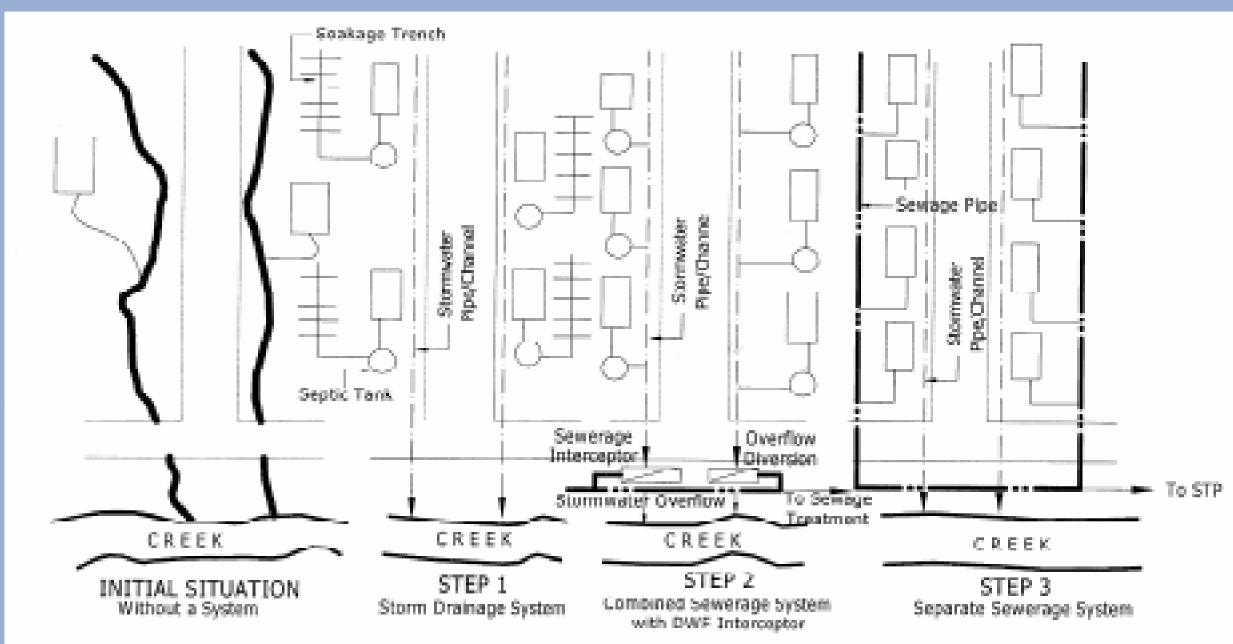
[18] Jonathan Parkinson & Kevin Tayler, Decentralized Wastewater Management in Peri-urban Areas in Low Income Countries.

Table 18 THE LGUs CAN DO IT!

Location / Age of the System	Population Served	Technology	Performance
Cabanatuan City (Construction is on-going; 2004- target completion date)	25,201	Collection: combined drainage system Treatment: DWF with STP Disposal: septage effluent to Pampanga River; sludge to be collected and treated for agricultural reuse	Environmental: Septage effluent is treated prior to river disposal & desludging by vacuum tanker to drying bed prior to agricultural use (EMP requires effluent testing). The STP operates only during the dry season or when the effluent quality concentration is high. Institutional: WD (M) / LGU (O); Users Fee (under negotiation) Capital Cost per beneficiary: PhP16,993 (for the whole combined system) and PhP 2,200 (for the DWF interceptor and STP).
Palawan Province (Construction is on-going; Q4 2003- target completion date)	12,750 (9 sub-projects in the municipalities of San Vicente, Roxas, Quezon, Dumaran, Taytay & El Nido	Collection: simplified / condominial sewer network Treatment: CST Disposal: sand filter / soakaway	Environmental: Septage effluent is treated prior to land disposal & desludging will be done by vacuum tanker to a drying bed prior to agricultural use (EMP requires effluent testing). Institutional: Association / Cooperative (M) / LGU (O); User Fee= Fixed rates varies from PhP 1.30 to PhP 10.50 to cover O&M cost (No full-cost recovery; Capital investment was provided by Provincial Government) Capital Cost per beneficiary: PhP 2,000 - P 3,500.

Source: Water District Development Project (WDDP), LBP, May 2003.

Box 12 Sewerage System Options for Scaling Up

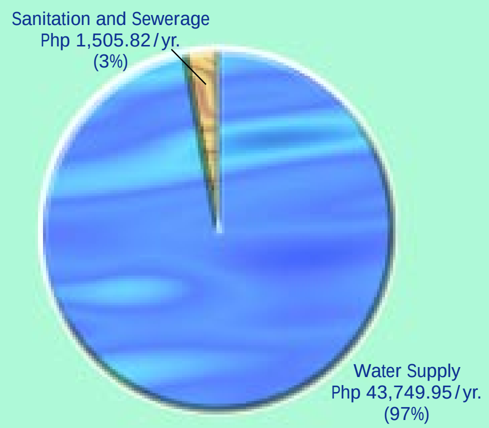


INVESTMENT REQUIREMENTS FOR SEWERAGE AND SANITATION

Investments on Sewerage and Sanitation History

Investments in sanitation and sewerage are lumped together with water supply as one sector, identified as "Water Supply and Sanitation" in nearly all investment packages prepared by the Government. The allocation for sewerage and sanitation is used for water supply due to the high demand for water. As a consequence, sewerage and sanitation are relegated to a small slice of the budget despite being five times the investment cost for the water supply (see Figure 23). The estimated average annual investment for sewerage is PhP 1.5 billion (3% for the sector or 0.05% of the 1999 GDP) as compared to an average annual investment for water supply of about PhP 43.7 billion (97% for the sector or 1.46% of the GDP). The treatment of wastewater could not compete with the increasing demands in water supply.

Figure 23 Annual Average Investment on Water Supply versus Sanitation and Sewerage (per billion)

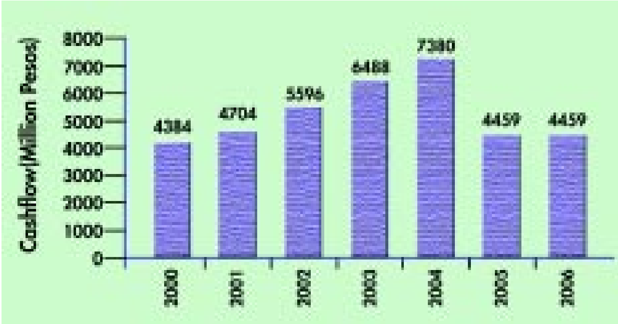


Source: C. Ancheta (2000), WPEP: Urban and Sanitation- 3 years of experience and lessons.

Sewerage and Sanitation Development Trend

The Medium-Term Philippine Development Plan (MTDP) is the document that embodies the policy framework and strategic plans and programs of all the sectors in the country. Investments in infrastructure development, which include water pollution control, must be in accordance with the priorities set in the MTDP before it could be approved with budgetary allocation from the Government. The MTDP embodies the vision of the incumbent leadership and thus is updated on a regular basis. Investment trends for sanitation have been increasing in recent years but are due to decline in the near future (see Figure 24).

Figure 24 Projected Investment Plan for Sanitation



Sources: MTPIP and NASAP, 1999.

Investment for Urban Sewerage and Sanitation

Investment to achieve the goals of the Clean Water Act would require budgetary allocations from the national Government and LGUs. Operations and maintenance of infrastructure and institutional components would require funding to ensure sustainability.

The population/settlement density and high cost of land require piped systems in urban areas. On the other hand, sanitation, including septage and sludge management, could be started in the rural areas. A 10-year program in treating domestic wastewater through sanitation in rural areas (PhP 53 billion) and a piped system in urban areas (PhP 158 billion) would require capital cost of PhP 211 billion and operating cost of PhP 18 billion per year (see Table 20).

Table 20 Investment in Sanitation and Sewerage

Coverage Area	Population (in million)		Service Coverage (in million)		Investment Requirement in PhP B)	
	2005	2015	2005	2015	2005	2015
Urban	48.85 (58%)	55.58 (60%)	9.77 (20%)	27.79 (50%)	55.69	158.40
Rural	35.37 (42%)	37.06 (40%)	17.69 (50%)	18.53 (50%)	50.42	52.81
Sub- Total	84.22 (100%)	92.64 (100%)	27.46 (33%)	46.32 (50%)	106.11	211.21
Program Support						
Operating Costs Urban					3.91	11.12
Operating Costs Rural					6.28	6.58
Support Activities					13.79	27.46
TOTAL					130.09	256.37

Notes: 1. Unit Cost, see Table 15.
2. Investment requirement was computed based on constant 2002 rates.
3. Support activities were estimated at 13% of the Capital Cost.

Projected Investment Plan

The Government will need PhP 25 billion per year for the physical infrastructure for the next 10 years. However, several constraints such as insufficiency of funds, site and right-of-way acquisition, environmental and social problems, among others, may be encountered and projection in this respect is conjectural. Thus, a phased implementation schedule is necessary such as the upscale model presented in Box 12. The projected 2005 and 2015 capital investment projection presented in Table 20 is consistent with the Provincial Water Supply, Sewerage, and Sanitation Sector Plan Study prepared for the 41 provinces. The balance will give the LGUs another 10 years for the expansion of their service area.

Financing Sources

The following nine conventional sources of funds are the most likely means of financing a sewerage and sanitation program. It is recommended that national technical assistance and training efforts concentrate on these nine areas: (1) privatization, (2) internal revenue allotment, (3) special levies, (4) development fees (permits, development impact fees, and groundwater protection fees), (5) surplus funds, (6) sewerage surcharges, (7) property tax, (8) credit, and (9) other private sector finance (beneficiary cash contributions, contributions in kind, and user fees).

The Clean Water Act has a provision for a water quality management fund, which would be the receptacle for the penalties, fines, etc. due from the non-compliance of the Act's stipulations. This fund would be used to finance the investment and implementation requirements in the Act. Due to the Government's current budget deficit and the high cost in the provision of sanitation and sewerage, these investments cannot be realized within the projected planning period of 10 years. However, this can be realized through private sector participation and investment. Regardless, whether these are implemented by the Government or the private sector, the users will have to pay the appropriate tariff rates to recover or to pay back these investments.

Privatization through build-operate-transfer (BOT), design-build-operate (DBO), and other systems are favorable due to the lack of, or insufficient, government funds for the capital investment and the high cost of operation. It has been proven that operation and maintenance of such specialized service is more sustainable if privately operated. This strategy would also allow the LGUs financial flexibility with other priorities and basic services.

The MWSS privatization laid the foundation for improvements in sewerage and sanitation services. Performance of the two concessionaires is presented in Box 13. The progress, however, experienced delays due to the following reasons:

(1) MWCI did not meet its sanitation target because the company moved away from dumping septage into the sea and instead set up sludge processing plants. Another option being considered is the use of the Lahar area in Pampanga, estimated at PhP 325 / m^3.

(2) MWSI had a difficult time in accelerating the desludging services because these services can only be done during non-work and non-rush hours and 40 percent of the West Zone comprises depressed areas with no septic tanks. Likewise, the public has poor sanitation awareness and is not keen in desludging their septic tanks.

MWCI has currently set aside 17 percent of the capital expenditure and about 7 percent of revenues for sewerage. The company has estimated that it will allot PhP 8 - 9.0 billion in five to seven years. The rationale for privatization is the combination of the investments needed at the onset and potential efficiency gains. However, these costs have to be recovered from tariff and revenues from users through government policies.

Sewerage Investments in Coastal Tourist Areas

To protect tourist areas, DOT has identified 12 popular and emerging coastal destinations[19]. Future investment requirements for the physical components of sewerage for coastal tourist areas for years 2005 and 2015 are PhP 2.5 billion and PhP 6.8 billion, respectively.

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[19] Huttche, White and Flores, Sustainable Coastal Tourism Handbook for the Philippines, 2002.

Box 13 Privatization: A Financing Option

MWSS Experience: The privatization experience revealed that sewerage connections increased less than 1% under MWSS in its last five years (1992-1996) of operation while the concessionaires had an average increase of 2.7% in their first five years (1997-2001) of operation. While there was an increase, the concessionaires are not still complying with the wastewater standards due to lack of STPs. Prior to privatization, MWSS had desludged an average of 850 tanks annually, which increased to 1,840 tanks per year under the concessionaires. The performances of the concessionaires are as follows:

Service Obligation	MWCI		MWSI	
	Agreed Targets	Actual	Agreed Targets	Actual
Sewer Coverage	3%	2.5%	16%	14%
Sanitation	38%	1%	33%	7%
Wastewater Quality	C	NC	C	NC

Note: C – Complying, NC – Non-complying

Brazilian Experience: The private sector is encouraged, for a fee, to collect and treat sewage, that is to reduce the pollution level of the sewage within the standards of the receiving body. The approach has allowed private sector involvement, which defrays the government's budget from the expensive investment for sewage collection and treatment facilities.

Source: World Bank Reports.

Cost Recovery and Willingness to Pay

Waste generators and users of receiving waters must be willing to pay for wastewater management services. WTP is defined as the maximum amount that would be paid for the level of service received rather than forego it altogether (all or nothing). Those who pay for user charges demonstrate, by doing so, their WTP is at least as great as the charge paid. In fact, it may be much greater: the user charge merely establishes the lower bound[20]. To the extent that the user's WTP is less than the user charge, the collection efficiency would be the ultimate determinant of whether or not the user charge is acceptable and within the financial capacity.

Sanitation and Sewerage

Average-income households are willing to pay for improved sanitation services, i.e., connection to sewer system with treatment at a cost of PhP 134 per household or PhP 27 per month per capita (for a household of five members), in 2000 prices (see Box 14). WTP adjusted to 2003 constant prices is PhP30 per month per capita, assuming 5 percent inflation rate. At PhP 5,700 per capita investment in the sector, cost recovery of capital investments would take almost 16 years, unless a cross-subsidy pricing system across sectors is developed (commercial and industries subsidizing households).

Environmental Protection and Conservation

Tourists are willing to pay for conservation and protection of the environment (see Box 15). Unlike households where user fees are paid monthly, the tourist pays a one-time user fee, unless returning in the future. For full-cost recovery, and assuming a tourist will return to the same coastal destination every year and that the economic life of the facility is 25 years, the user fee per tourist would be PhP274.

Box 14 Willingness to Pay for Wastewater Services

Willingness-to-Pay (WTP) studies (contingent valuation method) had been undertaken for improved sanitation services for urban centers. The households surveyed are willing to pay PhP118 to 134 /month/household for sewer connection with wastewater treatment.

Results of surveys undertaken for WTP for households [1/]

Location	% of Pop Served Willing	Sewer Conn. (PhP/ mo/hh)	Sewer Conn+ Treatment (PhP/ mo/hh)
Calamba	82	124	103
Davao	90	62	92
Dagupan	x	169	207
Average	nc	118	134

[1/] Based on WTP surveys in the ff. studies: Household WTP for Improved Sanitation Services, Calamba, Davao, Dagupan, 1993. All prices updated to 2000. x – not covered by study and nc – not conclusive.

[20] National Research Council, Washington, D.C., Managing Wastewater in Coastal Urban Areas, 1993.

Box 15 Coastal Tourism Sustainability in the Philippines – Is This Possible?

Tropical coastal areas have more to offer tourists in terms of sun, sea, and sand compared with the coasts in temperate climate zones. The Philippines' tropical climate, its 7,107 islands and diverse coastline of 17,460 kilometers create an important area for the development of coastal tourism. In the Philippines, development typically consists of small resorts, which are somewhat integrated into the local culture and environment.

Most coastal resorts are poorly planned with respect to the protection of the resources that make them attractive to tourists, namely coral reefs, near-shore water quality, and clean beaches. Large international resort chains have only recently begun to implement more stringent environmental practices on their properties.

The Philippines has a diverse coastal environment with a variety of ecosystems and an extremely rich biodiversity and productivity. Each ecosystem plays a critical role in maintaining the health of the coastal zone and of each other. Maintenance of coastal ecosystems is important in sustaining the tourism industry. Promoting conservation is an integral objective of eco-tourism. Apart from educating the guests about local environmental and conservation issues, revenue from eco-tourism should at least partially finance the costs of protecting natural areas. Since guests have different motivations for visiting the area, it is important to access market data, from government agencies and from visitors themselves, to better understand the market in order to develop the area as a coastal tourism destination.

Source: Huttche, White and Flores, Sustainable Coastal Tourism Handbook for the Philippines, 2002.

Willingness to Pay for Conservation: A Case Study in Port Barton, Palawan

In early 1998, a survey of tourists in Port Barton, Palawan was made to provide information for improving Port Barton as a tourist destination. The survey highlighted the characteristics of tourists coming to the Philippines and similar destinations and the experiences they seek during their stay.

Among the results of the survey was the WTP for conservation of the existing ecosystem in the area.

WTP for conservation: All who were surveyed were willing to "contribute" an average of PhP120 per person as a user fee to a marine sanctuary; 78% were willing to contribute an average of PhP150 to an environmental fund.

Perceived problems: Approximately 50% felt there were environmental problems in Port Barton. Complaints included litter on the beach, deforestation, coral damage, forest fires, and noise.

How to improve Port Barton: Most common answer – maintaining the cleanliness of the area.

CHALLENGES

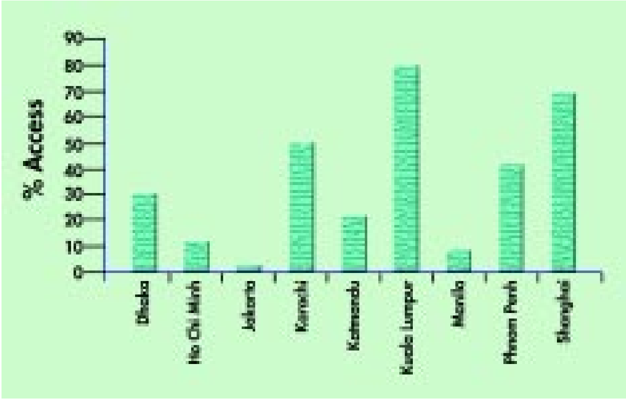
Clean water is essential in reducing poverty and achieving Millennium Development Goals (MDG) in the Philippines. The current surface and groundwater quality and availability indicate that access to clean water is becoming acute in urban and coastal areas. Poor quality water has large economic and quality of life costs, both now and in the future, in terms of health impacts, foregone tourism revenues, lost fisheries production, potable water, loss of image, etc. Economic costs of polluted water, for quantifiable impacts alone, are estimated to be more than PhP 67 billion (or US $ 1.3 billion) annually.

Household wastewater or sewage is a major source of pollution because treatment facilities are lacking. There has been little investment in collection, treatment, and disposal facilities. Institutional roles are unclear, and revenues for investment along with operation and maintenance are low. This is because user fees are low and fines and enforcement are not sufficient deterrents to reduce pollution. Access to sewerage in Metro Manila is poor compared with other cities in Asia (see Figure 25). Solid waste is also a major source of pollutants for water bodies which needs to be quantified and reduced.

Water quality needs to be addressed within an Integrated Water Resources Management (IWRM) framework that embeds social, economic, and environmental considerations. This section discusses challenges faced by the Philippines over the next several years to improve the quality of its surface, ground, and coastal waters to provide healthy living conditions.

1. Public Disclosure and Participation. Without reliable information and active involvement, the public assumes water quality management to be purely a government function. Political action, participation in decisions, and demand for specific actions will continue to lag without public information and knowledge. The public does not know or recognize the need and utility of its participation. Thus, there should be a systematic attempt to raise public awareness of the health and economic impacts of poor water quality and encourage participation in decision-making. Further, there should be a systematic collaboration and consensus building across sectors, and among affected stakeholders, to agree on priorities and adoptable measures. Eco-watch program for beaches where they are rated according to their water quality and suitability for recreation should be initiated in the Philippines (e.g. Blue Flag System for beaches in Mediterranean). Through such a program, coastal water quality would be recognized as an economic asset that plays an important role in coastal tourism. Once beaches are rated for their water quality, the need for sanitation and sewerage facilities in coastal areas for sustainable tourism would become obvious to LGUs and other stakeholders.

Figure 25. Access To Pipe Sewerage In Asian Cities



Sources: World Bank, ADB and other reports.

2. Wastewater Management in Urbanized and Coastal Tourist Centers. Focusing on critical areas is cost-effective and can benefit 40 million people, increase coastal tourism, and increase fish production, benefiting coastal areas and cities such as Manila, Cebu and Davao. The following needs to be addressed:

• *Expanding user base.* In cities, where sewerage systems are available, service connections should be expanded to cover all connectable properties. This can lower connection and user charges while making it attractive for private sector operators by expanding the number of users. At the same time, this would displace the need for individual septic tanks, which pollute the environment. The sludge from the septic tanks need septage treatment . For the unsewered areas, there are common sanitation and treatment technology choices that are low-cost, energy-efficient, have lower operation and maintenance requirements, and produce fewer byproducts.

• Constructing sewerage facilities in target areas. Facilities to collect, treat, and dispose waste - a major source of BOD - need to be constructed in the major urban and tourist areas.

• Promoting intermediate solutions. The following options may be applied in targeted areas: (a) dry-weather flow (DWF) interceptors to capture solid waste and wastewater at storm drainage outfalls (as proposed in Cabanatuan City), while serving concurrently as a primary treatment system; (b) intercepting pipelines in tourist or in urbanized areas to gather individual septic tank effluents, preventing direct discharge into ground and surface water and enabling proper treatment prior to disposal; (c) reuse and recycling of treated wastewater (as practiced in Hawaii, Australia and India) for irrigation and industrial use to minimize groundwater abstraction; and (d) where saline water intrusion and seepage pollution from surface runoff has occurred, recharge of groundwater to stop further damage (as now required in Chennai, India).

• Smaller collection and treatment systems. Prohibitive costs of conventional technologies for large sewage collection and treatment systems is a major deterrent to investment and operation. Unbundling or creating smaller, manageable systems for community-and neighborhood-based sub-systems may allow low-cost and acceptable technologies to flourish. Examples include: community-based small-bore sewerage systems in Port Barton, Palawan, and Orangi in Pakistan; and the condominial sewerage systems of Malang in Indonesia, Karachi in Pakistan, La Paz suburb in Bolivia, and Natal, Brasilia, Recife, and Salvador in Brazil. Similarly decentralized wastewater treatment systems, based on semi-standardized designs and a modular approach in operations and maintenance, do not have to depend on expensive technical inputs and energy. This has been successfully implemented by small and medium-sized coastal resorts in Bali, Indonesia. With active community participation, user needs and benefits would be better understood, and the resulting system will enjoy their active support and participation. The role of wetlands also needs to be explored.

3. Stimulating Revenue and Investments. Both tested and innovative approaches are needed to expand financing options for wastewater infrastructure. Inadequate funding ability of LGUs is further constrained by the limited willingness of households to pay for sewerage services. These constraints are obstacles to investments by the private sector.

• Increasing wastewater fees. The current levels of sewerage fees are considerably lower than other middle-income countries. There is a need for LGUs to demand and collect reasonable fees to recover the operation and maintenance costs of sewerage facilities, at a minimum.

• Broad-base industrial pollution charges. Successive governments have committed to Agenda 21 (adapted in 1996), which articulates the need for implementing the "polluter pays principle (PPP)." Modest gains have been made in Laguna de Bay through the introduction of pollution charges, and more recently DENR has mainstreamed a nationwide pollution charges program. Besides providing incentives to enterprises to reduce pollution, the revenues could also be used to support wastewater infrastructure. LLDA experience indicates that a pollution charge program is most effective at the watershed level.

• Incentives for private sector participation. The tasks of sewage collection, treatment, and disposal facilities by the private sector would need guaranteed user fees and increased accountability of service delivery to reduce risks. Incentives could be in the form of: tax incentives for the service provider, a guaranteed rate of return (based on prudent investment), and tax discounts for users. Other incentives are needed to increase the market viability. Since financing for such facilities is new to commercial banks, there is need for access to credit or guarantee facilities. Private sector or quasi-government organizations such as water districts may be encouraged, thus helping the Government to reduce the pollution loads that are disposed into water-bodies by allowing interested companies to collect, treat, and dispose the wastewater for a fee (e.g. experience in Brazil). This reduces the financial burden of the LGUs by capitalizing investments for treatment facilities.

4. Effective Regulations: Enacting the Clean Water Act. The proposed Clean Water Act is a national strategic goal. While passing this bill is important, implementation will require financing and enforcement. The Government would need PhP 25 billion / year for the next 10 years for physical infrastructures alone. Unless the law is assured of adequate funding, it will remain unimplemented or under-implemented as in the case of the Clean Air and the Ecological Solid Waste Management Laws. Considering the Government's growing fiscal deficit, it will be necessary to secure private sector participation and investments. Clear Implementing Rules and Regulations (IRR), where roles, standards, procedures, etc. are clearly detailed, should be promulgated as soon as the Clean Water Act is passed. The need for a separate environmental agency should be evaluated.

ANNEX 1: HOT SPOTS AND METHODOLOGY FOR RATING

The Philippine Government aims to maintain the quality of its surface waters according to their best beneficial use. This is embodied in the DENR Administrative Order (DAO) No. 34, which classifies bodies of water according to the degree of protection required. Class AA and SA have the most stringent water quality for fresh surface waters and marine / coastal waters; and Class D and SD waters have the least stringent water quality for fresh surface waters and marine waters, respectively.

Hot spot areas of surface water quality were assessed by province using Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) as parameters[21]. Groundwater quality was assessed by using Total Dissolved Solids (TDS) and Coliform. Saltwater intrusion was mapped based on National Water Resources Board (NWRB) data (See Water Quality Hot Spots Map). Areas in water quantity were assessed by river basin using the potential resource to demand for 2025, and annual water availability per capita.

Other hot spot areas were identified and rated on the basis of the objective of recovering the water quality of surface waters (rivers, lakes, and bays) for beneficial use, i.e., Class A (for fresh surface waters) for drinking, and Class SB (for coastal and marine waters) for recreation.

EVALUATION FACTORS

Water quality status of fresh surface waters and coastal and marine waters is rated SATISFACTORY (S), MARGINAL (M), and UNSATISFACTORY (U) based on water quality requirements as follows:

Surface Water Class A and Coastal and Marine Water Class SB

DO (mg/l)		BOD (mg/l)	
SATISFACTORY (S)	>5	SATISFACTORY (S)	<5
MARGINAL (M)	5	MARGINAL (M)	5
UNSATISFACTORY (U)	<5	UNSATISFACTORY (U)	>5
Minimum Requirement	5	Minimum Requirement	5

Water quality status of groundwater is rated SATISFACTORY (S) and UNSATISFACTORY (U) based on wells tested that met standards as follows:

Groundwater Wells Tests

TDS		COLIFORM	
SATISFACTORY (S)	Less than 10% of wells tested did not meet standard	SATISFACTORY (S)	No wells found positive for coliform (0%)
UNSATISFACTORY (U)	10% or more of wells tested did not meet standard	UNSATISFACTORY (U)	Wells found positive for coliform (>0%)
Standard	500 mg/l	Standard	negative

For water quantity rating for major rivers and basins, two evaluation factors were considered: (a) ratio of potential resource to demand for 2025; and (b) per capita water availability per year. A ratio of 2 or less for water resource available to demand per person is considered "stress" [22]. This stress is rated from 0 to 0.5 when the ratio is less than 2 or 0.5 to 1 when the ratio is more than 2.

The scorecard provides the comparative rating of the water resources quantity status in the regions as: SATISFACTORY (S), MARGINAL (M), and UNSATISFACTORY (U) based on significance of the evaluation factor's effect on the water resources quantity.

The scoring system for rating the water quantity

1.0 0.8	Below threshold level or minimum standard requirement not met - S
0.6	Within the threshold level or minimum standard requirement - M
0.4 0.2	Sufficiently higher than threshold level or minimum standard requirement - U

The weighted score for water quantity

Evaluation Factor	Indicator	Weight (in percent)
Quantity	Ratio of potential to demand for 2025	50
	Per capita water availability per year	50

[21] National standards for DO: 2-5 mg/l based on water usage and classification; BOD: 1-15 mg/l based on water usage and classification.

[22] JICA-NWRB Master Plan Study on Water Resources Mangement of the Philippines, 1998.

WATER QUALITY SCORECARD
FOR SURFACE WATER (RIVERS, LAKES, BAYS)

Region	Name of River / Lake / Bays	Location (Province)	Class	DO (mg / l) * Average (Range)	BOD (mg / l) * Average (Range)	Rating
NCR Metro Manila	Parañaque R.	Metro Manila	C	3.07 (0 - 9.50)	25.62 (7.0 - 54.0)	U
	San Juan R.	Metro Manila	C	3.0 (0 - 8.0)	34.81 (8.0 - 72.0)	U
	NMTT R. [1/]	Metro Manila	C	2.8 (0 - 7.5)	25.23 (7.0 - 54.0)	U
	Marikina R.	Metro Manila	C	5.03 (0 - 8.0)	12.11 (1.0 - 42.0)	U
	Pasig R.[2/]	Metro Manila	C	3.67 (0 - 6.5)	17.07 (2.0 - 59.0)	U
	Manila Bay	Metro Manila / R III / R IV	C	4.77 (3.90 - 5.48)	3.23 (2.50 - 4.18)	S
	Laguna de Bay[3/]	Metro Manila / Region IV	C	7.86 (6.1 - 14.0)	1.8 (0.2 - 7.0)	S
CAR Cordillera Administrative Region			ND			
I Ilocos	Laoag R.	Ilocos Norte	A	6.69 (4.03 -7.8)	—	S
	Amburayan R.	Benguet / Ilocos Sur / La Union	C	8.35 (6.0 - 11.0)	—	S
	Dagupan R.	Pangasinan	A / C	5,96 (2.0 - 11.82)	—	M
	Agno R. [2/]	Benguet / Pangasinan	A / C	6.78 (1.46 - 11.1)	—	S
II Cagayan Valley			ND			
III Central Luzon	Pampanga R. [1/]	Nueva Ecija / Pampanga	C	5.86 (4.85 - 7.21)	3.78 (1.0 - 15.0)	M
	Marilao R.	Bulacan	C	1.75 (0 - 5.75)	34.64 (10.0 - 147)	U
	Meycauayan R.	Bulacan	C	1.35 (0 - 5.55)	54.94 (11.0 - 170)	U
	Bocaue R.	Bulacan	C	6.19 (0.3 - 9.07)	11.13 (6.0 - 20.0)	S
	Labangan R.	Bulacan		5.33 (2.50 - 7.30)	18.48 (3.3 - 50.0)	M
	Sta. Maria R.	Bulacan		3.10 (0.10 - 5.20)	33.57	U
	Guiguinto R.	Bulacan	C	3.03 (1.50 - 3.80)	14.81	U
	San Fernando R.	Pampanga	C	2.86 (1.90 - 3.80)	29.4 (27.0 - 32.0)	U
IV Southern Tagalog	Mogpong R.	Marinduque	C	5.72 (3.45 - 7.80)	6.03 (4.73 - 8.01)	M
	Pagbilao R.	Quezón		5.28 (4.00 - 6.50)	6.26 (4.00 - 8.61)	M
	Bacoor R.	Cavite		6.10 ((5.30 - 7.40)	—	S
	Taal Lake	Batangas	B	7.4 0 (7.0 - 8.2)	1.50 (1.0 - 2.0)	S
	Palico R.	Batangas	C	6.95 (4.8 - 8.3)	1.11 (1.0 - 1.5)	S
	Pagbilao R.	Quezón		7.75 (6.2 - 10.2)	2.1 (1.0 - 5.0)	S
	Pagbilao Bay	Quezón	-	6.65 (4.77 - 7.10)	-	S
	Boac R.	Marinduque	C	10.42(6.24 - 17.13)	—	S
	Calancan Bay	Marinduque	-	7.14 (4.80 - 8.5)	—	S
	Cajimos Bay	Romblon	-	6.89 (6.0 - 9.0)	—	S
	Puerto Galera Bay	Mindoro Oriental	SA	7.67 (6.75 - 10.0)	—	S
	Naujan Lake	Mindoro Oriental	B	8.00 (1.0 - 9.6)	12.3	S
	Calapan R.	Mindoro Oriental		1.46 (0 - 7.0)	30.0 (2.0 - 225.0)	U
V Bicol	Bicol R. [2/]	Camarines Sur	A	5.28 (2.36 - 10.74)	—	M
VI Western Visayas	Jaro-Aganan R.	Iloilo	C	8.79 (0.90 - 14.50)	3.45 (.06 - 15.6)	S
	Panay R. [2/]	Iloilo	A	7.58 (1.40 - 12.80)	4.63 (0.4 - 52.0)	S
	Jalaur R.	Iloilo	C	8.30 (0.50 - 12.90)	6.40	S
	Iloilo R.	Iloilo		5.64 (1.70 - 10.40)	6.67 (0.8- 265.0)	M
	Panay R. [2/]	Iloilo	A	7.69 (1.40 - 23.20)	-	S
	Iloilo Coasts	Iloilo	—	8.34 (7.40 - 10.00)	-	S
VII Central Visayas	Guindarohan R.	Cebu	A	7.21 (6.50 - 8.30)	1.53 (0.4 - 4.0)	S
	Guadalupe R.	Cebu	C	4.32 (0.50 - 7.50)	1.90	U
	Dalaguete-Argao R.	Cebu	A / B	7.85 (6.9 - 10.10)	1.07 (0.3 - 2.6)	S
	Guinhulugan R.	Cebu	A / B	7.74 (7.10 - 8.40)	1.13 (0.6 - 2.4)	S
	Luyang R.	Cebu	A / B / C	7.17 (5.70 - 8.40)	1.1 (0.9 - 1.3)	S
	Cotcot R.	Cebu	A	6.56 (1.4 - 7.90)	3.06 (0.6 - 8.0)	U
	Bassak R.	Cebu		8.30	0.5 (0.2 - 0.8)	S
	Mananga R.	Cebu	A	5.5 (5.0 - 6.00)	7.1 (5.3 - 7.8)	M
	Balamban R.	Cebu	A / B	7.35 (6.3 - 8.70)	1.07 (0.2 - 2.53)	S
	Guinabasan R.	Cebu	A	8.05 (5.1 - 11.10)	2.13 (0.4 - 9.8)	S
	Minglanilla	Cebu	—	6.25 (2.1 - 9.70)	-	S
	Mandaue to Consolacion	Cebu	—	5.27 (0.0 - 14.00)		M
	Liloan to Compostela	Cebu	—	7.15 (4.1 - 14.0)	-	S
	Inabanga R.	Bohol	A / C	6.40 (5.40 - 7.40)	1.2 (0.8 - 1.6)	S
	Inabanga Beach	Bohol	-	6.93 (5.50 - 7.90)	-	S
	Ipil R.	Bohol	A	4.15 (2.80 - 5.20)	2.48 (1.2 - 4.0)	M
	Manaba R.	Bohol	B / C	7.65 (4.50 - 16.90)	—	S

WATER QUALITY SCORECARD
FOR SURFACE WATER (RIVERS, LAKES, BAYS)

Region	Name of River / Lake / Bays	Location (Province)	Class	DO (mg / l) * Average (Range)	BOD (mg / l) * Average (Range)	Rating
	Matul-id R.	Bohol	A	5.77 (5.70 - 5.90)	1.2 (1.2 - 1.2)	S
	Canaway R.	Negros Oriental	A	7.25 (6.90 - 7.40)	1.2 (0.6 - 1.8)	S
	Cawitan R.	Negros Oriental	A	7.73 (7.50 - 7.90)	0.5 (0.2 - 1.0)	S
	La Libertad R.	Negros Oriental	A	8.55 (7.90 - 9.20)	1.25 (0.1 - 6.6)	S
	Siaton R.	Negros Oriental	A	7.67 (7.30 - 7.90)	0.57 (0.1 - 1.3)	S
	Sicopong R.	Negros Oriental	A / B	3.21 (0.25 - 7.50)	40.73 (0.4 - 100)	U
	Tanjay R.	Negros Oriental	A / B	7.05 (6.83 - 7.30)	0.85 (0.7 - 1.0)	S
VIII Eastern Visayas	Danao Lake	Leyte	-	7.20 (6.3 - 7.9)	-	S
IX Western Mindanao	Mercedes R.	Zamboanga del Sur	B / C	5.16 (1.50 - 8.30)	4.72 (0.4 - 17.0)	M
	Saaz R.	Zamboanga del Sur	A / B	4.85 (1.70 - 7.80)	—	U
	Manicahan R.	Zamboanga del Sur	-	5.92 (2.50 - 9.40)	2.76 (0.1 - 8.0)	M
	Vista del Mar	Zamboanga del Sur	-	6.77 (4.90 - 8.80)	2.03 (0.1- 5.40)	S
	Cawacawa Beach	Zamboanga del Sur	-	5.4 0(2.10 - 8.50)	-	M
X Northern Mindanao	Cagayan de Oro R.[2/]	Misamis Oriental	A	8.08 (5.70 - 9.90)	—	S
	Iponan R.	Misamis Oriental	A	7.51 (2.10 - 9.20)	3.59 (0.7 - 17.0)	S
XI Southern Mindanao	Silway R.	South Cotabato	-	8.22 (5.60 - 73.0)	—	S
	Malalag Bay	Davao del Sur	-	6.30 (5.70 - 7.00)	-	S
	Digos R.	Davao del Sur	B / C	7.33 (5.80 - 9.0)	1.55 (0.1 - 7.8)	S
	Hijo R.	Davao del Norte	D	7.35 (5.80 - 9.0)	0.94 (0.3 - 4.0)	S
	Sibulan R.	Davao del Sur	A / B	7.69 (6.50 - 8.60)	1.68 (0.1 - 4.0)	S
	Pujada Bay	Davao Oriental	-	6.11 (3.20 - 6.80)	-	S
	Talomo R.	Davao City	B	7.47 (6.40 - 8.30)	2.73 (0.5 - 12.2)	S
	Padada R.	Davao del Sur	D	5.85 (0.00 - 7.40)	1.84 (0.3 - 18.0)	U
	Tuganay R.	Davao del Norte	B	6.02 (0.20 - 8.00)	1.37 (0.3 - 4.7)	U
	Agusan R. [2/]	Agusan del Norte	C	7.01 (2.60 - 8.10)	1.01 (0.1 - 5.6)	U
	Ilang R.	Davao City	C	6.69 (4.40 - 8.40)	2.29 (0.7 - 9.0)	S
	Lasang R.	Davao City	B	7.57 (6.30 - 8.50)	1.36 (0.4 - 3.0)	S
	Lipadas R	Davao City	AA / A	7.29 (5.30 - 8.50)	1.88 (0.3 - 8.7)	S
	Davao R. [2/]	Davao City	A / B	7.46 (5.8 - 8.60)	1.06 (0.1 - 2.4)	S
	Tagum R. [2/]	Davao del Norte	A	6.46 (4.80 - 7.80)	1.71 (0.3 - 36.0)	S
XII Central Mindanao			ND			
CARAGA	Agusan R. [2/]	Agusan del Norte / Agusan del Sur	A / B / C	5.94 (2.60 - 8.00)	—	M
	Magallanes R.	Agusan del Norte	A / B / C	7.75	—	S
ARMM Autonomous Region in Muslim Mindanao			ND			

Sources: DENR-EMB, 2003 and LLDA data for Laguna De Bay, 1999.

Notes: DO criteria: Class A, SB = 5mg/l
BOD criteria: Class A, SB = 5 mg/l
ND = No data
R = River
1/ NMTT - Navotas-Malabon-Tenejeros-Tullahan.
2/ Major river as per NWRB classification.
3/ Not yet officially classified but generally maintains Class C water.

* Monitored for at least three (3) years within the period 1996 - 2001 for annual mean DO and BOD levels.

GROUNDWATER QUALITY SCORECARD

Region	Province	TDS				Coliform			
		Wells Tested (No.)	Wells That Failed Criteria (No.)1/	Wells That Failed Criteria (%)1/	Rating 2/	Wells Tested (No.)	Wells That Failed Criteria (No.)3/	Wells That Failed Criteria (%)3/	Rating 2/
NCR Metro Manila	Metro Manila	49	5	10	U	ND			
CAR Cordillera Administrative Region	Benguet	ND				5	2	40	U
I Ilocos	Ilocos Norte	3	3	100	U	3	1	33	U
	Ilocos Sur	ND				3	3	100	U
	La Union	2	1	50	U	1	1	100	U
	Pangasinan	15	1	7	S	23	1	4	U
II Cagayan Valley	Isabela	20	3	15	U	9	7	78	U
	Quirino	1	0	0	S	ND			
III Central Luzon	Bataan	20	0	0	S	3	3	100	U
	Bulacan	1	1	100	U	ND			
	Nueva Ecija	14	0	0	S	7	0	0	S
	Pampanga	12	0	0	S	ND			
	Tarlac	5	2	40	U	ND			
	Zambales	6	1	17	U	5	5	100	U
IV Southern Tagalog	Batangas	15	0	0	S	ND			
	Cavite	31	1	3	S	ND			
	Laguna	69	6	9	S	6	0	0	S
	Palawan	1	0	0	S	ND			
	Rizal	5	1	20	U	ND			
V Bicol	Albay	7	2	29	U	6	4	67	U
	Camarines Norte	3	0	0	S	2	0	0	S
	Camarines Sur	5	1	20	U	5	0	0	S
	Masbate	14	11	79	U	ND			
	Sorsogon	3	0	0	S	3	0	0	S
VI Western Visayas	Iloilo	ND				2	2	100	U
	Negros Occidental	17	11	65	U	ND			
VII Central Visayas	Bohol	5	2	40	U	ND			
	Cebu	15	7	47	U	ND			
	Negros Oriental	9	1	11	U	ND			
VIII Eastern Visayas	Leyte	8	3	38	U	ND			
	Western Samar	2	2	100	U	2	2	100	U
IX Western Mindanao	Zamboanga del Norte	4	0	0	S	ND			
	Zamboanga del Sur	27	3	11	U	ND			
X Northern Mindanao	Misamis Oriental	46	12	26	U	44	44	100	U
XI Southern Mindanao	Davao del Sur	2	0	0	S	ND			
XII Central Mindanao	ND					ND			
CARAGA	ND					ND			
ARMM Autonomous Region in Muslim Mindanao	ND					ND			

Sources: NWRB-NWIN Project and compiled data from various Feasibility Studies of water districts-LWUA , 2003.

Notes: 1/ Wells tested did not meet standard for drinking water at 500 mg/l.

TDS S below 10% of wells tested did not meet standard

U 10% and above of wells tested did not meet standard

2/ Only provinces with data were included in the rating. - Coliform - S - no wells found positive for coliform (0%); U- wells tested found positive for coliform(>0%).

3/ Wells tested found positive for coliform.

ND = No Data.

WATER QUANTITY SCORECARD FOR MAJOR RIVERS AND BASINS AND HOT SPOTS RATING FOR WATER QUANTITY

Major River Basin	Water Resources Region		Yearly Water Requirement (in MCM) in 2025[1]/				Yearly Water Availability[2]/			Weighted Score	Water Rating		
			Potential	Demand	Potential Ratio	Potential Rating	[m3/person]	Ratio	Rating		Potential	Availability	Weighted Score
Pasig-Laguna	IV	Southern Tagalog	1,816	2,977	0.61	0.15	124	0.07	0.04	0.09	U	U	U
Cebu Island[3]/	VII	Central Visayas	708	932	0.76	0.19	218	0.13	0.06	0.13	U	U	U
Pampanga	III	Central Luzon	4,688	9,015	0.52	0.13	888	0.52	0.26	0.20	U	U	U
Agno	III	Central Luzon	2,275	4,063	0.56	0.14	972	0.57	0.29	0.21	U	U	U
Cagayan	II	Cagayan Valley	1,150	1,797	0.64	0.16	2,143	1.26	0.55	0.36	U	M	U
Jalaur	VI	Western Visayas	1,351	1,251	1.08	0.27	1,657	0.97	0.49	0.38	U	M	U
Bicol	V	Bicol	2,138	1,388	1.54	0.39	1,533	0.90	0.45	0.42	U	M	M
Ilog-Hilabangan	VI	Western Visayas	5,496	2,987	1.84	0.46	1,843	1.08	0.55	0.50	M	M	M
Agus	XII	Southern Mindanao	1,449	665	2.18	0.57	5,070	2.98	0.62	0.60	M	S	S
Davao	XI	Southeastern Mindanao	1,476	297	4.97	0.66	2,368	1.39	0.56	0.61	S	M	S
Tagoloan	X	Northern Mindanao	2,200	473	4.65	0.65	3,646	2.14	0.59	0.62	S	M	S
Tagum-Libuganon	XI	Southeastern Mindanao	2,504	412	6.08	0.69	3,449	2.03	0.58	0.64	S	M	S
Mindanao	XII	Southern Mindanao	24,854	6,923	3.59	0.61	7,027	4.13	0.67	0.64	S	S	S
Buayan Malungon	XI	Southeastern Mindanao	3,672	701	5.24	0.66	5,656	3.33	0.64	0.65	S	S	S
Abra	I	Ilocos	2,479	378	6.55	0.70	4,954	2.91	0.62	0.66	S	S	S
Panay	VI	Western Visayas	4,340	609	7.13	0.72	6,782	3.99	0.67	0.69	S	S	S
Cagayan de Oro	X	Northern Mindanao	4,326	355	12.18	0.88	9,321	5.48	0.73	0.80	S	S	S
Abulog	II	Cagayan Valley	1,827	237	7.72	0.74	19,228	11.31	0.97	0.86	S	S	S
Agusan	X	Northern Mindanao	15,984	1,037	15.41	0.98	13,732	8.08	0.84	0.91	S	S	S

Sources: NWRB-NWIN Project and compiled data from various Feasibility Studies of Water Districts-LWUA, 2003.

Notes:

1/ At 80% dependability of surface water availability using low flow and adopting low economic growth scenario (JICA/NWRB Master Plan Study on Water Resources Mngt. of the Philippines, 1998). Ratio of 2 or less is an indication of a shortfall that would create water shortage problem.

2/ Amount of annual renewable water resources per capita (Ibid). Areas where per capita water supply drops below 1,700 m^3/year are experiencing water stress (World Resources Institute, 2000).

3/ Cebu Island is included due to its significant economic role, second to Metro Manila.

U - Unsatisfactory M - Marginal S - Satisfactory

RELEVANT WEBSITES

Organization	Website address	Description & content
Department of Environment and Natural Resources (DENR)	www.denr.gov.ph	Overview of the programs and projects that help protect, preserve, and enhance the natural resources of the Philippines
Environmental Management Bureau (EMB)	www.emb.gov.ph	Focuses on environmental laws for various environmental media, standards, and environmental quality status of the country
Department of Health (DOH)	www.doh.gov.ph	Programs and projects to improve health and sanitation
National Water Resources Board (NWRB)	www.nwrb.gov.ph	Water resource regions and water quantity and availability
Laguna Lake Development Authority (LLDA)	www.llda.gov.ph	Environmental quality of Laguna de Bay and its watershed, including the Environmental User Fee System
Asian Development Bank (ADB)	www.adb.org/water	Information on water policy, water operations, water actions, and basic water sector information
Partnership in Environmental Management for the Seas of East Asia	www.pemsea.org	Marine pollution and initiatives in the 12 East Asian countries
Bureau of Fisheries and Aquatic Resources (BFAR)	www.bfar.gov.ph	Information on fishery laws and fishery resources, including production volume
US - Asia Environmental Partnership (USAEP)	www.usaep.org	Links to recent development in environment and its own projects in the region
US - Environmental Protection Agency (USEPA)	www.epa.gov	Extensive information available on all technical and legal aspects of environment, including water
United Nations Development Program (UNDP)	www.undp.org	UNDP water related programs
United Nations - Habitat (Water and Sanitation in the World's Cities)	www.unhabitat.org	Information on safe drinking water and adequate and low-cost sanitation facilities
Water Supply and Sanitation Performance Enhancement Project (WPEP)	www.wpep.org	Enhances the access of the under-served rural and urban poor to adequate water and sanitation services
World Bank Water and Sanitation Program (WSP)	www.wsp.org	Description and details regarding the World Bank Water and Sanitation Program
World Health Organization (WHO)	www.who.int/water	Water quality, particularly the 2nd edition of WHO Guidelines for Drinking Water Quality
Center Science and Environment (CSE)	www.rainwaterharvesting.org	Comprehensive website on water issues in India
World Bank	www.worldbank.org/html/fpd/water	Water Supply and Sanitation website
World Bank Water	lnweb18.worldbank.org/ESSD/ardext.nsf/18ByDocName/StrategyWater Resources SectorStrategyAnOverview	World Bank Water Strategy
National Environment Agency (Singapore)	www.app.nea.gov.sg	National Environment Agency (Singapore)
Pollution Control Department (Thailand)	www.pcd.com	Provides information on water quality in Thailand
Environmental Protection Department (Hong Kong)	www.edp.gov.hk	Provides information on water quality and water resources in Hong Kong
The Ministry of Water Resource (The People's Republic of China)	www.mwr.gov.cn	Information about the water resource issues in China
Network of professional institutions in Mediterranean (MEDCOAST)	www.unu.edu/hq/japanese/gs-j/gs-2003j/hokkaido3/ozhan-ab-e.pdf	Supports and enhances integrated coastal management practices and beach areas in the Mediterranean and Black Seas countries

GLOSSARY OF TERMS

Aerobic Bacteria: Bacteria that will live and reproduce only in an environment containing oxygen that is available for their respiration (breathing), namely atmospheric oxygen or oxygen dissolved in water.

Anaerobic Bacteria: Bacteria that live and reproduce in an environment containing no "free" or dissolved oxygen. Anaerobic bacteria obtain their oxygen supply by breaking down chemical compounds that contain oxygen such as sulfate.

Annual Renewable Water Resource: Average annual flow of rivers and recharge of groundwater.

Biological Oxygen Demand (BOD): The rate at which organisms use the oxygen in water or wastewater while stabilizing decomposable organic matter under aerobic conditions. BOD measurements are used as a measure of the organic strength of wastes in water. The greater the BOD, the greater the degree of organic pollution.

Coliform: A type of bacteria. The presence of coliform-group bacteria is an indication of possible pathogenic bacteriological contamination. The human intestinal tract is one of the main habitats of coliform bacteria and may also be found in the intestinal tracts of warm-blooded animals, and in plants, soil, air, and the aquatic environment. Fecal coliforms are those coliforms found in the feces of various warm-blooded animals.

Commerial Fisheries Production: Fishing with the use of fishing vessels of more than three gross tons.

Effluent: Wastewater or other liquid - raw (untreated), partially or completely treated - flowing FROM a basin, treatment process, or treatment plant.

Gross Domestic Product: The value of all goods and services produced domestically by a country.

Gross Regional Domestic Product: Aggregate of the gross value added or income from each industry or economic activity of the regional economy.

Gross Value Added: The difference between gross output and intermediate inputs.

Incidence Rate: Number of cases of a particular disease in a certain area per unit population.

Influent: Wastewater or other liquid - raw (untreated), partially or completely treated - flowing into a basin, treatment process, or treatment plant.

Inorganic Waste: Waste material such as sand, salt, iron, calcium, and other mineral materials that are only slightly affected by the action of organisms. Inorganic wastes are chemical substances of mineral origin; whereas organic wastes are chemical substances usually of animal or plant origin or sources. Bacteria and other small organisms generally can consume organic wastes.

Municipal Fisheries Production: Fishing done in coastal and inland waters with or without the use of boats of three gross tons or less.

Nutrients: Substances that are required to support living plants and organisms. Major nutrients are carbon, hydrogen, oxygen, sulfur, nitrogen, and phosphorus.

Pathogenic Organisms: Bacteria, viruses, or cysts that can cause disease (typhoid, cholera, dysentery) in a host such as a person. There are many types of organisms that do NOT cause disease and which are NOT pathogenic. Many beneficial bacteria are found in wastewater treatment processes that actively clean organic wastes.

Per Capita Annual Renewable Water Resources: The amount of available annual renewable water resources over the total population.

Receiving Water: A river, stream, lake, ocean, or other surface of groundwater into which treated or untreated wastewater is discharged.

Septic: A condition produced by anaerobic bacteria. If severe, the wastewater produces hydrogen sulfide, turns black, gives off foul odors, contains little or no dissolved oxygen, and the wastewater has a high oxygen demand.

Sludge: The settleable solids separated from liquids during processing or the deposits of foreign materials on the bottoms of streams or other bodies of water.

50% Dependability: The maximum limit to which the water resources should be exploited through provision of storage-type dams for regulating flow in each region.

80% Dependability: Corresponds to the probability of hydrologic conditions, based on which the maximum capacity of a water resources development project under the run-of-the river type is usually determined.

Water Resources Region: Based on NWRBs delineation for river basin planning. These regions do not necessarily follow geographical and administrative regions of the country. It is used in the discussion of water availability.

Watershed: A watershed is a land area drained by a body of water having a common outlet for surface run-off. A principal river basin has a drainage area of at least 40 km^2, while a major river basin has a drainage area of more than 1,400 km^2.

Sources: Adapted from various water quality glossaries and NEDA.

ACKNOWLEDGEMENTS

This Environment Monitor 2003 on water quality is a joint effort of several government agencies and private sector and civil society organizations at both the national and local levels. The valuable contributions of people who provided assistance in the preparation of this Monitor are acknowledged. The contribution, cooperation, and participation of the following are appreciated.

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Bureau of Fisheries and Aquatic Resources
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PHILIPPINES - AT A GLANCE

GEOGRAPHY

Area:
- total: 300,000 km^2
- land: 298,170 km^2
- water: 1,830 km^2

Boundaries:
- North: Balintang Channel
- South: Sulu and Celebes Seas
- East: Philippine Sea / Pacific Ocean
- West: South China Sea

Coastline: 36,289 km

Maritime claims: Total territorial water area incl.
- Economic Zone: 2,200,000 km^2
- Coastal: 266,000 km^2
- Oceanic: 1,934,000 km^2
- Continental shelf area: 184,600 km^2

Climate: tropical: northeast monsoon (Nov. to April); southwest monsoon (May to October)

Terrain: mostly mountains with narrow to extensive coastal lowlands

Elevation:
- lowest point: Philippine Sea 0 m
- highest point: Mt. Apo 2,954 m

Natural resources: timber, nickel, cobalt, silver, gold, salt, copper, petroleum

Land use:
- arable land: 19%
- permanent crops: 12%
- permanent pastures: 4%
- forest & wetlands: 46%
- others: 19%

Environment - International agreements:
party to: Climate Change, Endangered Species, Hazardous Wastes, Marine Dumping, Nuclear Test Ban, Ozone Layer Protection, Biodiversity, Wetlands, Whaling

ECONOMY / SOCIETY

GDP: 4,022.7B (2002)

GDP growth rate: real 4.4% (2002)

GDP - composition by sector: (2002)
- agriculture: 14.7%
- industry: 32.5%
- services: 52.8%

Inflation rate - consumer price index: 3.1 %

Unemployment rate: 11.4 %

Gross Domestic Investment / GDP: 19.3%

Exports of goods and services GDP: 48.9%

Gross domestic savings / GDP: 19.5%

Gross national savings / GDP: 26.8%

Industrial growth rate : 3.7%

Agriculture growth rate: 3.3%

Agriculture-products: rice, coconut, corn, sugarcane, banana, pineapple, mango, pork, eggs. beef, fish

Merchandise Exports: total value: PhP1,786 B

Merchandise Imports: total value: PhP1,989 B

Exchange Rate: 1 USD = 55.75 Philippine Peso, January 7, 2004

Population: 76.5 million (2000)

Population growth rate: 2.36%

Urban population (% of total population): 56.9

Birth rate: 29.5 / 1,000 population (1998)

Death rate: 6.3 / 1,000 population (1998)

Infant mortality rate: 48.9 / 1,000 live birth (1998)

Access to safe water (% of population): 79%

Access to sanitation (% of population): 74.22%

Life expectancy at birth: 67.4 years

Literacy (total population): 94.6%

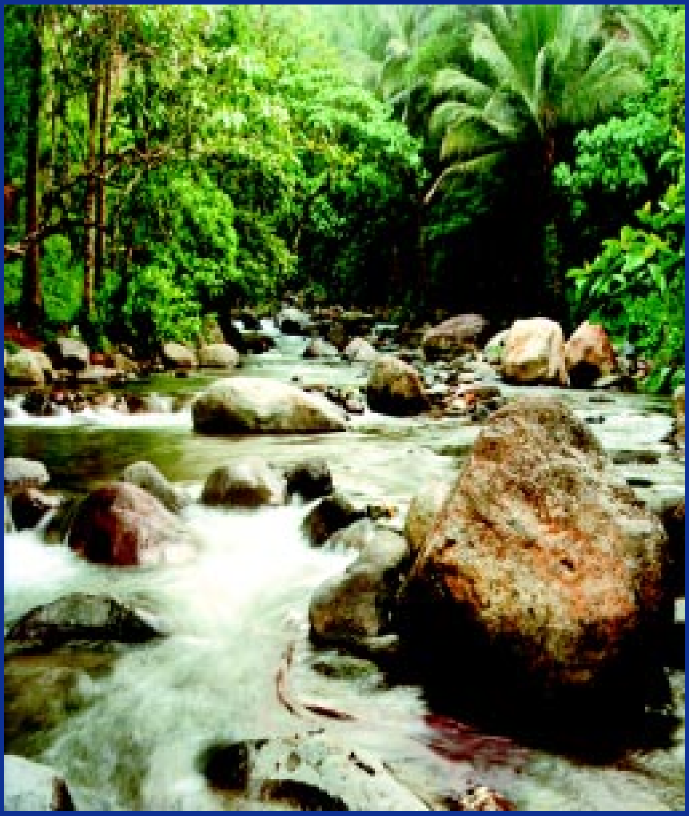
Elementary enrollment participation rate: 97%

National capital: Manila

Administrative divisions: 17 regions, 80 provinces

Independence: June 12, 1898

Source: National Statistics Office, National Economic and Development Authority, Medium Term Philippine Development Plan 2001-2004, 2001 Philippine Fisheries Profile, Bureau of Agricultural Statistics, 2000 Philippines Statistical Yearbook-National Statistical Coordination Board, World Development Indicator 2000.



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