Environmental Planning for Manado and Minahasa:

The Potential Environmental Impacts of Growth in Urban Populations, Tourism, and Industry

December 1992

OFFICE OF

HOUSING AND URBAN

PROGRAMS

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

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

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Prepared by:
Research Triangle Institute

For the:

U.S. Agency for International Development
Jakarta, Indonesia

Contract No. PDC-1008-I-00-9068-00
Delivery Order Number 23

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The views herein are those of the authors and do not necessarily reflect those of the Office of Housing or the U.S. Agency for International Development.

ENVIRONMENTAL PLANNING FOR MANADO AND MINAHASA:

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EXECUTIVE SUMMARY

OBJECTIVES AND SCOPE

1. This study was co-sponsored by the Government of Indonesia National Planning and Development Board (BAPPENAS), the USAID/Indonesia Office of Private Enterprise Development, Urban Policy Division (PED/UPD), the USAID/Indonesia Office of Agro-Enterprise and Environment (AEE), and the AID/Washington Office of Housing and Urban Programs.

This study was motivated by three concerns. First, Manado is a medium-sized city with a relatively healthy urban environment. Wise and timely planning, environmental management, and infrastructure investments should prevent the potentially serious environmental impacts of rapid urban growth. Second, rapid urban growth might also harm natural resources surrounding the city, primarily coastal and marine areas and the Bunaken Marine National Park, unless appropriate steps are taken to mitigate such effects. Third, official development plans project that tourism will grow rapidly in the Manado area and will make a substantial contribution to economic growth. There is some concern that tourism could accelerate growth in Manado's urban population and, thus, contribute directly and indirectly to degradation of environmental conditions in the city and the surrounding area. Maintaining environmental quality is important to sustaining tourism. Therefore, investments in urban infrastructure that are needed to maintain urban environmental quality might be further justified by demonstrating that local economic growth will be slowed by the environmental degradation that would occur without such investments.

2. This study has two objectives:

a. To identify, assess, and prioritize the major anticipated environmental impacts of estimated growth in urban population, tourism, and industry on the coastal and urban natural resource base in the Manado/Minahasa area.

b. To recommend ways to minimize the most serious potential environmental problems, including appropriate investments in infrastructure, financial measures to recover infrastructure costs, and policy improvements.

The period of interest is the ten-year period from 1992 to 2002. The study projects potential rates of growth in urban population and tourism and estimates the potential value of tourism in the study area over the next ten years. Potential environmental impacts of growth in urban population, tourism, and industry are assessed with respect to four distinct resources: the urban environment of Manado; the coastal land and waters of the Manado/Minahasa study area; Bunaken Marine National Park; and the Tondano River watershed.

BACKGROUND

3. Manado is a medium-sized coastal city in the northeast part of North Sulawesi, Indonesia. It is surrounded by Minahasa, a largely rural and agricultural regency. The largest sectors of Manado's economy are commerce, banking, and services, based in large part on the agricultural economy of Minahasa, plus government and university employment. Manado and Minahasa benefit from a wealth of natural resources, including a long coastline that supports fringing reefs, mangroves, and fisheries; Tondano Lake and the Tondano River watershed; and Bunaken Marine National Park, consisting of five islands and associated coral reefs, plus mangrove areas along the mainland coast.

4. The Manado/Minahasa area has been designated in national and provincial planning documents as a priority area for tourism development. The area already supports domestic tourism centered on inland resources and foreign tourism based primarily on recreation (diving, snorkling) in Bunaken Marine National Park. Developers have ambitious plans for tourist resorts in the area that will offer golf and beach vacations to foreign tourists. One resort has opened its first four-star hotel and another has begun construction.

PROJECTED GROWTH IN URBAN POPULATION

5. Manado has a population of approximately 320,000 in 1992, of which approximately 80% resides in the urbanized core area and 20% resides in more rural and less densely populated areas within the kotamadya boundaries. The population of Manado grew at average annual rate of approximately 4% between 1980 and 1990. The birth rate in Manado is 1.6%; population growth in the city, therefore, is due primarily to migration from rural areas in North Sulawesi. Assuming that the population of Manado continues to grow at an average annual rate of 3.5%, this study estimates that the total population of Manado will increase by 50% over the next ten years, reaching approximately 484,000 by the year 2002.

PROJECTED GROWTH IN TOURISM

6. Tourism development in Manado and Minahasa is targeted to foreign tourists visiting golf and beach resorts, and to divers interested in the Bunaken Marine National Park. Investors are directing the greatest proportion of their resources to "enclave" developments around four-star and five-star hotels. The potential impact of tourism was estimated under three growth scenarios: 30% (high, corresponding to the projections and plans of local developers), 26% (mid), and 20% (low). The rates are annualized average rates of growth in the number of tourists over the ten-year study period of 1992 to 2002. Results reveal that the likely impact of tourism on the existing urban infrastructure and the economy of the Manado-Minahasa area will be quite modest over the next ten years. Under the mid-growth scenario, tourists visiting the area in the year 2002 will increase the average daily population of the Manado area by less than 1% and the value added to the local economy through employment creation will comprise less than 2% of current (1992) GDP. Even under the high growth scenario, tourism will add only 1.1% to the local population and less than 3% to local GDP.

PROJECTED GROWTH IN INDUSTRY

7. There is little industry in Manado at this time and that which exists is primarily devoted to processing agricultural products. North Sulawesi has established an industrial development zone near Bitung, at the southeastern tip of the peninsula. Industries are being actively encouraged to relocate away from Manado. Therefore, industrial growth is likely to be small or even negative and is unlikely to have a significant impact on environmental conditions in and around Manado.

POTENTIAL IMPACTS OF GROWTH ON THE URBAN ENVIRONMENT

8. Population growth will cause the most important impacts on the urban environment of Manado over the next ten years. Substantial investments in urban infrastructure will be required to keep pace with population growth and to maintain the existing level of environmental quality in the city. The Indonesian government's Integrated Urban Infrastructure Development Program (IUIDP) has prepared plans for investments in water supply, sanitation, and solid waste management in Manado. These plans assume a rate of population growth lower than that actually experienced in Manado over the last ten years. Investments will need to be accelerated over and above expenditure rates in current plans to achieve IUIDP coverage targets over the next ten years.

Water Supply

9. The local water utility presently satisfies 44% of the residential demand for water through its piped water system in urban Manado, including 6% of the population that is served by communal standpipes. The utility loses approximately 42% of its total production to leaks and unaccounted-for water. Residents satisfy most of their additional demand with water from vendors and shallow wells. Transmission of pathogens appears to be controlled by disinfection of the piped water supply and the common practice of boiling water used for drinking and cooking. Reported cases of diarrhea have increased over the last several years, however, and the nature and extent of contamination in the shallow aquifer is unknown at this time. This report recommends that a careful study be conducted of existing and potential groundwater contamination and of residents' practices in the use of groundwater.

10. The IUIDP plan includes investments to reduce losses in the reticulation system, rehabilitate existing facilities, and develop new groundwater sources. Repairing leaks and reducing losses should be given highest priority because these measures improve the safety of the water supply and satisfy more of the demand for water without developing new sources or facilities. Improving the quality and reliability of the water supply will also increase its value to consumers. Although groundwater resources appear adequate to support increased usage, a systematic study of groundwater resources and flow patterns should be prepared before new wells are developed.

Urban Excreta and Wastewater Management

11. Two-thirds of the residents of Manado have access to adequate sanitation facilities, including cistern-flush or pour-flush toilets that drain to septic tanks or soak-away pits. Design standards for septic tanks appear appropriate; systems for inspection and maintenance, however, are inadequate, particularly for septage pumping and disposal. Although elevations vary, the water table is relatively shallow in many places in this coastal city. Reliance on on-site systems in densely populated areas has probably resulted in some degree of contamination of shallow groundwater with human wastes and degradation byproducts. No data are available, however, with which to determine how well the existing sanitation system is functioning, the age-distribution of septic tanks, what portion of the current stock may be close to general failure, and to what extent system failures are contributing and may contribute in the future to the contamination of shallow acquifers and surface water, including the Tondano River and Manado Bay. The recent arrival of cholera in the Manado area increases the importance of improving sanitation facilities.

12. The IUIDP plan for Manado anticipates continued reliance on on-site systems, expanding capacity for septage pumping and treatment, and constructing communal sanitation facilities for low-income groups. The plan includes funds for studying the feasibility of small bore sewers and off-site treatment lagoons for densely populated areas. This report recommends that such studies examine the potential for using a variety of non-traditional sanitation technologies that may be appropriate to conditions in Manado and can be built over time with relatively modest incremental investments. To optimize future investments in sanitation, this report also recommends that systematic data be developed concerning ground and surface water quality, geohydrology, the assimilative capacity of surface waters and Manado Bay, current health indicators, and the willingness and ability of residents to pay for sanitation improvements.

Solid Waste

13. The municipal solid waste service operates 15 trucks and a landfill, handling approximately 50% of the volume of solid waste generated in Manado each day. Service is reliable throughout the city, providing daily pick-up at most households and neighborhood collection sites. Most of the remaining waste is handled at individual homes by daily burning and burial. There is a modest amount of informal recycling of valuable materials, including aluminum, glass, and cardboard. The landfill is an open dump operation involving extensive burning, without daily covering of waste deposit cells. The landfill is not equipped for leachate collection or treatment.

14. The IUIDP plan for Manado anticipates increasing the city's fleet of collection trucks and developing a new landfill. As for other parts of the IUIDP program, investment will need to be accelerated to keep up with population growth and achieve target service levels. This report recommends that the new landfill either include provisions for leachate collection and treatment or that it be sited to avoid potential impacts of leachate on ground and surface water quality.

POTENTIAL IMPACTS ON COASTAL AND MARINE RESOURCES

15. Coastal and marine resources include coral reefs, mangrove stands, sea grass beds, and fisheries in Bunaken Marine National Park, Manado Bay, and along the northern coastline of North Sulawesi between Cape Araken and Likupang. The most important impact on these resources is overfishing by artisanal and small-scale commercial fishermen. Overfishing, however, is not attributable primarily to growth in the urban population or tourism and, thus, is not addressed in detail in this study. The most important impact related to urban growth and tourism is the destruction of coastal habitats by coastal construction practices including land clearing, diking, dredging and filling, and the clearing of mangroves and sea grass in recreational areas. Although impacts of coastal construction are limited at this time, they could become severe as the number of tourist facilities increases and in-fill development occurs along coastal roads. Development of the Molas Peninsula presents the additional potential for degrading the visual amenity values of the marine park if the design and height of tourist facilities and other buildings does not fit in with the natural forest cover now on the hillsides of the peninsula facing the park. Other potential impacts include oxygen depletion, toxic chemical contamination, and solid waste pollution in coastal waters.

16. Standards for controlling coastal construction practices should be strengthened and enforced. These rules should severely restrict land clearing, diking, dredging, filling, cutting mangroves or clearing sea grass beds, and any other practices that create direct physical alterations and damage to coastal habitats. Development on the Molas Peninsula should either be prohibited or designed to blend with its natural surroundings. Potential contamination of marine fauna with toxic chemicals can be largely eliminated by continuing the current prohibition on gold mining in the area and requiring tourist resorts to limit their use of pesticides on golf courses now being planned. A careful study of the assimilative capacity of Manado Bay and near-coastal waters for oxygen-demanding pollutants should be conducted to determine whether anticipated growth in urban waste discharges to the bay or localized discharges by tourist facilities are likely to have substantial adverse effects on coastal habitats and fisheries.

POTENTIAL IMPACTS ON THE TONDANO WATERSHED

17. The most significant impacts on the condition of the Tondano River above Manado are excessive erosion from hillside cultivation, solid and human waste discharges from settlements, and hydropower plants. The most important, by far, is soil erosion and the resultant sedimentation; this problem, however, is not related to urban growth in Manado and is not addressed in this study. Demand for power is directly related to urban growth in Manado and other cities in the region, notably the industrial zone at Bitung. The principal effects of hydropower development are habitat destruction and displacement of riparian communities, both of which can be minimized by decisions made in siting and designing hydropower projects. Dams also reduce the flow rate and volume of rivers, reducing their capacity to assimilate wastes discharged by riparian settlements, industries, and non-point discharges from agriculture. Water quality concerns should be integrated into plans for developing hydropower resources on the Tondano River to ensure that infrastructure improvements, regulatory measures, and changes in

agricultural practices throughout the watershed are coordinated and are sufficient to protect the long-term health of the river.

SUMMARY OF RECOMMENDATIONS

18. Table 1 presents a summary of the environmental problems facing the Mando areas. This study recommends that USAID, BAPPENAS, Manado, and Minahasa place a high priority on taking the following actions:

- Accelerate current plans for investment in water supply, wastewater management, and solid waste management to keep pace with higher-than-predicted rates of increase in the urban population. This study endorses current plans to repair leaks and control water losses in the piped water system, to expand coverage of on-site sanitation facilities, and to study the need for and feasibility of off-site systems for treating human wastes. The study of potential off-site systems should be expanded to include a broader range of technology options.

- Conduct a comprehensive study of the efficacy of existing sanitation systems, the content of existing discharges, current water quality conditions in groundwater, surface streams and the Manado Bay, the hydrology of surface aquifers underlying Manado, usage patterns for water from shallow wells and its role in increasing rates of diarrhea, the assimilative capacity of area waters for additional waste inputs, and the willingness of Manado residents to pay for improved water and sanitation services. This information is needed to optimize the design of future infrastructure investments in Manado.

- Improve the management of human wastes by providing technical assistance to homeowners for the design and maintenance of septic tanks and by implementing requirements for inspection and maintenance of septic tanks.

- Develop and enforce standards for coastal construction to restrict activities that cause direct destruction of coastal habitat.

- Prohibit development on the Molas Peninsula or establish design standards to ensure that any facilities constructed thereon blend with the surrounding environment and do not degrade the visual amenity value of Bunaken Marine National Park.

- Continue prohibitions on gold mining in the Tupaan District and require tourist resorts to limit their usage and discharges of pesticides, to avoid contamination of marine fauna with toxic chemicals.

- Incorporate water-quality concerns into basin-wide water resource development strategies for the Tondano River.

Table 1. PRIORITY AND COST SUMMARY OF PROBLEMS AFFECTING THE URBAN ENVIRONMENT AND COASTAL RESOURCES OF MANADO

	High Priority	Low Priority
High Cost	• Contamination of piped drinking water from leaks in distribution lines • Contamination of shallow aquifer due to inadequate sanitation in densely populated areas	• Potential oxygen depletion of Tondano River and Manado Bay from high BOD waste-water loadings and leachate from solid waste landfill • Potential depletion of deep aquifers from groundwater extraction by Manado and tourist resorts
Low Cost	• Physical damage to coastal habitats from resort construction, cutting mangroves and clearing sea grass beds • High BOD wastewater loadings to coastal waters from tourist facilities • Potential mercury contamination from gold mining near Arakan Peninsula • Contamination of coastal waters with solid waste from tourist resorts • Pesticide runoff from tourist resort golf courses	• Potential damage to marine habitats from offshore oil spills

TABLE OF CONTENTS

EXECUTIVE SUMMARY i

PART I
GROWTH PROJECTIONS

1. INTRODUCTION 1
   1.1 Objectives of the Assessment 3
   1.2 Rationale for the Assessment 4

2. PROJECTED GROWTH IN URBAN POPULATION 5
   2.1 Current Situation 5
   2.2 Forecasts 5

3. PROJECTED GROWTH IN INDUSTRY 7
   3.1 Current Conditions 7
   3.2 Economic Trends and Development Policies 7

PART II
POTENTIAL ENVIRONMENTAL IMPACTS
AND MITIGATION STRATEGIES

4. POTENTIAL IMPACTS TO THE URBAN ENVIRONMENT 11
   4.1 Introduction 11
   4.2 Water Supply 11
      4.2.1 Current conditions 11
      4.2.2 Potential impacts 12
      4.2.3 Mitigation measures 12
   4.3 Wastewater and Human Wastes 13
      4.3.1 Current conditions 13
      4.3.2 Potential impacts 14
      4.3.3 Mitigation measures 17
   4.4 Solid Waste 20
      4.4.1 Current conditions 20
      4.4.2 Potential impacts 21
      4.4.3 Mitigation measures 21

4.5 Tourism Facilities 22
4.5.1 Potential Impacts 22
4.5.2 Mitigation measures 23
4.6 Relative Significance of Impacts to the Urban Environment 24

5. POTENTIAL IMPACTS TO COASTAL AND MARINE RESOURCES 29
5.1 Introduction 29
5.2 Resources At Risk 30
5.3 Existing and Potential Impacts to Coastal and Marine Resources 32
5.3.1 Direct physical damage to coastal habitats 32
5.3.2 Soil erosion, sediments, and turbidity 33
5.3.3 Sewage, agricultural runoff, and eutrophication 34
5.3.4 Toxic chemical pollution 35
5.3.5 Solid waste pollution 36
5.3.6 Visual impact of tourism development 36
5.4 Relative Significance of Impacts to Coastal and Marine Resources 37

6. REFERENCES 41

ANNEXES

ANNEX A: SCOPE OF WORK, TEAM, AND WORKPLAN ..... A - 1
ANNEX B: SCOPE OF THE ASSESSMENT ..... B - 1
ANNEX C: TOURISM FORECASTS ..... C - 1
ANNEX D: EMPLOYMENT CREATION AND VALUE ADDED BY TOURISM ... D - 1
ANNEX E: POTENTIAL IMPACTS ON THE TONDANO RIVER WATERSHED ... E - 1

LIST OF TABLES

Table 1 Priority and Cost Summary of Problems Affecting the Urban Enviroment and Coastal Resources of Manado vii

Table 2.1 Population Forecasts for Manado and Minahasa, 1992 - 2002 6

Table 3.1 Types and Location of Industries in Selected Areas of Kabupaten Minahasa, 1992 9

Table 3.2 Types and Location of Selected Industries and Outlets in Manado Municipality, 1992 10

Table 4.1 Domestic Wastewater Characteristics 16

Table 4.2 Net Capital Costs of Additional Sanitation Capacity ($) 19

Table 4.3 Net Capital Costs of Additional Sanitation Capacity (Rp) 19

Table 4.4 Tourism Water Consumption and Waste Generation 22

Table 4.5 Summary of Impacts to the Urban Environment 26

Table 4.6 Comparison of Steps to Evaluate or Mitigate Impacts to the Urban Environment 27

Table 5.1 Summary of Impacts to Coastal and Marine Resources 38

Table 5.2 Comparison of Steps to Mitigate Impacts to Marine and Coastal Resources 39

Table A.1 Summary Workplan for the Assessment A-3

Table B.1 First-level Determination of Scope of the Assessment B-1

Table B.2 Scope of the Assessment: Urban Environment B-3

Table B.3 Scope of the Assessment: Coastal Resources B-5

Table B.4 Scope of the Assessment: Bunaken Marine National Park B-6

Table B.5 Scope of the Assessment: Tondano Watershed B-8

Table C.1 Current Accomodation and Capacity Estimates, 1990/1991 . . . . . C-2

Table C.2 Dive Operations Statistics for May 1991 to May 1992 . . . . . C-5

Table C.3 Number of Tourist Rooms Available C-10

Table C.4 Tourist Forecasts, 1992-2002 . . . . . C-13

Table C.5 Projected Number of Tourists, Moderate Growth C-14

Table C.6 Projected Number of Tourists, High Growth C-15

Table C.7 Projected Number of Tourists, Low Growth C-16

LIST OF TABLES

Table D.1 Regional GDP by Sectoral Origin D-2
Table D.2 Employment Creation in Tourism, 1992-2002 ..... D-5
Table D.3 Average Tourist Expenditures D-6
Table D.4 Employment Creation and Value Added, Moderate Growth D-8
Table D.5 Employment Creation and Value Added, High Growth D-9
Table D.6 Employment Creation and Value Added, Low Growth D-10

Table F.1 Land Use in Tondano Watershed E-3
Table F.2 Land Use and Soil Erosion around Lake Tondano E-4
Table F.3 Tondano River Water Flow E-5
Table F.4 Selected Protected Species in Tondano Watershed E-8

LIST OF FIGURES

Figure 1.1 Administrative map of Minahasa and Manado 2

Figure 5.1 Map showing the two areas of Bunaken Marine National Park 31

Figure E.1 Tondano River watershed E-2

PART I
GROWTH PROJECTIONS

1. INTRODUCTION

Manado is a coastal city and the seat of government for the province of North Sulawesi, Indonesia. Its population--approximately 320,000 in 1992--has been growing at about 4% per year over the last ten years, primarily from regional migration. Manado's economy consists primarily of commerce, banking and other services, and public sector activity (local and provincial government offices and a public university). Manado's economy is supported in large part by the agricultural production of Minahasa, a predominantly rural regency that surrounds Manado on its inland borders. The study region includes four distinct areas:

- Kotamadya Manado (the entire municipal area)
- the northern coastal areas of Kabupaten Minahasa, including Kecamatans Tanawangko, Tasik Ria-Malalayang, and Likupang;
- Bunaken National Marine Park; and
- the Tondano River watershed.

Kotamadya Manado is located at the mouth of the Tondano river, which flows into Manado Bay and links the northern coastal areas of North Sulawesi to Lake Tondano, Tondano Watershed and the hinterland of Kabupaten Minahasa. Figure I.1 shows an administrative map of Minahasa and Manado.

Manado and Minahasa benefit from a wealth of natural resources, the most visually dramatic of which is Bunaken Marine National Park. Manado is situated around Manado Bay and looks out onto Manado Tua, an inactive volcano included in the park. The park includes five islands that support extensive coral reef formations, mangrove stands, and an active fishery. The park also includes mangrove stands and dugong habitat along parts of the mainland coast.

Other important resources include the northern coastline of Minahasa, which supports mangroves, fringing reefs, and fisheries; the Tondano River, its watershed, and Tondano Lake, which supply water and power to Manado and support production of coconuts, cloves, and rice; and the urban environment of Manado itself, including its land, water, and air, Manado Bay, and agricultural areas outside of the core urban zone.

National and regional strategic planning has designated Manado city and nearby coastal areas in Minahasa regency as priority locations for tourism development. Manado and Minahasa already support domestic tourism, primarily in inland areas within the Tondano River watershed, and foreign tourism based primarily on diving and snorkling in Bunaken Marine National Park. Developers have ambitious plans for resorts that will offer golf and beach vacations to foreign tourists. One such resort has opened its first four-star hotel and another has begun construction.

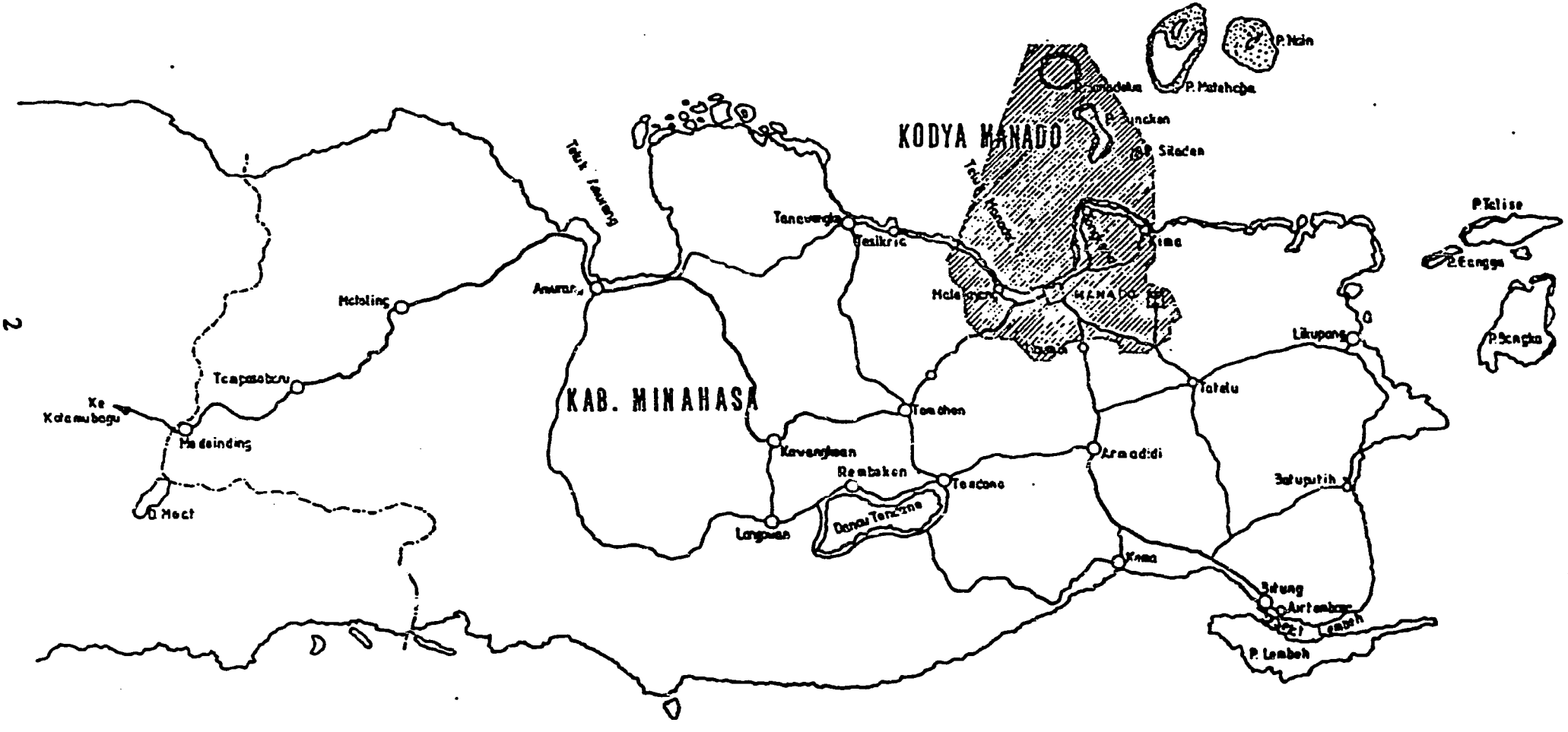

Figure 1.1 Administrative map of Minahasa and Manado.

1.1 Objectives of the Assessment

This study has two objectives:

1. To identify, assess, and prioritize the major environmental impacts of anticipated growth in urban population, tourism, and industry on the coastal and urban natural resource base of the Manado area.

2. To recommend ways of mitigating the most serious anticipated environmental problems, including appropriate investments in infrastructure, financial measures to recover infrastructure costs, and policy improvements.

The study is an example of a regional environmental impact assessment which examines the potential negative environmental effects that a specific set of *activities* may have on a specific set of *resources*. The study examines three "activities" or sources of potential impacts:

- growth in the urban population of Manado;
- growth in tourism within the study area; and
- change in industry within the study area.

The study assesses the potential effects of these activities on four identifiable resources that constitute the "coastal and urban natural resource base of the Manado area:"

- the urban environment of Manado, including its land, water, and air, and also including Manado Bay;
- Bunaken Marine National Park;
- coastal land, waters, and habitats along that portion of the northern coastline of Minahasa which is likely to be affected by growth in tourism; and
- the watershed of the Tondano River, which is the source of water and power for Manado.

The period of interest for this study is the next ten years, from 1992 to 2002.

The contract scope of work, composition of the study team, and workplan for this assignment are included at Annex A.

1.2 Rationale for the Assessment

The study was co-sponsored by BAPPENAS[1] and two offices of the USAID/Jakarta mission, the Office of Private Enterprises Development, Urban Policy Division (PED/UPD) and the Office of Agro-Enterprise and Environment (AEE). The study was motivated by the confluence of specific interests held by each of these participants. These interests have influenced the design and scope of this study.

Local and provincial officials are concerned about maintaining the environmental quality of Manado and areas surrounding the city. Manado recently received a national environmental award from BAPEDAL.[2] Promoting tourism in Manado and Minahasa is a major economic development initiative for North Sulawesi. Government officials appreciate that the long-term success of tourism depends in part on environmental conditions in and around Manado.

BAPPENAS has initiated a national program of comprehensive spatial planning with demonstration efforts in two provinces, one of which is North Sulawesi. During its first year, the program produced spatial plans for North Sulawesi, Minahasa, and Manado. These will form the basis of more detailed planning at the kecamatan level in each location. Officials in BAPPENAS have expressed an interest in examining how issues of environmental quality can be taken into account in the spatial planning effort.

USAID/AEE, in cooperation with the Ministry of Forestry and BAPPENAS, has initiated a seven-year Natural Resources Management project. One component of this project includes support for the development and implementation of a management plan for the Bunaken Marine National Park. USAID/AEE is interested in understanding the potential effects of tourism and urban growth in Manado on the marine park and including appropriate mitigation measures in the management plan for the park.

USAID/PED supports programs in urban infrastructure development, urban environmental management, and municipal finance. USAID/PED is interested in improving its understanding of urban environmental management issues and identifying innovative approaches to infrastructure financing and urban service delivery, including private sector participation.

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[1]Badan Perencanaan Pembangunan Nasional (National Planning Development Board).

[2]The national Environmental Impact Management Agency.

2. PROJECTED GROWTH IN URBAN POPULATION

2.1 Current Situation

In 1990, the population of Manado was estimated at 320,600, with about 75% living in the urban area (Monografi, 1990). About a quarter of the population is under 14 years of age. The growth rate for the period 1971-1980 is estimated at 2.76%; more recent figures from the World Bank indicate that urban growth in 1981-1990 was over 4% per year. This growth rate appears higher than expected. Published statistics based on the 1985 census indicate that the population of Manado in 1990 was only expected to be about 242,000.

The average population density in Manado is around 100 people/ha. Kecamatan Sario is considered the most densely populated area (123 people/ha) and Kecamatan Mapanget the least dense (40 people/ha). The present policy to achieve a more even population distribution is to induce residential development in the open areas along the coastal road from Malalayang to Molas.

Based on the 1990 Population Census, the total population of Minahasa is 702,604 or approximately 29% of the North Sulawesi total population. The growth rate during the period 1980-1990 is estimated at only 0.6% per annnum. Kecamatans Amurang and Likupang on the north coast have slightly larger growth rates, respectively 1.4 % and 1.3%. Minahasa may actually be losing population; in 1986, its estimated population was 825,000. Between 1986 and 1990, population estimates have been somewhat erratic with a steep decline in 1989 of about 4.6% and a recovery in 1990 of 1.2%. The low or possibly negative population growth rate in Minahasa is mainly caused by migration to the cities of Bitung and Manado.

World Bank data (World Bank, 1992) for Indonesia support the estimated growth rate of approximately 4% per year over the 1980-90 period. Indonesia as a whole experienced urban and rural annual growth rates of 5.36% and 0.79%, respectively. For Northern Sulawesi, the World Bank data indicate 4.76% growth per year in urban areas and 0.84% in rural areas. Overall, the population growth rate in Indonesia has decreased from 2.4% to 1.8% between the late 1960s and the late 1980s.

2.2 Forecasts

Middle, high, and low population forecasts have been prepared for Minahasa and Manado for the study period of 1992 to 2002. For Manado, the forecast includes estimates for the entire town area (kotamadya) and the more densely populated urban area. The latter is included for later comparison with data from the comprehensive study of infrastructure needs conducted by the Integrated Urban Infrastructure Development Program (IUIDP), which concentrates only on the fully urbanized areas (IUIDP, 1990). A considerable area of Kotamadya Manado is relatively sparsely populated and rural in character. About 25% of Manado's population live in its more rural areas. An estimated 75% of the population reside in the fully urbanized area.

Middle, high and low population forecasts are presented in Table 2.1. The middle estimates have been used for later analyses and assume a 3.5% per annum growth rate for Manado as a whole. It is likely that Manado will continue to show fairly robust growth. The country-wide decline in overall population growth rates, however, indicates that growth over the next ten years may not be as rapid as the 4% growth rate of the past ten years. Study estimates indicate that Manado will be close to one-half million people by the year 2002. Minahasa is expected to continue to experience migration of the work force to Mando and Bitung, which both have high growth potential. Projections assume a 0.5% per year growth rate for Minahasa, which would result in a total population of about 860,000 in 2002.

Separate forecasts have been prepared for the urbanized area of Manado, where the majority of urban services will be concentrated. These projections have assumed that about 80% of the total population of Manado will live in built-up areas during the study period. The population of urbanized Manado is estimated to reach about 390,000 by 2002.

Table 2.1 POPULATION FORECASTS FOR MANADO AND MINAHASA, 1992-2002

MANADO ENVIRONMENTAL IMPACT STUDY
Population Forecasts 1992 - 2002

AREA	1990	1992			1997			2002		
	Base	Best	Low	High	Best	Low	High	Best	Low	High
MANADO	320600	343435	336830	350103	407893	381093	436292	488449	431171	543700
MINAHASA	809986	818106	814041	834622	838764	824268	856448	859944	834622	891259
TOTAL	1130586	1161541	1150871	1184726	1246657	1205360	1292741	1344393	1265794	1434959
MANADO URBAN	256480	274748	269464	280083	326314	304874	349034	387559	344937	434960

Notes: Growth Rates for Best - Urban 3.5/Rural .5; Low - Urban 2.5/Rural.25; High - Urban 4.5/Rural.8
Manado urban is assumed to be 80% of total Manado population (IUIDP).

Source: Sensus Penduduk 1990, Kantor Statistik Koydya Manado Table 3
Minahasa Dalam Angka 1990, Kantor Statistik Kabupaten Minahasa Table 3.1.1
Indonesia: Growth, Infrastructure and Human Resources' The World Bank, May 26, 1992

3. PROJECTED GROWTH IN COMMERCIAL SECTOR

3.1 Current Conditions

The economic structure of Kabupaten Minahasa is typical of an agriculturally-based region: farming dominates employment (74%) and only 5% of the population is employed in small industry. The trend, however, is toward increased government employment and services, primarily in the northern coastal areas. The largest share of the regional GDP of Minahasa in 1989 was derived from agriculture (46%); smaller shares were from transport and communications (11.7%), housing and public administration (11.6%), and trade (7.0%). In 1989, the total regional GDP was Rp 329 billions in constant 1983 prices.

In contrast, Manado is dominated by an urban-based service economy. About 46% of employed workers in Manado were in the government or civil service. Private sector employment came from two sectors, construction (23%) and commercial (17%). The urban GDP was derived mostly from transport and communication (26.1%) and trade (22%). Government employment and public administration accounted for 19.2% of value added to the city's GDP. Hotels and restaurants contributed only 1.8% of the total income.

In 1990, the regional GDP for Manado was estimated at Rp 194 billions in constant 1983 prices. This was about 60% of the GDP for Minahasa. The regional GDP has experienced substantial growth at a rate of 3.29% in 1986 and 5.47% in 1988, and is expected to continue to accelerate in the period of 1990-1995 to an average annual growth rate of 8.00%.

Manado's economy is based primarily on commercial services for the surrounding agricultural areas, urban service sector businesses, and public sector (government and university) employment. There are few industrial facilities and no heavy manufacturing or mining in the area. The area's energy is supplied by hydropower from the Tondano River. Tables 3.1 and 3.2 describe the locations and types of industries in Minahasa and Manado, with emphasis on the industries located in the Tondano watershed, along the major rivers in Manado Kotamadya, and the northern coastal areas of North Sulawesi (from Tanawangko to Likupang).

Industries in the area generally do not have wastewater treatment facilities; they discharge their wastewater directly into surface waters. Most are small to medium-sized food processing operations that discharge oxygen demanding (mainly organic) compounds, measured as BOD_5 (5-day biochemical oxygen demand) and COD. Some nitrogen and phosphorous compounds are also discharged. Currently, no industries in the area are known to discharge significant quantities of toxic substances.

3.2 Economic Trends and Development Policies

Agriculture is expected to continue to be a leading sector in Minahasa with emphasis on estate crops, principally cloves and coconuts. Based on the low coverage of forests in

Minahasa (only 25% of total land-use), very carefully designed policy is needed if the forest resources in Minahasa are to be harvested without degrading watersheds. The same careful policymaking needs to be extended to mining activities in the watersheds and coastal areas. Gold mining may generate mercury pollution. The Tondano watershed already shows the negative impacts of low forest coverage and generates large volumes of sediment that threaten water supplies and hydropower generation downstream.

The development of the regional GDP during Pelita IV shows the structure of the regional economy of Manado. There have been no substantial shifts in the economy. Three major sectors-- transportation-communication, trading and commercial, and government services-- dominate the local economy and employment. These sectors together contributed a total of about 73% of employment in 1983 and only slightly decreased to 69% in 1990.

The North Sulawesi government is actively promoting the transfer of industrial facilities from the northern coastal areas of the province to the Kabima Industrial Zone, located between Kauditan, Bitung, and Kema. This policy is reflected in the official spacial development plan for North Sulawesi (RSTRP, 1991). The Kabima Industrial Zone is primarily planned for processing agriculture products such as estate crops, forest products, and fish. Moving industrial and commodity processing facilities to Kabima has the dual advantages of moving products closer to the port city of Bitung and protecting the environmental quality of the northern coastal areas of North Sulawesi.

Because of the official policy to concentrate industrial development near Bitung, this study concludes that the number of industrial and commodity processing facilities in Manado and its surrounding area will decline over the next ten years. Indeed, in attempting to visit some of the factory sites listed on current registers for Manado, the study team observed several facilities that had already closed up and moved, leaving only commodity purchasing and transport operations behind. It is also unlikely that new manufacturing operations of any substantial size will locate in or near Manado.

The new development policy for Manado is to develop the service sector, including banking, commerce, transportation, and tourism. Investments, including physical investments and provision of public utilities, are being directed to foster growth in these sectors. Manado's growing service sector will include an increasing variety of businesses that use environmentally harmful substances, such as dry cleaners, printing shops, photo processing shops, auto mechanics, painting contractors, and others. Although such businesses rarely cause substantial environmental harm, they can be the source of localized threats to environmental quality and public health.

Table 3.1 TYPES AND LOCATION OF INDUSTRIES IN SELECTED AREAS OF KABUPATEN MINAHASA, 1992

Kecamatan	Types of Industries
Tondano	Printing, Rice Mill, Meat, Abatoir, Tanning, Garments, Metal Works, Auto Workshop
Kakas	Clove Oil, Rice Mill
Eris	Clove Oil
Remboken	Clove Oil, Ceramics, Metal Works
Langowan	Clove Oil, Rice Mill, Brick, Garments
Tompaso	Sulphur, Kaolin, Ceramics
Kawangkoan	Corn, Meat, Abatoir, Tanning, Garments
Airmadidi	Nutmeg Canning, Carbon, Palm Sugar, Nutmeg Oil, Dried Fish, Fish Smoking, Ice, Garments
Dimembe	Nutmeg Canning, Tapioca, Carbon, Palm Sugar, Limestone, Nutmeg, Biscuit, Coconut Oil, Rice Mill, Corn, Meat, Abatoir, Carbon, Brick, Auto workshop, Hotels
Pineleng	Nutmeg Canning, Clove Oil, Nutmeg Oil, Nutmeg, Brick, Thatch roof.
Wori	Tapioca, Fish Meal, Carbon, Carbon, Palm Sugar, Droed Fish, Biscuit, Coconut Oil, Rice Mill, Meat, Abatoir, Hotels, Photo Shop.
Likupang	Tapioca, Fish Meal, Carbon, Palm Sugar, Dried Fish, Fish Smoking, Biscuit, Soybean, Cattle Feed, Coconut Oil, Carbon, Hotels.
Tomohon	Clove Oil, Sulphur, Printing, Palm Sugar, Soybean, Cattle Feed, Meat, Abatoir, Brick, Garments, Woodcarving, Metal Works, Auto workshop.

Source: Minahasa Dalam Angka, 1990

Table 3.2 TYPES AND LOCATION OF SELECTED INDUSTRIES AND OUTLETS IN MANADO MUNICIPALITY, 1992

Kecamatan:	Types of Industries	Outlet
Molas	Food, Soybean, Soysauce, Beverages, Coffee, Ice, Woodworking, Plastic/Sponges, Chemicals, Garments	Jengki-Tondano Sawangan, Coast
Wenang	Food, Soybean, Ice, Auto Workshop, Building Materials, Garments	Jengki-Tondano Sawangan, Coast
Sario	Building Materials, Food, Beverages, Ice, Soybean	Sario
Malalayang	Food, Nutmeg, Building Materials	Malalayang, Bahu

Source: Monografi Manado, 1990

PART II
POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION STRATEGIES

4. POTENTIAL IMPACTS ON THE URBAN ENVIRONMENT

4.1 Introduction

This portion of the analysis evaluates the potential effects of growth in urban population and tourism on the urban environment, i.e., the land, air, and water resources of Manado and its surrounding area. The analysis also considers the potential impacts of water pollution on public health. It focuses on three stresses which urban residents and tourists place on the urban environment: the demand for potable water, the generation of wastewater, and the generation of solid waste.

The Government of Indonesia's Integrated Urban Infrastructure Development Program (IUIDP), supported by the World Bank, has studied infrastructure requirements in Manado and reported its findings in *Indonesia: Growth, Infrastructure and Human Resources* (World Bank, 1992). Based on its findings and negotiations with the city of Manado, IUIDP prepared its current 5-year infrastructure development plan (PJM) for Manado. This study developed independent estimates of growth in demand for services, reviewed the IUIDP report and PJM, and concluded that the rate of investment must be accelerated beyond the level proposed in the PJM to reach agreed-upon targets for service and coverage.

4.2 Water Supply

4.2.1 Current conditions

The Manado PDAM[3] draws water from the Tondano river and from deep wells and springs to supply piped water to residents. The PDAM supplies piped water to approximately 51% of the population in the urban center of Manado, which represents 44% of the population of the entire kotamadya. Piped water service in the urban center of Manado includes a substantial number of communal standpipes serving 6% of the urban population. The PDAM loses approximately 42% of its production volume through unaccounted-for losses, both leaks and administrative losses.

Many households in the urban center of Manado use shallow wells as a supplementary source of water. Wells in densely populated urban neighborhoods (kampungs) are often in close proximity to septic tanks and latrines. Residents in the more rural areas of the kotamadya use groundwater from wells and tapped springs as a primary source of water.

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[3]Perusahaan Daerah Air Minum, the municipal water supply agency.

4.2.2 Potential impacts

The current production and use of potable water in Manado has two environmental impacts at present: public health problems stemming from the consumption of contaminated water, and the contamination of surface water with byproducts from water treatment. Future impacts could be more serious. If water production is not increased to meet the future demand of a growing population, groundwater resources could be depleted. Furthermore, public health problems could become worse as population densities increase, if Manado does not develop and maintain an adequate and safe supply of potable water.

Drinking water obtained from shallow wells and from the piped water supply may be contaminated with pathogens that cause diarrheal infections and other illnesses. Such contamination, if it exists, is caused by inadequate management of human wastes and poor maintenance of potable water supply lines. This problem is discussed further in the section on wastewater management.

The PDAM uses alum (aluminum sulfate) as a floculant to remove suspended solids from raw river water. Used alum sludge is returned to the river downstream of the treatment plant. This practice adds solids to the river, but probably has an insignificant impact compared to the sediment load already in the river from upstream erosion.

Water quantity and aquifer depletion does not appear to be a problem at this time. The water level in the river does not drop below usable quantities and shallow and deep groundwater resources appear to be abundant, with some localized saltwater intrusion near the coast (Sutoro and Satriyo, 1985). Groundwater hydrology in the area is not well understood, however, and the potential effects of increasing groundwater extraction to meet growing demand for water cannot be determined without a thorough assessment of the production potential of shallow and deep aquifers in the area.

4.2.3 Mitigation measures

The IUIDP study and the PJM have identified several feasible approaches to increasing the water supply for Manado. The PJM recommends expenditures to control leakage and lost water, rehabilitation of the treatment plant, rehabilitation of the major spring, and the construction of new groundwater works. Controlling losses and rehabilitating existing facilities will probably have the largest environmental benefits (assuming construction techniques are environmentally sensitive), because they do not involve the development of new sources and, in fact, reduce the need for such development. Reducing leaks in the water distribution system will also help reduce the potential for contamination of the piped water supply with wastewater.

Several issues need to be addressed with respect to Manado's plans to increase its water supply. First, and most important, more information is needed on the hydrology of shallow aquifer(s) underlying Manado and their existing levels of contamination, if any, with residuals

from human waste and wastewater. It is also important for public works and health officials to understand to what degree people rely on water from shallow wells, how such water is being used, and how reliance on this source may be affected by increasing water tariffs or improving the quality of piped water.

Second, the population estimates used in the PJM to plan increases in Manado's water supply during the period 1991 to 1995 appear to be too low. These estimates have used an urban growth rate for the central urban area, representing between 75% and 80% of the total urban population, of 1.3% per year. These rates were based on projections of the 1985 partial census.

In contrast, most recent estimates of population growth based on the 1990 census for the entire Kotamadaya indicate an annual growth rate of 4% per year for the period 1980 to 1990. Furthermore, recent IUIDP forecasts of the central core population show a growth rate of 2.9% per year. This would imply a growth rate for the area around the central urban core of about 8% per year, given a total growth rate of 4%. The residents in the area surrounding the central urban core will also need to be served with water and sanitation. The current study uses a growth rate of 3.5% for Manado, and projections run between 1992 and 2002 (see Table 2.1).

Finally, the potential hydrologic effects of developing new groundwater sources should be evaluated. More information is needed on the hydrology of deep aquifers in the area, their long-term production capacity, and the potential effects of increased extraction rates.

4.3 Wastewater and Human Wastes

4.3.1 Current conditions

All sanitation facilities in Manado are on-site systems with septic tanks, leach pits, or latrines. Approximately 66% of residents have adequate sanitation (Kesehatan Manado, 1990).

Septic tanks are constructed from concrete or concrete bricks and have two or three chambers, with the last chamber open at the bottom and serving as a leach pit. Dead coral has been used to some extent as an underdrain material for septic tanks. Soil permeability is low to medium and groundwater depth averages approximately 3 meters. Manado has a standard design for septic tanks; however, there are no provisions for inspection of new construction or the operation and maintenance of existing systems. Hotels and institutional buildings also use septic tanks. Tank maintenance is the responsibility of the property owner. Annual pumping is recommended but there is only one operational pumper in the city, with a capacity of 3 tanks per day. Since there are an estimated 20,000 septic tanks in Manado, tanks are pumped rarely, if ever. Pumped septage is transported to a private facility near Tomohon where the waste reportedly is treated and reused for fertilizer.

The squatter and low income areas near the rivers and in intertidal areas of the coast are not serviceable by conventional septic tanks. They are served by public, communal facilites (MCK) which provide adequate sanitation if used. Waste disposal in these communities, however, often results in the direct deposition of human wastes into the river.

4.3.2 Potential impacts

Domestic wastewater consists of grey water from cleaning, bathing, and other household uses and sewage containing human wastes. In Manado, grey water is generally discharged from households to the surface drainage system which has outfalls to surface streams. Water bearing human wastes passes through septic tanks or latrines to groundwater, from which it eventually discharges to surface streams and Manado Bay.

The mismanagement of domestic wastewater can cause two types of environmental impacts. The first is contamination of potable water supplies with pathogens and other pollutants from human waste. The second is reduced concentrations of dissolved oxygen in surface waters, which may have a detrimental impact on aquatic and marine fauna.

<u>Contamination of potable water supplies.</u>

Inadequate management of human wastes may result in the contamination of potable water supplies with pathogens and nitrates, both of which cause public health problems. Human wastes can contain a large variety of pathogens; from a public health perspective, the most significant are bacteria that cause diarrheal diseases and cholera, and viruses that can cause hepatitis. High concentrations of nitrate in drinking water can cause methemoglobinemia in infants less than 6 months old.

Pathogens will tend to die off in septic tanks that are operating properly, given adequate retention time, or will be trapped in the surrounding soils. As indicated earlier, however, there is good reason to believe many septic tanks in Manado are not operating properly. There is no regular inspection of new tanks and maintenance (pumping) is rare. The absence of any greater demand for pumping indicates that tanks rarely overflow. Given other factors, this probably indicates that they are not retaining solids well and that residence times for waste in the tanks are short or that tanks are being bypassed entirely. Increases in population density also affect the effectiveness of on-site sanitation systems as the absorptive capacity of soils is surpassed and contamination of groundwater exceeds natural flushing abilities.

Shallow aquifer(s) in the more densely populated areas of Manado are likely to be contaminated with organics, nitrates and pathogens; water quality data, however, were not readily available to confirm this. Shallow wells were observed in close proximity to latrines and septic tanks in the kampungs. Informal reports by residents indicated that it is standard practice to boil all drinking water; however, data on the use of hygiene practices to control diarrhea were not available. Boiling controls pathogens but does not remove nitrates.

Public health data for Manado show an increase of approximately 70% in reported cases of diarrhea over the last six years. This increase is much larger than the 25% total population growth over the same period. Manado's health agency has conducted public education campaigns concerning diarrhea over the same period and, thus, the increase is probably due in part to greater public awareness and people's willingness to report cases and seek treatment. However, these figures may also indicate an increasing problem with water contamination. It is likely that water contamination is contributing to the increase in diarrhea, although the magnitude of this impact cannot be determined from information available for this study.

It is important to note that the first reported outbreak of cholera in Manado occurred recently, in the area of Molas. Health officials were aware of a previous small outbreak in a distant kabupaten (Gorontalo), but this was apparently the first incident in Manado, at least in recent history. Early newspaper articles reported eight cases in the initial outbreak. The presence of cholera in the area should make improving human waste management a higher priority.

In the rural areas around Manado, on-site systems become less of a problem because lower population densities are better suited for on-site systems and more forgiving of failures. Maintenance will still be an issue with rural systems and septage must be managed. This includes provisions for pumper trucks and septage treatment. Latrines typically are more appropriate in rural areas than in urban areas because of the lower population densities and greater assimilative capacities of soils.

Reduced concentrations of dissolved oxygen in surface waters.

Table 4.1 is a compilation of some of the more important constituents in wastewater. BOD_5 (five-day biochemical oxygen demand) is a measure of the quantity of biodegradable compounds (both dissolved and suspended) in wastewater. When discharged into aquatic environments, these compounds are oxidized, drawing down the concentration of dissolved oxygen in the water. Nitrogen and phosphorous may also reduce dissolved oxygen concentrations through the process of eutrophication. Nitrogen and phosphorous are nutrients that, when discharged to surface waters, may stimulate the growth of algae and aquatic or marine flora. Subsequent decomposition of the increased biomass consumes dissolved oxygen.

Properly operating septic tanks can remove 60% of the BOD_5 and most of the inorganic solids in sewage. Nitrogen compounds tend to be oxidized to nitrates, which are mobile and will be transported via groundwater to surface water. Phosphorous compounds associate strongly with many soils and are generally retained in soils down-gradient from septic tank leach pits. Grey water generally contains low concentrations of oxygen demanding compounds (BOD_5), low to moderate amounts of suspended solids, few pathogenic organisms, and moderate amounts of nutrients (mainly phosphorus compounds).

Table 4.1 DOMESTIC WASTEWATER CHARACTERISTICS

Constituent	Range of Mass of Constituent (g/capita/day)	Total Mass of Constituent Produced for 343,435[4] people (kg/day)
BOD_5	45 - 54	15,500 - 18,500
Inorganic solids	5 - 15	1,720 - 5,150
Nitrogen, total as N	5 - 12	1,720 - 4,120
Phosphorous, total as P	0.8 - 4.0	275 - 1,370
Microorganisms, total bacteria	10^9 - 10^{10} per 100 mL of wastewater	

Source: S.J. Arceivala, Wastewater Treatment and Disposal, 1981, Marcel Dekker, New York.

An unsystematic inspection of soaps and detergents available in Manado indicated no attempt to limit phosphorus concentrations in these products. The combination of grey water disposal to surface waters and suspected high concentrations of phosphorus compounds in cleaning agents lead to the possibility of substantial amounts of phosphorous entering the rivers and marine environment.

The discharge of grey water to surface streams and the sanitation practices of communities near the rivers (combined with leachate from solid waste dumps and waste discharges from food processing, to be discussed later) probably results in a significant reduction of dissolved oxygen in surface streams as they pass through Manado, particularly in the lowest reach of the Tondano River. Although some water quality data have been collected for the Tondano River, they are insufficient to evaluate the status of the river and to what extent it is affected by wastewater.

Nutrient loadings into Manado Bay are unlikely to have a substantial effect on dissolved oxygen concentrations in the bay at the current rates of discharge. The assimilative capacity of the bay is probably quite large, due to its depth and the strength of local currents. Water quality data are not available, however, to evaluate the situation and support this conclusion.

Much more information on water resources is needed to predict the environmental impacts that substantial growth in the urban population may have on these resources. Information is needed about current water quality conditions, the area's hydrology and geohydrology, and

[4]See Table 2.1.

the assimilative capacity of the Tondano River, other surface streams, and Manado Bay. Although urban growth will clearly place these resources under increased stress, data are insufficient to predict how rapidly such stress may degrade the resources and, therefore, what degree of mitigation will be needed to avoid substantial negative impacts.

4.3.3 Mitigation measures

The PJM identifies a strategy for improving sanitation facilities and for meeting the needs of anticipated growth. The plan calls for improving public awareness of sanitation issues, establishing a revolving fund to provide credit to property owners for the construction of on-site sanitation facilities, developing a feasibility study and detailed design for off-site facilities in high density urban areas, expanding the facitlities for handling septage, and constructing public facilities (MCK) for low income groups residing along rivers. The plan begins to address all of the anticipated sanitation needs of Manado. A substantial amount of work is needed, however, to ensure that improvements to the sanitation system are tailored to the particular circumstances found in Manado. This study concludes that several steps should be taken to improve the existing plan.

<u>Off-site systems</u>

The PJM includes plans for studying the feasibility of using small bore sewers and treatment lagoons. In accordance with national guidelines, the plan anticipates that such systems would be installed in any area that reaches or exceeds a density of 200 people per hectare or where groundwater is at a depth of 1.5 meters or less. It is possible that other types of low cost, off-site systems would be more appropriate for Manado and that such systems should be installed when population density reaches a level substantially lower than or higher than 200 people per hectare. Manado needs more information than the PJM indicates will be collected to determine whether, when, and where new off-site systems are needed, to optimize their design, and to ensure that they will actually mitigate potential environmental and public health impacts.

The first step should be a survey of the design, density, and performance of existing on-site systems, coupled with a thorough study of the current levels of contamination in shallow groundwater, surface streams, and Manado Bay. The surface drainage network should be included in this study. This information should be used to determine the effect of current conditions on water quality and public health and to estimate the residual assimilative capacity of groundwater, surface water, and the bay for future wastewater discharges. Information on groundwater flow rates and soil conditions should be used to determine whether a higher- or lower-than-standard density of on-site systems can be tolerated in Manado.

The next step should be an evaluation of alternative technologies for off-site wastewater treatment. The evaluation should be broadened to consider alternative collection systems (such as simplified sewage and condominal sewers) and treatment systems (such as multiple house

septic tanks or anaerobic filters). Systems incorporating wetlands treatment or land application should also be considered if water quality data indicate that nutrient removal is required for environmental protection.

Finally, two other factors affecting the design of off-site systems should be considered. The first is the cost and sizing of off-site systems. Technologies that can be built in smaller increments are financially more feasible because they require smaller incremental investments. Second, the potential pitfalls of off-site treatment need to be taken into account. If a large off-site system fails, larger quantities of untreated sewage may be discharged to a river or bay rather than the smaller, dispersed flows resulting from the failure of on-site systems or smaller off-site systems. Large system failures can be particularly tragic if the city is experiencing problems with cholera. Although steps can be taken to reduce the probability of large system failures as well as to minimize the impacts of such failures, planners should be realistic about the capacity of responsible agencies to conduct proper operations and maintenance procedures.

Magnitude and cost of system expansion

The PJM for Manado is designed to achieve a target of 80% coverage in sanitation for the period 1991-95. As was the case for water supply, the plan was prepared using a population projection substantially lower than the figure estimated in this study. Consequently, a greater investment than that included in the current PJM will be required to reach the 80% target. Furthermore, this study concerns the period 1992 to 2002, reaching seven years beyond the end of the current PJM. The following analysis provides a rough estimate of the potential cost of meeting the 80% target for sanitation coverage between now and 2002.

Based on figures used to develop the PJM, it is assumed that 20% of the population growth will occur in high density areas that will require off-site sanitation, 17% will be in low income areas to be serviced with communal facilities, and the remaining 63% will use on-site systems. Also, based on IUIDP figures, an off-site system for 62,111 people is expected to cost Rp 10 billion (Rp 160,000 per person); an on-site system for 7 people will cost Rp 226,000 (Rp 32,000 per person); and a communal facility with 6 stalls for 150 people will cost Rp 3 million (Rp 20,000 per person). The total capital cost of initiating service to 164,000 people between 1992 and 2002 is Rp. 19.1 billion (in 1990 Rupiah), as shown in Table 4.2.

Proposed IUIDP investments from 1991 to 1995 will finance 3600 on-site systems (serving 25,000 persons) and build 73 communal facilities (serving 11,000 persons). The construction of off-site systems is beyond the end date of the current plan. The estimated net cost of system expansion needed from 1992-2002, over and above that provided for in the current five-year plan, is shown in Table 4.3.

Table 4.2 TOTAL CAPITAL COSTS OF ADDITIONAL SANITATION CAPACITY, 1992 - 2002 (in 1990 Rp)

System	Population to be Served	Cost per Person	Total Cost for System
Off-Site	95,000	Rp 160,000/cap	Rp 15.2 billion
On-Site	103,000	Rp 32,000/cap	Rp 3.3 billion
Communal	28,000	Rp 20,000/cap	Rp 0.6 billion
		Total Cost 1992 - 2002	Rp 19.1 billion

Table 4.3 NET CAPITAL COSTS OF ADDITIONAL SANITATION CAPACITY, 1992-2002 (in 1990 Rp)

System	Population to be Served	Cost per Person	Total Cost for System
Off-Site	95,000	Rp 160,000/cap	Rp 15.2 billion
On-Site	78,000	Rp 32,000/cap	Rp 2.5 billion
Communal	17,000	Rp 20,000/cap	Rp 0.3 billion
		Shortfall Cost 1992 - 2002	Rp 16.2 billion

Tables 4.2 and 4.3 represent total capital costs required from all sources; some of the sanitation needs will be met originally by private homeowners. The cost of the septage handling and disposal equipment was not identified separately in the PJM and is not included here. The eventual cost of off-site systems may be substantially different from that estimated here if studies recommended earlier in this section indicate that systems of a different design than that used in the PJM are appropriate to Manado, or if the number of people living in high density areas that require such systems is substantially greater than or less than 20% of the population of Manado.

Other issues

The following recommendations regarding other aspects of Manado's sanitation system should also be considered:

- Technical assistance could be provided to residents to aid in the construction and maintenance of adequate sanitation facilities. This assistance could be made available to all households as well as to persons seeking credit for building new facilities.
- Permitting and inspection of new construction would help to assure that an adequate quality of construction is maintained.
- Periodic inspections of existing facilities would assist householders in identifying system problems before major failures occur.
- Prohibiting the use of coral in the construction of septic tanks would reduce this source of pressure on coral reefs.
- A study of the design, use, and effectiveness of communal facilities (MCK) would be useful in optimizing this part of the program.

4.4 Solid Waste

4.4.1 Current conditions

The Dinas Kebersihan (department of public works) for Manado operates a fleet of fifteen waste collection trucks and provides daily pickup from many individual homes and neighborhood collection sites in the urban areas of the city. Using information on waste generation rates and the capacity of the waste collection system, this study estimates that the Dinas Kebershihan collects approximately 45-55% of the solid waste generated by households, markets, and institutions in the city.[5] A higher proportion of generated waste is collected in the urban areas than in outlying rural areas of the kotamadya. From general appearances there is very little uncollected or unmanaged solid waste in urban Manado. Most streets are free of trash, with only occasional solid waste accumulations in surface drains. Waste that is not collected by the city appears to be burned or buried by residents.

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[5]The Municipal Solid Waste (MSW) generation for Manado has been estimated in two ways. Assuming a population of 274,748 people in 1992, a generation rate of 0.6 kg/capita/day and a density of 250 kg/m^3, the amount of solid waste generated in Manado is estimated at 165 tons/day and 660 m^3/day. Alternatively, a 1990 Dinas Kebersihan study found the MSW generation rate in Manado to be 3 L/capita/day which sould correspond to 820 m^3/day at the 1992 population level. The rate of collection can be calculated as follows. The average capacity of trucks in the fleet is approximately 7m^3 and the trucks average 4 trips per day; the fleet, therefore, collects 364 m^3/day. Based on the two estimates of the quantity of waste generated, the amount collected is 55% and 45% of the amount generated. In comparison, the 1990 report by the IUIDP estimated waste collection coverage in Manado at 57%.

The city's landfill operation is located in a sparsely populated area outside of the urban center. The landfill maintains open trash fires with no periodic covering of cells and no leachate control or treatment, allowing for easy access by disease vectors and dispersion of trash and ash by wind and rain. A dam has recently been built at the toe of the landfill to contain leachate and runoff; however, no provision for treatment or reduction of leachate volume has been initiated. The organic compounds and nutrients released by the decomposition of the waste materials will tend to enter the shallow ground water and surface water down gradient of the landfill. Without treatment, these contaminants will decrease oxygen concentrations and stimulate eutrophication of surface waters in the area. Toxic chemicals, if present, may also contaminate nearby waters and eventually reach the bay.

Some evidence of informal waste recycling (scavenging) was apparent in the city and at the landfill. Materials being collected included aluminum, reusable glass containers, and cardboard.

4.4.2 Potential impacts

Proper solid waste management practices minimize disease vectors (rodents, flies, etc.) and reduce the risk of leachate contamination of surface and ground waters. Current practices in Manado are generally good. Frequent waste collection appears to be effective in controlling disease vectors. The most significant potential impact at this time is the possibility of surface and groundwater with untreated leachate from the open landfill.

However, two factors may reduce the impact of the leachate on the marine environment: 1) the landfill is located inland so the stream into which the leachate discharges acts as a treatment system, removing BOD_5 and nutrients, and sacrificing surface water quality (and possibility ground water quality) in an area downstream of the landfill; 2) most of the organic wastes disposed of in a landfill are less easily degraded than human wastes and some degradation occurs in the landfill resulting in the removal of carbon compounds as methane. These factors combine to decrease the load of oxygen-demanding compounds to the environment. Assuming that the total mass of degradable waste disposed of in the landfill is of the same order as that of the human wastes generated in the city, the impacts of landfill leachate are probably less significant than those of human wastes.

The use of on-site burial and burning for uncollected waste does not appear to have negative consequences at this time, although it can result in localized ground water contamination and decreased air quality as population densities increase. Hazardous waste does not appear to be a significant component of the solid waste stream and, thus, does not present a significant hazard to the environment or to the health of sanitation workers and scavengers.

4.4.3 Mitigation measures

The PJM identifies the need for additional solid waste collection equipment and the need to design and build a new disposal site. These projects are necessary to meet existing and

projected demand at an average level of service for all of Manado of approximately 60%. Because the population has grown faster than expected, the solid waste plan must be reevaluated at the new population levels. Population distribution is an important factor in designing solid waste systems. Therefore, it is necessary to determine the differential growth rate of high density areas so that the demand for solid waste services can be determined more accurately. As suggested in the PJM, it is important to consider the environmental impacts of the landfill operation when selecting the new site and when designing and operating the facilities. This includes leachate collection, treatment, and control at the new site.

4.5 Tourism Facilities

4.5.1 Potential Impacts

The potential environmental impacts of tourism facilities on the urban environment are similar in kind to those of domestic activities, but the magnitude of the impact per person is usually greater. Tourist facilities are usually closer to the coast, they use more water per capita, they generate more solid waste per capita, and they may be associated with high impact facilities such as golf courses. Hotels will generally use groundwater if it is available and will treat surface water only if necessary. Irrigation requirements for golf courses and grounds will typically be met with surface water. Table 4.4 presents estimates of water usage, wastewater generation, and solid waste mass and volume from tourist facilities using the tourism growth projections developed earlier in this study. In addition to these direct impacts, spin-off development is likely to create settlements and resulting environmental impacts near tourist facilities in response to available jobs. The possible environmental effects of tourism development include: eutrophication of surface waters caused by the nutrients in wastewater, landfill leachate, and golf course fertilizer runoff; groundwater contamination or depletion by large users such as golf courses; and pesticide runoff from golf courses and gardens.

Table 4.4 TOURISM WATER CONSUMPTION AND WASTE GENERATION[6]

	1992	1997	2002
Tourists per day	460	2000	4200
Water usage (based on 400 L/ca/day)	180 m^3	800 m^3	1,700 m^3
Wastewater (based on 80% of water)	150 m^3	640 m^3	1,300 m^3
Solid waste (based on 1.6 kg/ca/day)	740 kg	3,200 kg	6,720 kg
Solid waste volume (based on 150 kg/m^3)	4.9 m^3	21 m^3	45 m^3

[6]based on mid projections of tourism and on water usage and solid waste generation from industrialized nations.

4.5.2 Mitigation measures

Water Supply at Tourist Resorts

Tourism developments will generally be located outside the urban areas of Manado, which will minimize their impact on the aquifers that supply the urban areas in the near term. However, large water users such as golf courses must be sensitive to their impact on local conditions and limit water quantities to acceptable levels. Hotels should be required to conduct or support assessments of groundwater potential before developing sources for high volume uses. Tourist developments are also better able to support higher technology options such as water treatment and wastewater reuse if necessary to conserve potable water supplies.

Wastewater Management at Tourist Resorts

A generally higher level of treatment is appropriate for tourist developments because of the availability of capital, operating funds, and operating expertise. Such systems may use stabilization ponds, activated sludge, or other secondary treatment. Pump stations may be incorporated to remove wastes from sensitive coastal areas or to reuse the treated wastewater for irrigation. The Manado Beach Hotel has an extended aeration activated sludge plant that was sized to handle the projected development in the area of approximately 2000 rooms. The effluent from the plant is chlorinated and discharged into a small stream which discharges into the ocean. When the plant is fully loaded the effluent will make up a significant fraction of the flow in the small stream and, thus, is likely to make the stream eutrophic and may significantly affect dissolved oxygen concentrations in coastal waters in the stream plume. The Paradise Hotel development plans to use either a lagoon treatment system or several large septic tanks. Studies at each area of tourist development are needed to determine the specific impacts that the individual development is likely to have on the environment.

Solid Waste Management at Tourist Resorts

The solid waste from tourist developments can be handled on-site for large developments. The waste from smaller developments can be incorporated into the municipal system. Large developments will need to design, build, and operate disposal sites so as to minimize environmental impacts. It may be possible to treat the leachate from these landfills in the wastewater treatment system for the development. If this is done, the treatment plant must be designed to handle the high BOD_5 concentrations associated with landfill leachate. The Manado Beach Hotel has identified and begun to use a site on its property for landfilling its solid waste. Its location is such that any leachate from the site will flow into the same stream that receives the effluent from the wastewater treatment plant. The hotel managers have no plans to treat leachate at this time. The Paradise Hotel development has not yet designated a site for its solid waste.

Golf Courses

Golf courses appear to be a main feature at most of the tourist developments. High concentrations of fertilizer for greens maintenance and of pesticides for weed and insect control are common in golf course management. Run-off from golf course irrigation may be a significant source of pollutants, causing eutrophication of streams and area coastal waters, and pesticide contamination, or even poisoning, of bird and fish species. These problems can be avoided and controlled by limiting the amount of fertilizers and pesticides used, choosing pesticides wisely, and, if necessary, collecting and treating the run-off. Resorts should be required to conduct or support studies to identify appropriate measures for avoiding negative impacts from use of chemicals on golf courses.

4.6 Summary and Conclusions: The Relative Significance of Impacts and Mitigation Measures

This chapter has identified potential impacts of growth to the urban environment of Manado and has discussed various steps that might be taken to address these impacts. Tables 4.5 and 4.6 provide some perspective regarding the relative significance of the impacts and the relative costs of addressing them. Table 4.5 summarizes the impacts, their potential severity, and the nature and relative significance of their causes. The impacts are rated with respect to each other; the sources are rated with respect to other sources of the same impact. Table 4.6 summarizes steps to evaluate or mitigate the impacts, with an indication of their relative importance and cost. These tables reflect several conclusions, discussed below.

The two most important impacts to the urban environment are the contamination of drinking water supplies with human waste and oxygen depletion in surface waters. Data are insufficient to determine the current extent and severity of these problems. It is clear, however, that these problems exist to some extent now and that they could become much more severe over time, even within the next ten years. It is more important to protect drinking water than surface water, both because public health impacts are generally considered more important than ecological impacts and because the assimilative capacity of Manado Bay is expected to be quite large. Water quality in the Tondano River can probably be compromised substantially before it has any effect on the bay.

The other urban environmental impacts examined--groundwater depletion and disposal of used alum in the Tondano River--are not significant at this time. Groundwater depletion could become a problem over the long term, of course, and it is important that studies of deep aquifer hydrology be completed before extensive groundwater projects are developed. Given existing information, however, it appears that groundwater resources are more than adequate to meet anticipated uses over the next ten years.

The most important causes of contaminated drinking water are inadequate management of human wastes and leaks in the piped water distribution system. Although there is insufficient

data to determine the current extent of contamination, Manado's reliance on on-site sanitation systems, the lack of adequate maintenance for such systems, the common practice of using water from shallow wells, the fact that over one-third of the water utility's production volume is lost, and the recent increase in reported cases of diarrhea all point to the existence of a problem now. Problems with inadequate sanitation could become much more severe as the urban population grows and its density increases.

Inadequate management of human wastes and domestic wastewater is also the most important cause of oxygen depletion in surface waters. The other causes--wastewater from processing agricultural products, leachate from landfills, and wastewater from tourist facilities--are less important because they comprise a smaller volume of waste and because their potential effects are more localized.

Table 4.5 SUMMARY OF IMPACTS TO THE URBAN ENVIRONMENT

Type of Impact	Potential Severity of Impact	Sources of Impact	Relative Significance of Source
Public health problems due to consumption of contaminated drinking water	Higher	Inadequate management of human wastes and domestic grey water	High
		Leaks in piped water supply	High
Oxygen depletion in surface streams and Manado Bay, due to discharges of high-BOD wastes and nutrients	Higher	Inadequate management of human wastes and domestic grey water	Higher
		Wastewater from processing agricultural products	Lower
		Leachate from solid waste landfills	Lower
		Wastewater from tourist facilities (rooms, restaurants, golf courses) and leachate from on-site landfills	Lower
Depletion of deep aquifers from overextraction of groundwater	Lower	Use of groundwater for municipal water supply	Higher
		Use of groundwater for tourist facilities	Lower
Increased level of solids in Tondano River from disposal of used alum	Lower	Disposal of used alum from the water treatment plant into the Tondano River	---

Table 4.6 COMPARISON OF STEPS TO EVALUATE OR MITIGATE IMPACTS TO THE URBAN ENVIRONMENT

Impact	Steps to Address Impact	Importance of Step	Relative Cost
Drinking water contamination	Evaluate current contamination levels, sources, hydrology of shallow aquifers, usage patterns for well water, and its role in diarrhea rates	High	Low
	Control leaks in piped water network	High	High
Oxygen depletion in surface waters and Manado Bay	Evaluate oxygen levels in surface and bay waters, BOD of discharges, flow rates in streams and currentss in near-coastal waters	High	Low
	Collect/treat leachate from municipal landfill	Low	High
	Require tourist facilities to control nutrient and BOD discharges from domestic uses, landfill leachate, and golf course runoff.	Low	High
Drinking water contamination and oxygen depletion	Evaluate alternative wastewater management technologies for off-site systems	High	Low
	Improve management of human waste and wastewater by constructing new off-site systems and additional on-site systems	High	High
	Improve management of human waste and wastewater with technical assistance to residents, initial and on-going inspections of on-site systems	High	Low
Depletion of deep aquifers	Evaluate hydrology and production capacity of aquifers to be used for municipal supplies and tourist resorts	Low	Low
	Require tourist facilities to limit use of groundwater, possibly by reusing wastewater	Low	High

As shown in Table 4.6, most of the steps that could be taken to address problems with drinking water contamination and oxygen depletion in surface water are rated high in importance. Of these, two steps require substantial investments: controlling leaks in the piped water distribution system and constructing new off-site and on-site sanitation systems. Both activities will be pursued with support from the IUIDP; work on water system leaks and on-site sanitation systems is programmed in the PJM for 1991-95, as is a feasibility study for off-site sanitation systems. Support for constructing off-site systems is anticipated in the next programming cycle for the PJM (1996-2000).

There are several important steps that should be taken and that are relatively inexpensive when compared with the costs of major infrastructure investments. Most of these are studies--of groundwater (contamination, flow, usage), surface water (quality, flows, discharges), and sanitation technologies. These studies are critically important to understand the current magnitude and extent of problems, to quantify the relative contribution of different sources, and to design effective and cost efficient solutions. Much more information is needed to design infrastructure investments that are tailored to Manado's particular characteristics and needs.

Manado will, of course, also need to increase the volume of drinking water it supplies to its residents to keep up with population growth and to improve health conditions. To this end, the PJM includes provisions for rehabilitating the existing treatment plant and a spring, and for constructing new water production works. It is important to recognize that increasing production capacity will not in itself solve the problem. There is a complex relationship between improvements to the municipal water supply, the cost of water, and resident's reliance on alternative water sources such as shallow wells.

5. POTENTIAL IMPACTS ON COASTAL AND MARINE RESOURCES

5.1 Introduction

This portion of the study examines the potential impacts of urban growth and tourism development in and around Manado on the area's marine and coastal environments. Results from this portion of the study will be used to augment the work of the Natural Resource Management (NRM) Project[7] by providing information on the interactions between urban development and marine and coastal resource management.

During the study it became apparent that the two most important sources of harm to the ecological status of reef systems in Bunaken Marine National Park are overfishing and direct physical damage to the reefs caused by boat mooring and coral mining. These impacts may be aggravated to some degree by growth in the urban population of Manado and tourism, insofar as such growth increases the commercial demand for fish or the number of boats using park waters. The impacts, however, are attributable primarily to the traditional fishing, reef-picking, and boat mooring practices of island residents. They are, therefore, beyond the formal scope of this analysis.

The NRM Project is working with national, provincial, and local officials to develop and implement a management plan for the Bunaken Marine National Park. This plan includes measures to address impacts attributable to the practices of island residents. The study team strongly endorses the intent of the NRM Project to help national and local officials devise measures by which island residents may remain in the park and be vested with legally-recognized rights to use park resources, including land, water, and protected fishing grounds. Such rights will give island residents a strong incentive to organize themselves so that they may use park resources wisely and protect park resources from abuse by non-residents.

Although it was not the principal focus of the work reported herein, the study team did make recommendations to the NRM Project regarding specific measures that should be addressed in the management plan for Bunaken Marine National Park.

5.2 Resources At Risk

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[7]USAID/I/AEE initiated the NRM Project in August 1991 in collaboration with the GOI Ministry of Forestry and BAPPENAS. One of the key elements of the NRM Project work program is developing a management plan for Bunaken Marine National Park. The NRM Project will also update management plans for other marine protected areas in North Sulawesi, help identify research needs for improving protected area management, train government staff and local communities (including private sector) in techniques for the sustainable management of marine protected areas, evaluate the design and implementation of management plans for protected areas, and recommend options for improving relevant policies and practices.

The marine and coastal resources potentially at risk of negative impacts from growth in and around Manado are located in the Bunaken Marine National Park and along the northern coastline of North Sulawesi from Cape Araken to Likupang.

Bunaken Marine National Park (shown in Figure 5.1) encompasses a total area of 89,065 hectares, most of which is open sea, and is divided into two distinct units. The northern unit of the park (75,265 ha) includes five islands (P. Bunaken, P. Manado Tua, P. Mantehage, P. Siladen, P. Nain), one islet (P. Nain Kecil), and fringing reefs of the mainland adjacent to P. Bunaken (at Tanjung Pisok on the Molas Peninsula). The southern unit of the park is smaller (13,800 ha) and consists of extensive fringing reefs along the Arakan-Wowontulap area of the mainland, southwest of Manado. Bunaken Marine National Park was officially designated a national park in October 1991.

The marine park includes extensive reef systems around the islands and along its mainland boundaries, supporting underwater flora and fauna that are typical of the central Indo-Pacific region. Most reef systems in the study area offer clear water, safe diving, relatively short boat trips to dive sites, a variety and abundance of marine life, and underwater scenery including spectacular drop-offs and small caves. These assets should increase international tourism if the ecological status of the reefs can be improved or, at least, conserved at its present level.

Mangrove stands and beds of seagrass are common along the mainland and island coasts, although the extent of their coverage is declining. These resources are critical to coastal ecology in three ways: they are primary producers and their detritus is the base of the food chain that supports zooplankton, coral, and other fauna; they stabilize sediments, control turbidity, and provide stable strata that can be colonized by other species; and they are critical habitat for the juvenile stages of many reef fish and shellfish. In addition, mangroves provide habitat for other fauna (birds, amphibians, etc.) and protect coastal areas from erosion and storm damage.

The marine park, coastal waters, and Manado Bay support active, if depleted, artisanal and small-scale commercial fisheries. A 1991 study found over 1,800 heads of families residing on islands in the marine park who are artisanal fishermen. Many families living along the mainland coast rely on a combination of small-scale farming and artisanal fishing. Small fleets of outrigger boats, manually propelled, work regularly in Manado Bay.

Most of the area's beaches are composed of broken coral fragments. There are very few white sand beaches of the type most attractive for tourist recreation.

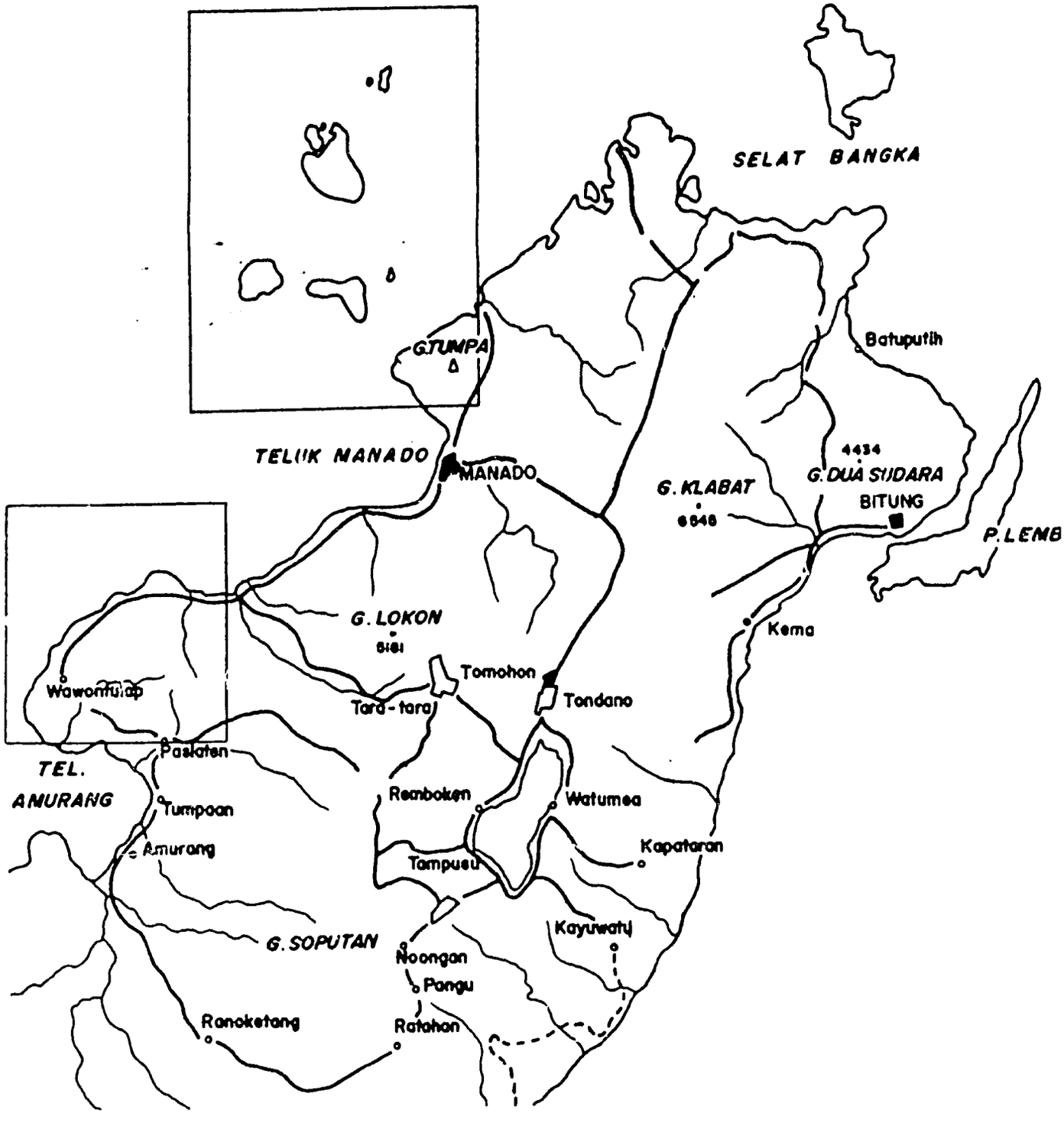

Figure 5.1 Map showing the two areas of Bunaken Marine National Park (boxed areas).

To summarize, the following related and interdependent resources are potentially at risk from the effects of urban growth and tourism development:

- the coral reefs, mangroves, seagrass beds, and associated flora and fauna located in the northern unit of Bunaken Marine National Park;
- the fringing reefs, mangroves, seagrass beds, and associated flora and fauna located along the mainland coast within the study area, including the Araken-Wowontulap area (which forms the southern unit of the Bunaken Marine National Park), the Molas Peninsula, and areas extending northward to Likupang; and
- commercial and artisanal fisheries along the mainland coast, in Manado Bay, and in the Bunaken Marine National Park.

5.3 Existing and Potential Impacts to Coastal and Marine Resources

The coastal and marine resources in the study area are affected by six types of negative environmental impacts:

- Direct physical damage to coastal habitats;
- Soil erosion, sediment, and turbidity;
- Sewage, agricultural runoff, and eutrophication;
- Toxic chemical pollution;
- Solid waste pollution; and
- Visual impacts of on-shore development.

In addition to their effects on coastal ecology, sewage and toxic chemicals may also contaminate fish and shellfish, making their consumption potentially hazardous to humans. As stated earlier, two other types of impacts--direct physical damage to reefs and over-fishing--are not addressed here because they are not primarily attributable to urban growth or tourism development.

5.3.1 Direct physical damage to coastal habitats

One of the clearest causes of degradation of coastal habitats observed to date has been the cutting of mangroves in the study area. Potential dredging and filling operations for resort development could be a major source of degradation of reef, seagrass, lagoon and mangrove systems. Dredging of lagoons and offshore areas for fill usually means scraping off the cover of sea grasses. This action has immediate effects, which reverse the natural benefits of lagoons previously outlined. Dredging removes the vegetation that binds the bottom of the lagoon or offshore area -- and thereby reduces water clarity. Dredging also removes the base of the food chain for all the reef, mangrove and lagoon organisms that derive subsistence from the sea grass system. And finally, the sea grass blades that provide a protective nursery for larval and juvenile stages are also lost, with consequent decline in the populations of these species.

5.3.2 Soil erosion, sediments, and turbidity

High sediment loadings and the associated turbidity plumes can damage sea grass beds and coral reef formations in two ways. First, chronic turbidity and deposited sediment cut down on light penetration sufficiently to inhibit photosynthesis in sea grass beds and coral formations, slowing the growth of individual organisms and the spread of communities. Second, coral species that form flattened, horizontal formations are often unable to expel ingested sediment particles or to clear the surface of the colony and may die from smothering or physical damage.

High sediment loadings may be caused by erosion in watersheds, mainland construction, near-shore dredge and fill operations, and dredging coastal navigation channels. The most significant source of sediments in the study area at this time is erosion in the Tondano River watershed. Coastal construction is modest at this time but is a potentially significant source of sediment-related impacts over the next ten years, especially along the Molas Peninsula. There appears to be no channel dredging activity at this time and it is unlikely in the future, due to the great depth of near-coastal waters and the routing of all commercial shipping in the area to the harbor at Bitung.

The Tondano River is the major stream system in the study area, draining the watershed above Manado and flowing into the Manado Bay. Agricultural practices in the watersheds, especially the cultivation of cloves, create massive erosion. Studies have estimated that 220,000 tons of soil are lost from the watershed each year. The eroded soils are washed into streams which eventually convey them into Manado Bay and other coastal waters around Manado.

Fortunately, sediments carried by the Todano River appear to have no adverse effect on the coral reefs fringing the islands in Bunaken Marine National Park, for two reasons. First, the distance of the river mouth from the park islands (approximately 8 kilometers to Bunaken Island) and the great depth of Manado Bay (averaging over 200 meters) allows most of the sediment to settle out of the water column before it reaches the islands. Second, strong currents sweep through a deep trench that runs between the mainland at Molas Peninsula and the islands P. Bunaken and P. Siladen. These currents appear to sweep most sediment remaining suspended in the water column onto the southern shore of the Molas Peninsula, into the trench, or through the trench and beyond.

Coastal construction may be a significant source of sediments over the next ten years. Construction is underway at the Paradise Resort near Likupang and plans exist to expand the Manado Beach Hotel complex and develop tourist facilities on the Molas Peninsula. Further development of areas along the coastal highway south of Manado is also likely. Standard construction practices in the area do not employ modern methods to minimize erosion and runoff and, in fact, may involve substantial diking, dredging, and filling to drain low-lying areas and extend beaches.

Sediment generated by coastal construction may cause localized negative impacts on sea grass beds and fringing reefs along the mainland coast. Construction may affect nearby sea grass beds; the resulting decline in sea grass habitat would probably occur in small increments but could eventually become significant as cumulative damage grows over time. Construction on the Molas Peninsula and at Likupang may also endanger fringing reefs along these portions of the mainland coast. Construction at the Manado Beach Hotel complex and along the coastal highway south of Manado is unlikely to affect fringing coral reefs, because the only reefs in the area lie to the southwest along the Arakan-Wowontulap coast and the prevailing current is to the northeast.

5.3.3 Sewage, agricultural runoff, and eutrophication

Sewage and runoff water that is contaminated with fertilizers or livestock wastes contains nitrogen and phosphorous. Eutrophication is the introduction of such nutrients to surface or coastal waters. Eutrophication leads to increased production by aquatic and marine flora and a resulting increase in biomass. Eutrophication can damage marine and coastal environments in two ways. First, eutrophication frequently causes a shift in community structure. Coral reefs are particularly susceptible to sewage pollution because they reflect a delicate balance among a large number of species, maintained in part by the relatively low levels of nutrients in tropical water. Sewage pollution upsets the balance by making available large amounts of nutrients which lead to a dramatic increase in the populations of certain species, usually at the expense of other species. The typical response to eutrophic conditions is for macro-algae species to grow over and kill the polyps of the coral communities.

The second mechanism by which eutrophication damages coastal environments is oxygen depletion. As plant biomass increases, the decomposition of dead organisms consumes oxygen dissolved in the water. In areas of restricted flow such as small streams, bays, and lagoons, oxygen-depleted water is not replaced rapidly and low oxygen levels can kill or weaken fish and shellfish. Under conditions of very restricted flow, eutrophication may result in anaerobic decomposition and the associated nuisance odors.

The Tondano River and other surface streams in the Manado area carry untreated sewage and septage into Manado Bay. This pollution appears to have no adverse effect on the coral reefs in the marine park or along the Molas Peninsula, due to the depth of the bay waters, the deep trench, and the strong currents. Existing rates of nutrient loading into Manado Bay are also unlikely to have any substantial effect on levels of dissolved oxygen in the bay due to the same factors, although no data are available with which to substantiate this conclusion.

Hotels and coastal resorts in tropical developing nations frequently pollute near-shore waters. Septic tank systems and package treatment systems used by such facilities often malfunction. Furthermore, given the shoreside location of most tourist facilities, septic tank leaching fields are usually in sandy soil or limestone rock, neither of which removes nutrients or retains septage long enough to kill pathogens before the flow reaches coastal waters. When a large number of hotels, resorts, and restaurants are built on the same beach system, pollution may

reach a level that is offensive to the guests and room occupancy rates may begin to decline. The hotels and resorts then usually take one of three courses of action: collectively organize and build an adequate sewage treatment system for their own needs, build an interceptor pipe to connect with an existing or newly constructed municipal treatment system, or build an interceptor pipe to an ocean outfall that carries the effluent offshore -- at least beyond their areas of use.

People living on the islands in the marine park generate untreated sewage and septage and fish wastes from artisanal fishermen. These wastes probably create eutrophic conditions in localized areas on the sea grass beds and reef flats off some of the islands. Determining the extent and significance of effects from island-generated wastes is beyond the scope of this study, and will be examined as part of the NRM Project research program. When untreated human waste is discharged to a marine environment, the risk of contamination of fish and shellfish with pathogenic organisms such as cholera exists. The possibility of human infection is increased if these seafoods are consumed raw.

5.3.4 Toxic chemical pollution

Toxic chemical contamination of coastal and marine environments may originate from two sources: the contamination of on-shore surface waters with industrial chemicals, metals, and pesticides; and oil and chemical spills from commercial shipping traffic.

Limited data on water quality have been collected for the Tondano River and near-coastal waters around Manado. While these data indicate the presence of some mercury in bay sediment, they do not indicate the presence of other chemicals in the water column or sediments. Substantial contamination with industrial toxic chemicals is unlikely, because of the types of industry currently in the area and is unlikely to emerge over the next ten years, due to the current policy to concentrate industrial development in Bitung.

Gold has been discovered in the Tupaan District, inland from Cape Arakan (Profil Kesehatan, 1989). A preliminary study of the potential impacts of gold mining has been performed. Gold mining would be likely to result in mercury contamination of the surface waters and the near-coastal waters along the western coast of Cape Arakan. Due to prevailing currents, the contamination could reach areas along the northern coast of Cape Araken (which is in the southern unit of Bunaken Marine National Park) and marine habitats further upstream. Even at low levels,mercury in coastal and ocean ecosystems has repeatedly been found to concentrate in the higher trophic levels, notably large predatory fish and shellfish. Many of these are important food species for local populations. Mercury contamination of humans leads to well-documented health problems, including the gross deformities and abnormalities accompanying Minamata disease (mercury poisoning).

The port of Manado has been closed to commercial shipping traffic and regional shipping lanes apparently do not run close to the coastline near Manado and the marine park. There is, however, always a small chance of an oil spill from an accident offshore or a ship running

aground. Indonesia does have a national oil spill contingency and response plan, although no specific plans appear to have been developed for the northern coast of North Sulawesi. Institutions that are planning, developing, and managing the Bunaken Marine National Park should devote some attention to evaluating the likelihood of shipping accidents in the area and developing appropriate contingency plans.

5.3.5 Solid waste pollution

On a 20-minute snorkel reconnaissance of the fringing reef off the southern side of Bunaken Island six items of plastic were found floating in the water column. Five were clear plastic and one was black plastic. Clear plastic bags are seen by turtles as jelly fish and ingested, usually leading to their death. And, of course, solid waste -- such as floating pieces of plastic seen by divers and snorkelers decreases the quality of their recreational experience. servation of trash recently collected on Bunaken indicates that trash is more likely to come from tourist and local sources on the islands than from Manado.

5.3.6 Visual impact of tourism development

One of the most commendable and appealing aspects of resort development in many of the newer diving destinations is that the structures blend in with the environment. Ideally none of the resorts will exceed the canopy of the surrounding trees. Resorts can be sited and designed so that they are virtually invisible when viewed from the beach or coastal waters of marine park areas. In the few interviews with diving and snorkeling tourists, the relatively small scale of the resorts and the harmony of the resorts with the surrounding natural landscape were frequently mentioned as special attractions of Manado.

The hillsides of the Molas Peninsula are visible from the Park, particularly from the eastern side of Bunaken and Siladen Islands and the coastal waters in between these islands and the Peninsula. The highest elevation on the ridge of the Peninsula is 637 meters. Resort development on the ridge and down the ocean-facing slopes would have a panoramic view of the islands, Manado Bay and the ocean horizon. If future tourist facilities on Molas Peninsula were to exceed the canopy of the existing vegetation (which appear to be two stories tall), they would be visible from the marine park. The worst visual impact scenario would be high-rise hotel towers. The tourist hotels at Tasik Ria and Likupang are four- and five-story buildings. Presently, the construction of a road from the airport directly to the northern part of the Molas Peninsula is under discussion. If this occurs, the lands on the peninsula will be particularly attractive to resort developers. The team heard reports that much of the land on the peninsula has already been purchased by developers and designated for tourism-related land uses. Development in this area should be designed to blend in with the natural scenery visible from the Park.

5.4 Relative Significance of Impacts to Coastal and Marine Resources

This chapter has identified potential impacts of growth in urban population, industry, and tourism to coastal and marine resources. As indicated earlier, the team concluded that overfishing is the most significant problem in the area, apparently affecting Manado Bay, Bunaken Marine National Park, and the coastal waters along the full extent of the study area. Overfishing, however, is attributable to inadequate coordination and regulation of artisanal and small commercial fishermen, not to growth in the urban population or tourism. It is, therefore, beyond the scope of this analysis.

Table 5.1 summarizes the the potential significance of various impacts and the nature and relative significance of their causes. Impacts are rated with respect to each other; the sources are rated with respect to other sources of the same impact. Table 5.2 summarizes steps that could be taken to address the impacts, with an indication of their relative importance and cost. These tables reflect several conclusions, discussed below.

The most significant potential impact is direct physical damage to coastal habitats caused by coastal construction activities, including land clearing, diking, dredging, and filling to change coastal morphology, and the removal of mangrove stands and sea grass beds in resort and beach areas. These activities can have a devastating effect on coastal habitats. Although individual impacts are localized, rapid proliferation of tourist resorts accompanied by in-fill development along the coastal roads could create widespread devastation. Evidence of poor construction practices and the damage that accompanies them is apparent at the Manado Beach Hotel in Tasik Ria and the Paradise Resort in Likupang. To address this problem, responsible agencies should develop and enforce regulations that require developers to use construction techniques and design standards specifically appropriate to coastal construction projects.

The other significant potential impact is the degradation of the visual integrity and amenity value of Bunaken Marine National Park that will occur if tourist facilities or other development on the Molas Peninsula are not designed to blend in with the existing forest cover. The hillsides of this area have a panoramic view of the islands, Manado Bay, and the ocean. The view, the undeveloped forest vegetation and the proximity to the islands of Bunaken Marine National Park make this area a prime candidate for tourism development. If a direct access highway is constructed from the northern section of the Peninsula to the airport -- as is currently being planned -- the tourism potential increases even further. Any development in this area should be designed to preserve an uncluttered, "un-urbanized" view from the marine park.

Finally, other potential impacts -- oxygen depletion, toxic chemical contamination, and solid waste pollution -- are less significant primarily because they are less likely (toxic chemical contamination) or, if they occur, would be mild and localized (oxygen depletion, solid waste pollution). It is important, therefore, to maintain conditions that limit the potential impact of these sources to present levels. The government should continue to prohibit gold mining in

Tupaan district and tourist facilities should be required to maintain adequate control of waste loadings to coastal waters, pesticide run-off, and solid waste. Manado must also improve its solid waste management and wastewater management capacity to keep up with the rapid growth of its population.

Table 5.1 SUMMARY OF IMPACTS TO COASTAL AND MARINE RESOURCES

Type of Impact	Potential Severity	Sources of Impact	Relative Significance of Source
Direct physical damage to coastal habitats: loss of mangrove stands and sea grass beds	Higher	Coastal construction: land clearing, dredge and fill operations, cutting mangroves to clear resort sight lines and beaches, clearing sea grass from beach areas.	Higher
		Erosion in Tondano River watershed	Lower
Oxygen depletion in coastal waters	Lower	High BOD and nutrient loadings in Tondano River outflow to Manado Bay	Lower
		High BOD and nutrient loadings in wastewater from tourist facilities	Higher
Toxic chemical contamination of sediments, fish and shellfish	Lower	Pesticides in runoff from golf courses at tourist resorts	Higher
		Mercury in wastewater from future gold mining in Tupaan district	Lower
		Oil spill in offshore waters	Lower
Solid waste pollution of coastal waters	Lower	Inadequate management of solid waste in Manado and tourist resorts	----
Degradation of visual amenities in Bunaken Park	Higher	Construction of tourist facilities on Molas Peninsula taller than the forest canopy	----

Table 5.2 COMPARISON OF STEPS TO MITIGATE IMPACTS TO MARINE AND COASTAL RESOURCES

Impact	Steps to Address Impact	Importance of Step	Relative Cost*
Direct physical damage to coastal habitats	Develop and enforce standards for coastal construction to restrict diking, dredging, and filling and to require erosion control	High	Low
	Tighten and enforce restrictions on cutting mangroves and clearing sea grass	High	Low
Oxygen depletion in coastal waters	Reduce waste loadings to the Tondano River by improving sanitation in Manado	Low[8]	High
	Reduce waste loadings to coastal waters by requiring tourist facilities to treat wastewater	High	Low
Toxic chemical contamination	Require tourist resorts to limit pesticide use on golf courses and/or remove residuals from runoff and leachate	High	High
	Prohibit gold mining in Tupaan district	High	Low
	Maintain an oil spill response capabilty	Low	Low
Solid waste pollution of coastal water	Maintain adequate solid waste management in Manado	High	High
	Maintain adequate solid waste management at tourist resorts	High	Low
Degradation of visual amenities in Bunaken Park	Prohibit development on Molas Peninsula or require that facilities blend in with the natural environment and that their height be below canopy level.	High	Low

* Administrative cost of implementing the measure described. This does not refer to or include the opportunity cost, if any, incurred by foregoing the restricted activity.

[8] At present rates of discharge, wastes in the Tondano River appear to be within the assimilative capacity of Manado Bay and adjoining waters. Studies to collect information on current water quality and assimilative capacity are recommended elsewhere in this report. Despite its low significance with respect to protecting coastal resources, improving sanitation is a high priority to protect public health. See Sections 4.3 and 4.6.

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ANNEX A:

SCOPE OF WORK, TEAM, AND WORKPLAN

ATTACHMENT A

TERMS OF REFERENCE

FOR AN

ASSESSMENT OF URBAN ENVIRONMENTAL IMPACTS

IN MANADO, NORTH SULAWESI

I. INTRODUCTION

A. Purpose

The study has two purposes:

A. To identify, assess and prioritize major environmental impacts of estimated growth in urban/industrial/tourism development on the surrounding coastal and urban natural resource base;

B. To provide recommendations for mitigating the most serious environmental problems, including appropriate investments in infrastructure, financial measures to recover infrastructure costs, and policy improvements.

In addition, the study will alert government, NGO, and private sector institutions to the potential environmental problems associated with urbanization and the techniques available to mitigate those problems.

B. Problem and Significance

The impact of "rural" pressures on natural resources in developing countries has been well documented but relatively little is understood about the impact of urban and industrial development on natural resources. This lack of information is particularly significant for Manado, the capital city of North Sulawesi. This rapidly growing city of 300,000 residents is surrounded by beautiful beaches, rich marine resources and fertile mountains. In particular, the Bunaken-Manado Tua National Park, a spectacular group of coral reefs of significant ecological and tourist interest, is located near the city. The timing is also critical because Manado is expected to experience a major tourist boom in the next few years as international flights are opened up to Japan, Australia and the Philippines.

While Manado is relatively clean by Indonesian standards, the urban environmental infrastructure is not currently equipped to handle the projected developmental growth. Phuket Island in Thailand, for example, experienced a 400% increase in tourist visits during the 80s when international tourism was actively promoted. The corresponding urban development had major negative impacts on the environment that has questioned the

sustainability of its tourism-based economic development. Therefore, there is a need to determine the most appropriate policies and infrastructure investments in Manado to support sustainable economic growth for the region.

C. Rationale

This study will illustrate that unless properly managed, rapid urban development may cause significant adverse environmental impacts on natural resources and that greater attention to mitigating these urban impacts is both justified and feasible. Thus, the study will identify priority urban environmental problems and recommend appropriate mitigation measures, including the identification of infrastructure needs, feasible local financing and cost recovery mechanisms. The review and discussion of the study's findings and recommendations will also educate key decision makers and the general public on the feasibility of recommended policy improvements and mitigation measures. This study will also help determine the feasibility of additional USAID assistance, such as USAID-supported capital projects (Housing Guaranty loans and Capital Projects Funds) designed to protect both the urban areas themselves and the surrounding natural resources. In addition to the specific outputs, the study will test a useful methodology which can be applied in similar urban areas. (Potential additional sites suggested by the Indonesian Ministry of Environment include: Senggigi, Lombok; Kuta, Bali; Pasir Putih, East Java; and Pangandaran, West Java). Finally, the study will support the implementation of activities under the USAID-assisted Natural Resources Management (NRM) project, such as the development of improved policies for managing economically-important natural resources as well as the design and implementation of a multi-purposed management plan for the Bunaken-Manado Tua Marine National Park.

II. OBJECTIVE OF THE STUDY

The objectives of the study are (a) to identify and assess priority environmental problems caused by rapid urban, industrial and tourism development and (b) recommend specific measures and policy improvements to mitigate major problems.

III. Tasks

The contractor will undertake the following tasks:

A. Conduct Scoping Session

The contractor will hold a preliminary scoping session with local Government, private sector, NGOs, university and USAID representatives in Manado to discuss the scope of work of the study and specific tasks.

B. Develop Field Work Plan

Based on the Scoping Session, the contractor will develop a work plan aimed at documenting major existing and expected environmental impacts of urban/industrial/tourism development. Environmental resources of concern may include: surrounding watershed (e.g., mining areas, industries and intensive agriculture), water supply and coastal resources (e.g., coral reefs, beaches, mangroves and fishery areas). Pollution threats may include: water pollutants, air pollutants and solid waste. Accordingly, the contractor will undertake the following steps:

1. Describe Current and Expected Major Environmental Impacts

Describe major current environmental impacts based on existing data and supplemented by selected sampling (if appropriate) to provide additional information as needed and feasible. Identify major urban activities which may potentially threaten critical natural resources, such as the disposal of untreated human waste and garbage, discharge of untreated industrial/mining waste, and soil erosion from road construction. An example of sampling may include testing the present water quality in the river and at adjacent beaches in terms of BOD, E Coli, and turbidity.

Diagnostic analyses should be developed for solid waste generated, sediment and chemical runoff from mining operations, silt loading from eroding construction sites and other sources of pollutants of primary concern. The intent is not to precisely measure the extent of environmental damage, but to provide general orders of magnitude useful for formulating improved policies.

2. Estimate Urban and Industrial Growth in the Manado Area

Estimate the growth of urban/industrial development in the Manado area, including the expected growth of tourism.

3. Determine the Potential Value of the Tourism Industry

Estimate the potential economic contributions and value of the tourism industry in the Manado area. Estimate net revenues in Manado based on accepted estimates of tourist expenditures, foreign exchange "leakage" and income multipliers. Estimate portion of tourist revenue that would potentially be at risk due to serious environmental degradation. Sources of estimates would include at least the following:

- Estimates from the newer hotels and restaurants in the area regarding the portion of their anticipated tourist trade is expected to be related to the quality of the reefs, fishing, and general environmental quality.

- Estimates based on extrapolation from the experience of other tourist areas (such as Pattaya) in terms of the impact of environmental degradation on tourist trade.

This estimate is meant to be indicative and provide a basis for evaluating possible financial measures (e.g., tourism tax).

4. Identify the Most Serious Expected Environmental Impacts

Identify the most serious environmental impacts and likely consequences expected over the next ten years assuming there are no major infrastructure investments or policy changes. Estimate the expected increase in pollution, water demand and major environmental impacts. based on growth in population and economic activities resulting from birth rate, migration and service and industrial growth (including tourist industry) in Manado. This analysis should include the following assessments:

- o Assess the likely environmental impact on Bunaken Reef of continued urban growth in Manado.

- o Assess the likely impact of urban growth on water supply, water quality, coastal resources (other than Bunaken Reef).

- o estimate the effect of the identified adverse environmental impacts on potential economic development (including but not limited to, the potential tourism industry).

5. Identify Important Institutions and Social-Economic Issues

Identify critical institutional and social-economic issues which may either accelerate some of the major environmental problems or contribute to their eventual resolution.

C. **Identify and Analyze the Feasibility of Capital Investments in Infrastructure, Financial Measures and Improved Policies to Mitigate Major Environmental Impacts**

Identify and analyze the feasibility of capital investments, financial measures and improved policies to mitigate major environmental impacts. Possible capital investments may include: waste water treatment facilities, water supply system, solid waste disposal facility and/or recycling plant. Improved policies may include development zoning and/or environmental impact assessments, while financial measures may include a tourism tax, property tax or the following:

- Special Assessments: to recover infrastructure costs, assessments are levied on immediate beneficiaries based on frontage, land area, or land value;
- Subdivision regulations: set standards for infrastructure as well as parcel sizes, right-of-way widths, easements, etc. as part of land subdivision and registration, and may also require fees for off-site infrastructure;
- Development fees: compensate local authorities for the burden of off-site infrastructure costs through imposition of either impact or permit fees;
- Excess Appropriation: involves taking land for infrastructure as well as an excess margin of land to be conveyed to a private developer for private commercial development

Estimate the capital and operating costs of implementing the proposed infrastructure and mitigation measures. Identify potential sources of financing and cost recovery for implementing the environmental improvements. (Potential sources should include but not be limited to: local revenue, central Government funds, USAID Housing Guaranty loan funds, tourist fees/taxes, and property taxes). Assess the feasibility of implementing the recommendations based on current constraints.

D. Assessment of Methodology

The contractor shall provide 2-4 pages of comments on lessons learned from field-testing the methodology developed at the scoping session. This would involve an assessment of the utility of the types of data collected, rationale for the study area delineated, guidance for analyzing linkages between urban activities and ecological impacts, and guidance for study of alternative sources of financing and cost recovery for implementing environmental improvements.

E. Discuss and Submit Draft Report

The contractor will prepare and present a draft report with an executive summary to BAPPENAS, local Government officials and USAID/Jakarta. Copies of the draft report will be submitted for review at least 9 days prior to departure, intended to allow for a discussion of findings, conclusions and recommendations by the contractor and the Mission prior to the workshop, as outlined below, and to permit possible changes stemming these discussions or the workshop to be incorporated during the final week of field work.

F. Present Draft Report

The contractor will organize a workshop in Manado and present the major findings, conclusions, and recommendations. The presentation will describe the application of the methodology, analysis, and recommendations. Copies of the summary shall be submitted at the conclusion of the field work. The intended audience for the workshop will include central and local government officials, as well as representatives of NGOs, universities, the private sector, and the media. The purpose of this workshop will be to illustrate the methodology employed, share information, identify potential weaknesses, and build public support for the implementation of recommendations.

G. Submit Revised Draft and Final Report

The contractor will submit a revised draft report, with executive summary, that describes the application of the methodology, the analysis, major problems encountered, findings and recommendations (including information obtained at the final workshop). Copies of the revised draft report shall be submitted prior to the departure of the team leader. USAID/Jakarta and PRE/H will provide written comments as soon as possible upon receipt of the revised draft. The contractor will submit the final report within 10 days of receipt of Mission and PRE/H comments.

IV. Reports and Deliverables

The contractor will prepare ten (10) copies of the draft report within 27 workdays after beginning work and deliver them to USAID/Jakarta for distribution. The contractor will submit ten (10) copies of the final report and deliver them to USAID/Jakarta for distribution within 10 workdays after receiving Mission and PRE/H comments.

V. Personnel

The following personnel are required to conduct this study:

1. Environmental Planning and Policy Specialist (expat) (36 days)
2. Coastal Resources/Environmental Scientist (expat) (18 days)
3. Urban Planning and Finance Specialist (expat) (18 days)
4. Urban Planning/ Infrastructure Specialist (expat) (14 days)
5. Urban/Environmental Planner (local) (36 days)
6. Environmental Scientist (local) (18 days)

A. Qualifications

1. Environmental Planning and Policy Specialist (expat) (36 days)

Must possess at least a Masters degree in environmental planning/policy or related field and have at least five years experience working in environmental planning/policy in developing countries (previous experience in Indonesia would be most advantageous). Must have a demonstrated capability to lead a team of consultants and produce the required analysis/reports on time. Must have strong interpersonal skills.

2. Coastal Resources/Environmental Scientist (expat) (18 days)

Must possess at least a Masters degree in environmental science or related field and have at least three years experience working in environmental analysis/testing in developing countries including experience in tropical coastal resources (previous experience in Indonesia would be most advantageous. Must have a demonstrated capability to work as part of a team of

consultants and produce the required analysis/reports on time. Must have strong interpersonal skills.

3. Urban Planning and Finance Specialist (expat) (18 days)

Must possess at least a Masters degree in urban planning, urban finance or related field and have at least three years experience working in urban planning and finance in developing countries (previous experience in Indonesia would be most advantageous).

4. Urban Planning and Infrastructure Specialist (expat) (14 days)

Must possess at least a Master degree in Civil/ Environmental Engineering, or related field and have at least five years experience in planning and design of urban services infrastructure, such as wastewater treatment facilities, solid waste management facilities and environmental infrastructure facilities. Must have a demonstrated capability to work as part of a team of consultants and produce the required analysis/reports on time. Must have strong interpersonal skills.

5. Urban/Environmental Planner (local) (36 days)

Must possess at least a Masters degree in urban/environmental planning or related field and have at least five years professional experience. Must have a demonstrated capability to work as part of a team of consultants and produce the required analysis/reports on time. Must have strong interpersonal skills.

6. Environmental Scientist (local) (18 days)

Must possess at least a Masters degree in environmental science or related field and have at least five years professional experience working in environmental analysis/testing. Must have a demonstrated capability to work as part of a team of consultants and produce the required analysis/reports on time. Must have strong interpersonal skills.

VI. Roles and Responsibilities

The contractor will work under the technical direction of the USAID/Jakarta Urban Policy Division. He/She will also work closely with representatives of key Government officials (BAPPENAS and local government officials), private sector firms, NGOs as well as with the USAID Project Officer for the Natural Resources Management (NRM) project.

VII. **Logistics**

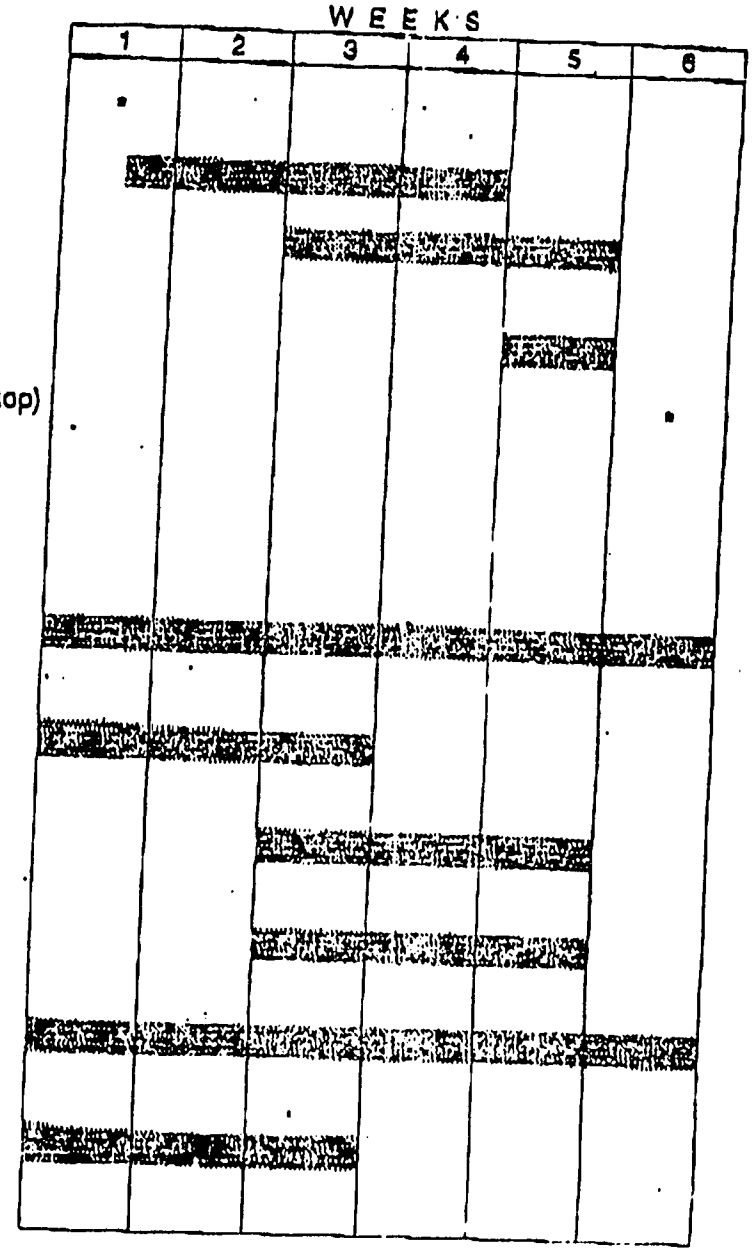
The contractor will be responsible for providing all logistical requirements.

VIII. **Level of Effort**

Approximately five person months of assistance are required (three and a half person months of expatriate assistance and over two person months of local expertise). Up to three work days can be performed in the U.S. prior to arriving in Indonesia. A six day work week is authorized.

51

Implementation Schedule



1. Scoping Session
2. Develop Methodology
3. Analyze Mitigations
4. Prepare/Discuss Draft (* submit draft)
5. Present Draft Report (Workshop)
6. Submit Revised Report

1. Planning/Policy Specialist (expat) 36 days
2. Environmental Scientist (expat) 18 days
3. Urban Finance Specialist (expat) 18 days
4. Urban Infrastructure Spec. (expat) 18 days
5. Urban/Envir. Planner (local) 36 days
6. Environmental Scientist (local) 18 days

ANNEX A: SCOPE OF WORK, TEAM, AND WORKPLAN

A.1 Scope of Work

The terms of reference for this assessment specified that the following tasks be performed:

1. Describe current and expected major environmental impacts of growth in urban population, industry, and tourism.

2. Estimate potential growth in urban population and the industrial sector.

3. Estimate potential growth and determine the potential value of growth in tourism.

4. Identify the most serious expected environmental impacts and recommend measures to avoid or minimize such impacts.

5. Identify institutional and socio-economic issues that may accelerate potential environmental impacts or contribute to their mitigation.

A.2 Composition of the Study Team

The study team included six people experienced in a variety of disciplines:

- Mr. Gene Brantly, an environmental policy analyst with broad experience in environmental investigations and training in environmental law, who served as team leader for the assessment;

- Dr. Rusdian Lubis, a Indonesian specialist in environmental planning and impact assessment who was worked on a variety of environmental impact assessments, including a comprehensive analysis of a major urban area in South Sulawesi;

- Ms. Jane Walker, an economist who also has extensive experience preparing demand projections and financial analyses for urban infrastructure projects, and who had performed a previous study on the Manado water utility;

- Dr. William Hogrewe, an environmental engineer with experience designing and analyzing environmental infrastructure projects for island environments;

- Dr. Jens Sorenson, a specialist in coastal zone management and marine park planning who has prepared management plans for several large marine parks; and

- Dr. Remy Mangindaan, a fisheries scientist at Sam Ratulangi University in Manado who has conducted prior research on water quality and fisheries in the Manado area.

57

2.3 Workplan for the Assessment

The team was authorized to spend a total of 138 person-days of effort over a six-week period to conduct the assessment. The allocation of this level of effort, the phasing of activities required to perform the scope of work, and the allocation of assignments to members of the team are summarized in Table A-1.

54

Table A-1. SUMMARY WORKPLAN FOR THE ASSESSMENT

Schedule	Activity	Participants
Week 1	Planning meetings in US prior to departure.	Brantly Walker Hogrewe
	Meet with GOI and USAID officials in Jakarta to clarify terms of reference.	Brantly Lubis
Week 2	Meet with local and provincial officials in Manado to refine scope of the assessment.	Brantly Lubis Mangindaan
	Complete scoping of assessment and refine methodology to be used.	Brantly Lubis
Weeks 2 and 3	Collect information needed for the assessment--government documents, studies by university faculty and international organizations, and interviews with government officials (local and provincial), private developers, technical staff of sectoral agencies, and expatriate staff of other projects headquartered in Manado.	Brantly Lubis Mangindaan
Week 3	Initial reconnaisance and supplementary data gathering for analysis of impacts to the marine park and coastal areas.	Sorenson
	Initial reconnaisance and supplementary data gathering for analysis of impacts to urban environment.	Hogrewe
	Initial reconnaisance and supplementary data gathering for the tourism analysis. Develop population projections.	Walker
Weeks 3 and 4	Conduct detailed interviews with hotel developers and managers and dive shop owners to develop information for tourism analysis.	All team members participated

Table A-1. SUMMARY WORKPLAN FOR THE ASSESSMENT (Continued)		
Schedule	Activity	Participants
Week 4	Analyse marine and coastal issues, develop recommendations for marine park management and coastal zone management.	Sorenson
	Prepare tourism analysis.	Walker
	Analyse urban environmental impacts, including effects of population and industry.	Hogrewe Lubis
	Analyse impacts in Tondano watershed.	Lubis
	Analyse institutional and policy issues.	Brantly
	Continue to gather supplementary data and assist with interpretation of data and reports in Bahasa Indonesia.	Mangindaan
Week 5	Develop recommendations re. infrastructure improvements	Hogrewe
	Prepare draft report and present results to interested parties in Manado	All team members participated
Week 6	Present results to USAID and GOI officials in Jakarta.	Brantly Lubis
	Develop recommendations re. infrastructure financing.	Brantly Walker
	Prepare final report with revisions to address USAID and GOI comments.	Brantly Lubis Others as required
	Time allocated to travel.	All team members

56

ANNEX B: SCOPE OF THE ASSESSMENT

B.1 Resources at Risk and Sources of Environmental Impacts

The team conducted a preliminary assessment to determine which of the sources of potential environmental impacts would be likely to affect each of the areas resources. Table B.1 summarizes the results of the preliminary assessment.

For several combinations, the team concluded that a particular source of impacts has no substantial effect on a particular resource. Any possible environmental effects that are attributable to these combinations are insignificant when compared to the major environmental impacts affecting each resource. No further analysis of these combinations was performed. The reasoning behind each finding of "no substantial effect" is summarized below.

Table B.1 FIRST-LEVEL DETERMINATION OF SCOPE OF THE ASSESSMENT

Resources	Sources of Environmental Impacts		
	Urban Population	Tourism	Industry
Urban Environment	Examined	Examined	Examined
Bunaken Marine National Park	No substantial effect on Park islands	Examined	No substantial effect on Park islands
Coastal Resources	Examined	Examined	Examined
Tondano River and Watershed	Examined	No substantial effect	Examined

B.1.1 Urban Population and Industry Impact on Bunaken Marine National Park

There is a deep trench between Tanjung Pisok (part of mainland Manado) and Bunaken Island, the most shore-ward island of the park. The water between islands within the park is also impressively deep. Although data on bathymetry and currents need to be developed, staff at USAID's Natural Resources Management Project are convinced that the current through the near-shore trench is consistently strong. Observations made during this assignment tend to confirm this. The strength of the current and the depth of the trench

indicate that there is little possibility of pollution (sediment, BOD, nutrients, solid waste, industrial chemicals) in the outflow of the Tondano River or other tributaries to Manado Bay being transported to Bunaken Marine National Park. The team concluded, therefore, that wastewater and solid waste generated by the urban population of Manado and industries in the study area does not have a substantial effect on the coral reefs or other resources of the islands in the northern sector of the Bunaken Marine National Park.

There are no geographic barriers to the mainland expansion of urban Manado. This fact, coupled with government policies concerning residency in the Park, precludes the possibility of substantial migration into the Park. Furthermore, the government has established policies prohibiting industrial development in the Park and there are no indications that natural gas, oil, or valuable minerals are present in the Park. Population and industrial growth, therefore, are not expected to have any direct impacts on the northern sector of the Park.

B.1.2 Tourism's Impact on Tondano River Watershed

Tourism will not have a substantial effect on the Tondano River watershed during the study period. All of the intense development of tourist accomodations is planned for coastal areas. Based on conversations with Manado residents, current recreational uses of the watershed are largely limited to day-trips to Tondano Lake. When queried about potential tourist attractions, people working in tourism development in the private and public sectors felt that inland attractions, such as Tondano Lake and hot springs, would not develop quickly. Seventy percent of the land in the watershed is used for agriculture, and hydropower dams are being built on Tondano River; any potential effects of tourism are dwarfed by the environmental problems associated with these activities.

B.2 Potential Environmental Impacts Examined in the Assessment

The second stage of the scoping activity developed an inventory of current and potential environmental impacts that would need to be examined during the assessment. These were developed on the basis of interviews with a number of officials, academicians, and expatriates involved in technical assistance projects, and reviews of several studies by government agencies and international organizations. The final scope of the assessment is presented in tables B.2 through B.4.

Table B.2 SCOPE OF THE ASSESSMENT: URBAN ENVIRONMENT

AREA: Kotamadya Manado RESOURCE: Water Quality: Surface Water, Groundwater, and Manado Bay		
Potential Impact	Activities/Sources	Actors
Contamination with high levels of BOD, nutrients, and pathogens may lead to: • eutrophication of surface water and Manado Bay • nitrates in groundwater • increased occurence of water-borne diseases	Inadequate design, construction, and maintenance of septic tanks (residential, commercial, institutional), including improper disposal of septage and continued use of septic tanks in areas of high population density.	Kotamadya Manado. Tank supply and service companies, homeowners, commercial real estate owners, institutional managers.
	Inadequate sanitation facilities in marginal communities	Kotamadya Manado
High BOD and nutrient discharges to surface water.	No treatment of collected surface drainage	Kotamadya Manado
	No/inadequate treatment of discharges from coconut and palm oil processing	Business owners
	Runoff of fertilizers from coconut farms	Farmers, extension agents
	No treatment of leachate from solid waste landfill	Kotamadya Manado
Contamination of surface water with solid waste.	Improper disposal of solid waste in and near surface water and surface drains; inadequate collection service.	Residents, Kotamadya Manado
Chemical contamination of surface water and Manado Bay	Runoff of pesticides from rice, coconuts	Farmers, extension agents
	Improper disposal of hazardous wastes?	Residents, proprietors, institutions.
	Discharges from metal finishing shops?	Business owners

TABLE B.2 (Continued)

AREA: Kotamadya Manado and Adjacent Area RESOURCE: Air Quality		
Impact	Activities	Actors
Increased levels of CO, NOx, & particulates, and decreased visibility	Inadequate emission controls on vehicles, poor design of traffic flow patterns.	Kotamadya Manado, vehicle manufacturers, automobile owners.
Increased levels of CO and decreased visibility	Open fires for burning underbrush on coconut fields and trash.	City residents and farmers.
	Trash burning at city landfill.	Kotamadya Manado
AREA: Kotamadya Manado RESOURCE: Land		
Soil contamination	Improper disposal of solid waste, including hazardous materials	Residents, farmers, hospitals, small scale chemical and metal shops, Kotamadya Manado
Degradation and erosion of coastal land	Inappropriate land uses, improper design and construction techniques for fragile coastal land, including mangrove stands and beaches.	Developers, Kotamadya Manado and Minahasa.
Soil erosion	Agricultural practices	Farmers

60

Table B.3 SCOPE OF THE ASSESSMENT: COASTAL RESOURCES

AREA: Coastal Resources RESOURCE: Mangroves		
Impact	Activities	Actors
Direct impact: "conversion"	Removal of mangroves in front of tourist hotels and cottages	Hotel and cottage owners/managers
	Removal of mangroves to build fish ponds	NRM and Agriculture officials. Proprietors?
RESOURCE: Coral Reefs		
Direct impacts: loss of coral	Removal of mangroves may cause eventual loss of coral due to sedimentation and loss of nutrient filtering	Mangroves removed to construct tourist hotels and cottages by owners, managers.
Destruction of coral	Bombing for fish	Traditional fishermen fishing along coast
RESOURCE: Fisheries		
Direct impacts: loss of fish species	Bombing and poisoning cause indiscriminate harvesting of fish.	Traditional fishermen
Indirect impact: loss of habitat	All activities that destroy coral reefs destroy habitat for commercially valuable reef species and destroy feeding grounds for deep-water pelagic fishes.	See entries re destruction of coral reefs
Direct impacts on small reef fish	Small reef fish are caught in large quantities for use as bait for deepwater fishing	Commercial fishing fleets Traditional fishermen
Indirect impact: eutrophication in Manado Bay	Nutrient loading to Bay from excreta and grey water conducted by ground & surface water	See Table 4.5

Table B.4 SCOPE OF THE ASSESSMENT: BUNAKEN MARINE NATIONAL PARK

AREA: Bunaken Marine National Park RESOURCE: Coral Reefs		
Impacts	Activities	Actors
Direct impact: destruction of coral reef	Mining coral for use in foundations and roadbeds on Bunaken Island	Island residents in Bunaken Park
	Mining coral for use in septic tanks on mainland	Island and mainland residents
	Dropping boat anchors directly on the reef	Captains of boats serving tourists; fishermen?
Death of coral due to sedimentation	Soil erosion caused by agricultural practices	Island residents in Bunaken Park
	Removal of sea grass and mangroves associated with building beach cottages -- eliminates erosion traps	Owners, builders, and managers of beach cottages
Littering of coral reef and injury to large species from plastic bags and other solid waste	Disposal of trash from boats serving tourists; and fishermen? and from island residents? And possibly transport of solid waste from mainland.	Tourists and tour captains. Fishermen. Island residents & waste collectors. Mando residents & waste collectors.

62

Table B.4 (continued)

AREA: Bunaken Marine National Park RESOURCE: Mangroves		
Impact	Activities	Actors
Direct impact: removal and destruction	Harvesting for firewood, building materials, furniture	Island residents
	Removing mangroves to clear water/beach in front of tourist cottages	Owners/builders/ managers of tourist cottages
RESOURCE: Sea floor/sea grass beds		
Direct impact: removal	Clearing sea grass from areas to prepare clean mooring sites	Cottage owners/ managers. Fishermen.
RESOURCE: Fisheries		
Direct impact: over-harvesting	Bombing and poisoning	Traditional fishermen
Indirect impact: destruction of habitat	All activities that destroy mangroves and coral reefs	See relevant entries

Table B.5 SCOPE OF THE ASSESSMENT: TONDANO WATERSHED

Impacts	Activities	Actors
Sedimentation of Tondano River and Tondano Lake	Soil erosion from agricultural land.	Farmers Note: there are no forestry concessions in the watershed.
Contamination of the river with high BOD discharges, nutrients, pathogens	Inadequate sanitation in communities along the river.	Residents, local government, regency government
Contamination with nutrients, pesticides	Run-off from crop lands	Farmers, extension agents, agri-chemical distributors
Contamination of the river with solid waste	Improper disposal of solid waste in communities along the river	Residents, local governments, regency government
Chemical contamination of the river	Mining Industry	Proprietors, regency government

ANNEX C: TOURISM FORECASTS

C.1 Overview - Manado and Minahasa

The coastal city of Manado and the surrounding regency of Minahasa have traditionally been tourist destinations within Indonesia. The main attractions in the region are the rich sea environment, the coastal area, and the mountain region around Remboken.

Tourist arrivals (those staying in hotels and dive centers rather than general visitors) are estimated at about 36,000 in 1991. About 80% (30,000) are Indonesian tourists and the remaining 6000 are international tourists. The majority of foreign tourists (about 43%) are Europeans, followed by Japanese (about 22%). General five-year trends on total visitor arrivals show that local visitors are increasing at a stable rate of about 8% per year. Foreign visitors over the period show an average increase of about 30% per year, though there are significant variations over this period. For example, between 1990 and 1991 there was an estimated 56% increase in foreign visitor arrivals.

C.2 The Current Situation

Together Manado and Minahasa have about 80% of the star-rated hotels and the guest houses (melati), as well as about 80% of the restaurants in Northern Suluwesi as a whole. This suggests that Minahasa, and most specifically Manado, have the main concentration of tourist stays of the region.

Table C.1 looks at the current capacity of the existing hotels and melati in Manado and Minahasa for 1990. Given current occupancy rates of rated hotels of about 55% and estimated occupancy rates for the melati of about 40%, the average occupancy rate for the table is estimated at 45% with a tourist stay for these categories of hotels estimated at 5.5 days. Given an optimal occupancy rate of 75% (very few hotels achieve over 80% occupancy on a consistent basis), it is estimated that the study area has current capacity to accommodate about 20,000 extra visitors per year in these two types of accommodations.

The main gap in the accommodation market in the study area was in 4-star hotels. The opening of the Manado Beach Hotel in 1991 provided 207 rooms at the 4-star level. Given current occupancy rates of about 15%, it is clear that this category of accommodation is also in sufficient supply for the near term.

Table C.1a CURRENT ACCOMODATION ESTIMATES (Manado and Minahasa - 1990/1991)

Type of Accomo-dation	Rooms			Beds			Avg. No. of Beds/ Room
	Manado	Minahasa	Total	Manado	Minahasa	Total	
Deluxe	0	0	0	0	0	0	1.8
Superior	191	0	191	315	0	315	1.65
Melati	367	109	476	514	153	666	1.40
TOTAL	558	109	667	829	153	982	

Table C.1b CURRENT CAPACITY ESTIMATES (Manado and Minahasa - Based on 1990 Occupancy)

	Manado	Minahasa	Total
Total Capacity (Beds)	828.95	152.6	981.55
Optimal Occupancy Rates 75%	622	114	736
Current Occupancy Rates 45%	373	69	442
Surplus/Deficit (Beds)	249	46	294
Total Tourists (annual, at avg. stay of 5.5 days)	24,755	4,557	29,313
Total Capacity	41,259	7,595	48.854
Surplus Capacity Accomodations	16,504	3,038	19,542

Source: Parpostel Sulutteng dalam Angka '91, Department Pariwisata, Pos Dan telekomunikasi

C.3 Profiles of Planned Tourist Enclaves and Dive Resorts

Though it appears there is no comprehensive demand study for the tourist market for the study area, current and planned developments are focused on the international tourist market, mainly Japan, requiring 4-star and 5-star accommodation. Further, developers' plans indicate that resort-based accommodation would be predominate in developments. Resort-type accommodation is comprehensive in nature and includes a full-service package that contains restaurants, entertainment, etc. These resorts are expected to be based on golf and beach activities. It is understood that the private developers have prepared individual market studies; these were not made available to the consultants.

The two main tourist sites identified in the study area are Tasik Ria and Likupang. It is projected that these developments will make the most significant impact on tourism over the next 10 years mainly because they are most advanced in terms of investment plans and schedules. A number of other investors, mainly dive shop/resort operators have also indicated that they may expand operations as the tourist demand increases. Existing dive resorts appear to operate near capacity at the peak tourist seasons and on weekends. The area around Moles appears to have generated significant private investor interest, but no firm plans or projected schedules for development were available. It is significant that a further 11 coastal sites have also been identified for tourist developments.

C.3.1 Tasik Ria

The Tasik Ria area is about 10 kms south of Manado along the shoreline. The development at Tasik Ria began with the opening of the Manado Beach Hotel (MBH) in 1991. This 207 bed 4-star hotel caters to both local and international tourist. It categorizes itself as a beach hotel although at present there are no diving facilities or sea- based at the hotel site. It is understood, however, that facilities for diving, etc. may be opening this year. Current occupancy rate is low, about 14%, which is not unusual in a new hotel. The hotel has a maximum of 120,000 guest nights per year at 100% occupancy. Between January and June 1992, the hotel had about 8300 guest nights.

The MBH is located on a 30 hectare site with outline plans for another 4 hotels to bring the total development to 1500 rooms. An additional 500 units of low density accommodation (cottages and apartments) are also planned at the site. There are also plans for a golf course. It is feasible to complete construction of a hotel in two years. It is also possible to undertake overlapping construction in order to build several hotels over the same period. The original plan was to complete the full development by 1995. Clearly, from a construction point of view, it would be possible to complete the full development at Tasik Ria by 2002.

The overall investment estimate for the hotel construction at the MBH was about Rp 40 billion, with an additional Rp 17 billion for services such as water and sanitation, access roads, and related infrastructure. The group of investors for the MBH is made up of the local government, Manado Tourist development Corporation (MTDC), Bank Exim, PDN, and Hotel Indonesia, which also operates the hotel. The MBH has been consciously built as a "flagship" by the

67

investment group and has hosted many official functions. At present there is no information on the negotiation status for new investment groups and new hotels.

C.3.2 Likupang

The major development at Likupang includes a hotel and resort complex with two 18-hole golf courses, a fishing marina, and various other sea and coast based attractions. The 450 hectare site is located about 42 kilometers north of Manado city and 30 kilometers north of the airport.

The developers of this complex, the Paradise Hotel and Resort and Paradise Golf and Country Club, are P. T. Dinnelator Beach Paradise. The first 250 room 4-star hotel is under construction as is the first 9 holes of the golf course. These are expected to open in the fall of 1993. The full development will include three more 4-star hotels, to bring the total hotel accommodation to 1000 rooms. This is scheduled to be completed within 10 years. The completed golf resort is expected to have two 18-hole courses and is marketed as a country club. There are plans for additional low density housing, possibly for a retirement community with options for investment in these units. The outline estimate for the complete cost of development is about $250 million.

The target market for the development is foreign tourists, specifically Japan. Though diving will be available, much of the marketing is centered on golf. The resort is planned to be self-contained with all major tourist services available on site. Tourist expenditure per day is estimated at about $200. The developers have prepared a marketing plan and demand forecast for this resort. The plan assumed the upgrading of the Sam Ratulangi airport to take wide-bodied jets by 1995 with full completion of the airport by 1996. The developers also anticipate the improvement in 45 km of access road to Likupang from the airport to a width of 12 meters by the public sector.

C.3.3 Dive Resorts

Within the study area, there are four licensed diving operations. A special license must be obtained from the Ministry Tourism and Telecommunications in order provide services to SCUBA divers, particularly to use a compressor to fill tanks with compressed air. The four diving centers are Nusantara Diving Center, Barracuda Diving Resort, Murex (Manado Underwater Explorations), and Tirta Satwa. These dive centers provide full dive services as well as accommodation and eating facilities.

An informal survey was made, based on interviews conducted with the management at each of the diving operations. As a result of these interviews it was estimated that between 50% and 75% of the dive center users were SCUBA divers. The remainder were divided between snorkeling and viewing the reef through glass bottom boats (catamarans). Almost all the divers and a majority of the snorkelers were international tourists -- mostly from Germany, the Netherlands, France, Japan, Korea and Australia.

Table C.2 shows dive operation statistics between May 1991 and May 1992 based on consultant interviews. The daily average number of users for the facilities was about 50 divers/marine

tourists. The average of 50 does not allow however for high season peaks (June-September and December-January). The number of tourists estimated from daily users of the dive centers is just over 4,100 during the survey period, assuming the average length of stay at a dive resort is 4.5 nights.

Table C.2 DIVE OPERATIONS STATISTICS FOR MAY 1991 TO MAY 1992

	Total # of users	Number of rooms	Number of marine assoc. employees	Number of non marine employees	Boats
Nusantara Diving Center	7,275	25	36	34	10
Barracuda Diving Resort	4,666	18	18	39	12
Murex (Manado Underwater Explorations)	5,400	11	22	8	8
Tirta Satwa	1,148	2	7	3	5
Total:	18,489	56	83	84	35

Average users per day = 50 (18,489/365 days)
Number of Tourist = 4108 (18,489/4.5 nights per stay)
@ 4.5 nights per stay

Table C.2 shows 35 boats associated with the diving operations. The boats vary considerably in type and size. Murex owns one live-aboard dive boat. The most common boat is a fiberglass outrigger canoe about 12 meters long. There are 12 of these. There are 11 single-hull dive (or long) boats averaging 8 meters in length. There are also 5 catamarans, used as glass bottom boats or for other water transport purposes, and 7 speedboats that are used for emergency response, water skiing, or other nondiving or snorkeling purposes.

C.4 Tourist Profiles

The study has identified three major tourist profiles within the tourism sector for the study area. These are resort tourism, eco-tourism (diving) and local tourism. Through there will be crossover between the groups, each displays a specific set of characteristics that are important to the analysis.

C.4.1 Eco-tourism (Diving)

At present the largest tourist market for the study area is the serious diving community. Study estimates indicate that at present about 70% of all foreign tourists are divers. They are attracted by the reef and the marine park. Though this is an increasing market, it is unlikely that serious divers will be attracted to integrated resort communities which are more expensive than dive centers and offer more amenities than divers want to pay for through higher room rates. Divers usually require a fairly rigorous diving schedule of 2 dives a day and one night dive per week.

C.4.2 Golf and Beach Resorts

It is clear from the current developments and investment plans that the new tourist market in the study area is based on the development of 4-star and 5-star resort accommodation in an environmentally attractive setting that is constructed rather than natural. The main attraction for these tourists will be golf and the beach setting. Sea sports such as fishing and diving are a secondary attraction. Anecdotal evidence indicates that many tourists who visit beach resorts prefer to swim in the swimming pool rather than in the ocean.

Tourists who visit resorts, though conscious of the beauty of the natural surroundings, often are often more aware of the "micro" environment (grounds and gardens of the resort) than the specific environmental problems of the area. Only when these problems become so onerous that they impinge on the "micro" environment will tourist flows be diminished.

C.4.3 Local Tourism

At present about 80% of all tourist visitors to Manado are national tourists. The main attraction for this tourist market is the mountain area around Remboken. This area includes Lake Tondono, numerous hot springs, parks and tourist cottages. It is estimated that over 40,000 tourists visited the area between April 1990 and March 1991.

Though local tourism is not restricted to the mountain region, it is clear that this area has a

special attraction. Although these tourist areas are outside the coastal zone which is the main emphasis of the study, they are within the Tondono River watershed.

C.5 Tourist Forecast Issues

In developing tourist forecasts for this study area, two main issues must be taken into account. These are the provision of essential public infrastructure, primarily the airport and related access roads, and the carrying capacity of the reef in terms of divers and sea-based recreation.

C.5.1 The Airport and Access Roads

The anticipated large increase in foreign tourists is predicated on the upgrading and expansion of Sam Ratulangi Airport, Manado, to take wide-bodied jets (DC 10s, 747s). It is understood that plans are in hand to begin the upgrading of the airport in October 1993. It is anticipated that the work will take about 3 years and include lengthening of the runway by 250 meters, refurbishment and expansion of the terminal, upgrading of navigational aids, provision of enhanced emergency services and the provision of an emergency power supply. The estimated cost of the expansion is about $42 million and is expected to be financed through the Asian Development Bank.

Demand forecasts for foreign arrivals are based on the expectation of 7 direct international flights of wide-bodied jets a week from regional destinations as follows: 2 from Japan and 1 each from South Korea, Taiwan, Hong Kong, Singapore and Thailand. GOI projections for the number of passengers at the airport in 2000 is 428,000. A number of international carriers have already applied for permits to serve Manado as an international gateway for regularly scheduled flights. These include Japan Airlines, Singapore Airline Royal Brunei, China Airways, Quantas, and Philippine Airlines.

It is understood that international airline agreements regulate the number of international gateway airports for a particular country in regard to reciprocity or reciprocal agreements between national carriers. The situation with respect to Manado becoming an international gateway for Indonesia is not yet clear and it is possible that this could complicate development plans. Currently there are two international flights a week to Davao in the Philippines on Bouraq Airlines. In addition, two charter flights a week from Singapore are scheduled to begin in September.

For the purpose of forecasting the number of tourists, it was assumed that the Sam Ratulangi Airport would be fully operational as a gateway airport by 1996. The occupancy rate of hotels and rate of expansion in rooms is most concentrated after 1995 when the airport becomes operational.

In addition to the airport, the upgrading and completion of access roads to the various resort sites is of critical importance. Plans are in hand for a ring road around Manado to service the south beaches and the Tasik Ria area. More immediately, about 45 kms. of road is to be upgraded to 12 meters width between the airport and the Lukopang resorts. Given an indicative

71

figure of about RP 40 million per km for a 4 m width, indicative cost estimates are about RP 50 million for this access road. Supporting infrastructure for tourist development, such as access roads, will be the responsibility of the local government.

C.5.2 Carrying Capacity of the Reef Area

For the purpose of the tourist forecasts for divers and other tourists associated mainly with reef activities, it was necessary to consider an indicative estimate of the absolute carrying capacity of the reef. The study has assumed that there are about 20 suitable dive sites in the immediate area that will serve the tourist enclaves around Manado. Dive experts indicate that it is unlikely that there would be more than 18 divers at any one dive site at any one time. The indicative carrying capacity of these dive sites is therefore about 360 divers per day. Current estimates from the consultant's survey of dive centers indicate that there are now an average of about 50 divers/marine tourists at dive sites on any one day.

Assuming that the dive sites are in 100% use for the entire year the theoretical carrying capacity of the diving reef is about 130,000 divers per year (360 divers for 365 days). It is estimated that divers usually stay about a week in a single dive location and it assumed that the length of stay for this category of tourist is about 4.5 days. This gives a maximum for diving/marine tourists of about 30,000 per year. New dive sites will obviously increase the number of divers that can be accomodated, and the study has estimated that the carrying capacity of the reef area is between 30 and 50 thousand divers a year.

C.6 Tourist Forecasts

C.6.1 Methodology

The main purpose of the forecasts for tourism growth is to establish the number of tourists visiting the study area over the timeframe of the study. The tourism forecasts within the study are used for two main purposes. First, they establish the potential demand from the transient tourist population on urban services (i.e., water supply, waste water and solid waste disposal) within the study area. Second, growth in tourist arrivals is used to assess the potential economic value of the tourist industry.

The method used to calculate future tourist numbers was based on a "supply side" approach due to the lack of a comprehensive tourist demand analysis for the Manado/Minahasa region for the study period. Using this approach, growth in tourism is based on the growth in the available tourist accommodation. Conversely, lack of suitable accommodation is assumend to be a major constraint to the expansion of tourism. Interviews were held with the major developers of the existing developments and those under construction (see Section C.3 above) to establish the most likely completion schedule and size of major hotel developments. The majority of these developments are for 4-star and 5-star hotels and major tourist complexes.

7V

The tourist forecasts cover a 10-year time frame from 1992 to 2002. Three classes of accommodation that are currently available and are programmed to be available are considered in the forecasts. These include 5-star and 4-star (deluxe), 1-3-star (superior), and melati (guesthouses and pondoks). Increases in the number of rooms available in each category were estimated for three scenarios: mid, high, low growth. Data for expected growth in accommodation was based on interviews with the major developers and investors of current hotels and resorts and those under construction.

The critical assumptions in the analysis include the construction schedule for major tourist resorts, the number of available beds at each resort, occupancy rates, and length of stay. Once the number of rooms was established for each category of hotel for each year of the forecast, the number of tourists was calculated using standard methodology as follows. The average number of beds was established per room by category of hotel; next an occupancy rate per hotel was estimated in order to calculate the number of guest nights; and finally the average length of stay was estimated to determine the number of tourists.

Average annual growth rates to provide a trend analysis for tourism were also calculated on the model's assumptions. These were compared to tourist growth rates for other sites in Indonesia (Bali in particular) to act as a cross-check on the validity of the growth rate assumptions.

C.7 Critical Assumptions

C.7.1 Construction Schedule:

The model is driven by the number of new rooms available per year. Table C.3 sets out estimates for room availability by year and by class of accommodation. The high forecast is based on the complete realization of developers forecast plans for the deluxe developments and a modest increase in superior accommodation given the current overcapacity in this category (see Table C.1). For all forecasts the melati category of accommodation is held constant. The total number of rooms available in the high forecast in 2002 is 4276.

The mid-forecast is based on a more modest completion schedule for the main tourist enclaves, Tasik Ria and Likupang, with most of the developments phased in after the completion of the airport in 1996. The increase in superior accommodations of about 300 rooms is also phased in after completion of the airport. Overall there are 3276 rooms available in 2002 in the mid-growth forecast scenario.

The low forecast is the most conservative with no new accommodation available until 1995 when the airport improvements should be operational but not completed. The large developments are assumed to complete only about half of their projected construction schedule by 2002. An additional 100 rooms are estimated to be added to the superior category. Total available room stock in 2002 is 2074.

Table C.3 NUMBER OF TOURIST ROOMS AVAILABLE (by year, 1992-2002)

Tourist Demand Forecasts 1992 - 2002 MID FORECAST

By Type of Accommodation	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	TOTAL
Number of Rooms by Year Occupied												
Deluxe (4+ plus)												
Tasik Nia	207			200		200	200			200		1007
Likupang			250			250			250		250	1000
Other					100		100				93	293
Sub Total												2300
3 - 1+	191			100			100			109		500
Meleti	476											476
TOTAL (Incremental)	874	0	250	300	100	450	400	0	250	309	343	1276
CUMULATIVE	874	874	1124	1424	1524	1974	2374	2374	2624	2933	3276	

Tourist Demand Forecasts 1992 - 2002 HIGH FORECAST

By Type of Accommodation	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	TOTAL
Number of Rooms by Year Occupied												
Deluxe (4+ plus)												
Tasik Nia	207		200		200		200		200	200	293	1500
Likupang			250		250		250		250		200	1200
Other			100		100		100		100		100	500
Sub Total												3200
3 - 1+	191			100		100		100		109		600
Meleti	476											476
TOTAL (Incremental)	874	0	550	100	550	100	550	100	550	309	593	4276
CUMULATIVE	874	874	1424	1524	2074	2174	2724	2824	3374	3683	4276	

Tourist Demand Forecasts 1992 - 2002 LOW FORECAST

By Type of Accommodation	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	TOTAL
Number of Rooms by Year Occupied												
Deluxe (4+ plus)												
Tasik Nia	207				200			200				607
Likupang				250			250					500
Other						100				100		200
Sub Total												1307
3 - 1+	191			100								291
Meleti	476											476
TOTAL (Incremental)	874	0	0	350	200	100	250	200	0	100		2074
CUMULATIVE	874	874	874	1224	1424	1524	1774	1974	1974	2074	2074	

C.7.2 Number of Beds

Once the number of available rooms has been estimated, it is necessary to estimate the number of beds to be able to calculate available guest nights. Given information on existing accommodation in Manado (4) for 1- to 3-star and melati accommodation, average beds per room have been estimated at 1.6 and 1.4 respectively. A 4-star developer in Manado indicated that their planning estimated included a bed/room ratio of 1.8. Studies of large tourist developments on Bali (6) also have used this ratio for major tourist complexes. This study has adopted a 1.8 bed to room ratio for 4-star hotels.

C.7.3 Occupancy Rates

One of the most critical assumptions in the calculation of the tourist forecasts is the occupancy rate, the ratio of occupied beds to total beds. This rate is multiplied by the number of available beds to calculate the number of bed nights or tourist stays on any one day. For example, an occupancy rate of 15% for 200 available beds would indicate that 30 beds would be used on any one day and 10,950 (30 x 365) would be used per year.

The maximum occupancy rate usually achieved internationally is between 75% and 80%. It is unusual for hotels to maintain an average annual occupancy rate of over 80% The study has taken an occupancy rate of 45% for 1-3-star hotels based on existing tourist statistics for 1990. An occupancy rate of 15% was calculated for the Manado Beach Hotel (4-star), based on records for 6 months. The study has used an initial rate of 40% for the melati accommodation.

Occupancy rates are increased over the time frame of the study to achieve a maximum of 75% in 2002. It is likely that developers will need to see occupancy rates of at least 60% to maintain interest in continued investment in their hotel and tourist complexes. After the airport is completed in 1996, all occupancy rates have been assumed to be over 60%.

C.7.4 Length of Stay

In order to estimate the number of tourists, it is necessary to calculate the length of stay for each visitor. For example, annual guest nights of 10,950 at an average length of stay of 3.5 nights would represent about 3130 tourists.

The study has estimated the length of stay for 4-star and 5-star hotels at 3.5 nights per visit. These planning estimates have been used by the Paradise Beach Resort planners and are commonly used for deluxe hotels for average length of stays. Data on hotels in Manado indicate a longer length of stay and 4.5 nights per stay has been used for the 1- to 3-star hotel and 5 nights has been used for melati class.

C.7.5 Foreign and Local Tourist Flows

Tourist flows for 1991 indicate about 36000 visitors registered at hotels and dive centers. About 20% or 6000 were foreign visitors and the remainder were Indonesian nationals. In discussing

tourist demand with several developers and dive centers, it was clear that foreign tourists are the target market for the majority of the proposed resort and dive center developments. For the purpose of the study estimates, it has been assumed that 80% of guest nights in 4-star hotels, 50% of guest nights in 1- to 3-star hotels, and 20% of guest nights in melati will be foreign tourists by 2002. It is projected that about 70% of tourists will be foreign nationals at this time.

C.8 Results

The results of the full tourist analysis are presented in the following tables: Table C.4 summarizes the results; Table C.5 shows the mid-forecast; Table C.6 shows the high forecast; and Table C.7 shows the low forecast.

Tourist forecasts for year 2002 are presented for the mid, high and low projections based on estimated completion of major hotel developments. The 1992 base is assumed to be about an 11% increase on the total number of tourist recorded in hotels and dive centers of about 36,000. Foreign tourist arrivals are expected to grow at about 30% to about 8200 and local tourist are expected to maintain their growth trend of about 8% per year.

Overall the average annual growth rate for the mid-range forecast for the 10-year period is estimated at about 26% per year. The growth rate for tourists on Bali, for example, averaged about 27% per year from 1969 to 1973 at the beginning stages of their tourist industry. The Bali case mirrors the study forecasts, because these Bali growth rates reflect the period directly after the Tuban airport near Denpasar had been upgraded to handle jet aircraft (World Bank, 1985). This timeframe roughly corresponds with the study's most concentrated growth after the Sam Ratulangi Airport is operational. The specific profile of the percentage increase will most likely be higher at the beginning of the period because of the relatively low base of absolute tourist numbers. Once the absolute numbers of visitors increases, it is expected that the average growth rate would decline. The average annual growth rate for the high forecast is 30% per year and for the low case, 20%.

Tourist impact on the resident population appears small in terms of absolute numbers of tourist, both foreign and local, in the study area on any single day. In fact only in the high case and for the Manado area do tourists represent over 1% of the resident population. Though seasonality has not be taken into account and it is possible these numbers may double or triple in the high season, they still appear to be a manageable number of tourists in terms of resident populations.

Table C.4 TOURIST FORECASTS, 1992-2002

Forecast Scenario	Mid	High	Low
Number of Tourists 1992 (Base Year)	40100	40100	40100
Number of Tourists 2002 (Forecast Year)	409000	545400	248800
Average Annual Growth Rate	26%	30%	20%
Average Number of Tourists 2002 (any one day)	4205	5540	2613
Tourists as Percent of Resident Population 2002 - (Best Estimate) Manado (Kota)	.9%	1.1%	.5%
Tourists as Percent of Resident Population 2002 - (Best Estimate) Manado & Minahasa	.3%	.4%	.2%

Table C.5 PROJECTED NUMBER OF TOURISTS, MODERATE GROWTH (by year, 1992-2002)

TOURIST FORECASTS Rio

By Type of Accomodation		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Rooms:												
Deluxe (40 plus)		207	207	457	657	757	1207	1507	1507	1757	1957	2300
Superior (8 to800)		191	191	191	291	291	291	391	391	391	500	500
Relati 1-3		476	476	476	476	476	476	476	476	476	476	476
TOTAL		874	874	1124	1424	1524	1974	2374	2374	2624	2933	3276
Incremental No. of Rooms		0	0	250	550	650	1100	1500	1500	1750	2059	2402
Beds:												
Deluxe (40 plus)	1.8	373	373	823	1183	1363	2173	2713	2713	3163	3523	4140
Superior (8 to800)	1.6	306	306	306	466	466	466	626	626	626	800	800
Relati 1-3	1.4	666	666	666	666	666	666	666	666	666	666	666
TOTAL		1345	1345	1795	2315	2495	3305	4005	4005	4455	4989	5606
Occupancy (Percentage)												
Bed Nights		%	%	%	%	%	%	%	%	%	%	%
Deluxe (40 plus)		0.15	56 0.20	75 0.30	247 0.40	473 0.45	613 0.60	1304 0.60	1620 0.65	1763 0.65	2056 0.70	2466 0.75	3105
Superior (8 to800)		0.50	153 0.50	153 0.55	168 0.55	256 0.55	256 0.60	279 0.62	308 0.65	407 0.65	407 0.70	560 0.75	600
Relati 1-3		0.45	300 0.45	300 0.50	333 0.52	347 0.52	347 0.55	367 0.60	400 0.65	433 0.70	466 0.70	466 0.75	500
TOTAL - Bed Nights (TOURIST PER DAY)			509	527	748	1076	1216	1949	2415	2603	2929	3492	4205
Length of Stay (Days) (Total tourists)												
Deluxe (40 plus)	3.5		5029	7771	25736	49331	63945	135943	169731	183876	214379	257150	323807
Superior (8 to800)	4.5		12394	12394	13633	20771	20771	22659	31461	32903	32903	45422	48666.7
Relati 1-3	5		21891	21891	24324	25297	25297	26756	29188	31621	34053	34053	34485.4
TOTAL			40114	42056	63692	95399	110012	185358	230380	248479	281415	336625	408959
Number of Tourists(Annual)												
Deluxe (40 plus)			5029	7771	25736	49331	63945	135943	169731	183876	214379	257150	323807
Superior (8 to800)			12394	12394	13633	20771	20771	22659	31461	32903	32903	45422	48666.7
Relati 1-3			21891	21891	24324	25297	25297	26756	29188	31621	34053	34053	34485.4
TOTAL			40114	42056	63692	95399	110012	185358	230380	248479	281415	336625	408959
Number of Tourists(Annual)												
Foreign			8202	9173	21822	40110	64524	123169	154297	166618	191507	230699	285809
Local			31912	32883	41870	55288	45489	62189	76173	81861	89908	105926	123150
TOTAL			40114	42056	63692	95399	110012	185358	230380	248479	281415	336625	408959
				5%	51%	50%	15%	68%	24%	8%	13%	20%	21%
						0.3534	0.3805	0.4453	0.3403	0.3354	0.1513	0.1358	0.18121
								0.3798	0.4184	0.3315	0.2584	0.267	0.17351
FORECASTS:												
Number of Tourists(Annual)		1991 Base:	Foreign:		6000	Local:	34000	Total:	36000			
	Rate											
Foreign Growth Rate	42.63%	8202	11698	16686	23799	33945	48417	69057	98498	140489	200383	285809
Local	14.46%	31912	36526	41807	47851	54779	62689	71753	82127	94002	107593	123150
TOTAL	26.14%	40114	48224	58492	71651	88715	111106	140810	180625	234491	307976	408959
% Foreign		0.20	0.24	0.29	0.33	0.38	0.44	0.49	0.55	0.60	0.65	0.70
Number of Tourists(Annual) Percentage Increase												
Foreign		37%	12%	138%	84%	61%	91%	25%	8%	15%	26%	24%
Local		6%	3%	27%	32%	-18%	37%	22%	7%	16%	18%	15%
TOTAL			5%	51%	50%	15%	68%	24%	8%	13%	20%	21%

Table C.6 PROJECTED NUMBER OF TOURISTS, HIGH GROWTH (by year, 1992-2002)

TOURIST FORECASTS		High										
By Type of Accommodation		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Rooms:												
Deluxe (48 plus)		207	207	757	757	1307	1857	1857	1857	2407	2407	3200
Superior (8 to48)		191	191	191	291	391	391	391	491	491	591	640
Relati 1-3		476	476	476	476	476	476	476	476	476	476	476
TOTAL		874	874	1424	1524	2174	2724	2724	2824	3374	3474	4276
Incremental No. of Rooms		0	0	550	650	1300	1850	1850	1950	2500	2600	3402
Beds:												
Deluxe (48 plus)	1.8	373	373	1363	1363	2353	3343	3343	3343	4333	4333	5760
Superior (8 to48)	1.6	306	306	306	466	626	626	626	786	786	946	960
Relati 1-3	1.4	666	666	666	666	666	666	666	666	666	666	666
TOTAL		1345	1345	2335	2495	3645	4635	4635	4795	5785	5945	7386
Occupancy (Percentage)												
Bed Nights		%	%	%	%	%	%	%	%	%	%	%
Deluxe (48 plus)		0.15	56 0.20	75 0.30	409 0.40	545 0.45	1059 0.40	2066 0.40	2066 0.45	2173 0.45	2816 0.70	3033 0.75	4320
Superior (8 to48)		0.50	153 0.50	153 0.55	160 0.55	256 0.55	344 0.40	375 0.62	388 0.65	511 0.65	511 0.70	662 0.75	720
Relati 1-3		0.45	300 0.45	300 0.50	333 0.52	347 0.52	347 0.55	347 0.60	400 0.65	433 0.70	466 0.70	466 0.75	500
TOTAL - Bed Nights (TOURIST PER DAY)			509	527	910	1148	1749	2747	2793	3116	3793	4161	5540
Length of Stay (Days) (Total tourists)												
Deluxe (48 plus)	3.5	5029	7771	42630	54840	110404	209151	209151	226581	293408	316290	450514
Superior (8 to48)	4.5	12394	12394	13633	20771	27909	30446	31461	41419	41419	53689	58400
Relati 1-3	5	21091	21091	24324	25297	25297	26756	29100	31621	34053	34053	34485.4
TOTAL		40114	42956	80587	102907	163609	266353	269900	299620	369160	404022	543400
Number of Tourists(Annual)												
Deluxe (48 plus)		5029	7771	42630	54840	110404	209151	209151	226581	293408	316290	450514
Superior (8 to48)		12394	12394	13633	20771	27909	30446	31461	41419	41419	53689	58400
Relati 1-3		21091	21091	24324	25297	25297	26756	29100	31621	34053	34053	34485.4
TOTAL		40114	42956	80587	102907	163609	266353	269900	299620	369160	404022	543400
Number of Tourists(Annual)												
Foreign		8292	9173	30270	43865	104546	184051	185743	204156	258329	281310	391069
Local		31912	32083	50317	59043	59063	81503	84057	95464	110831	122712	154331
TOTAL		40114	42956	80587	102907	163609	266353	269900	299620	369160	404022	545400
			52	922	282	592	632	12	112	232	92	352
					0.4139	0.5943	0.4113	0.4103	0.2565	0.1105	0.1457	0.22549
							0.4919	0.4840	0.3237	0.3147	0.2156	0.45598
FORECAST:												
Number of Tourists(Annual)		1991 Base:	Foreign:	6000	Local:	30000	Total:	36000				
	Rate											
Foreign Growth Rate	47.182	8292	12071	17766	26146	38521	56635	83352	122673	180545	265717	391069
Local	17.072	31912	37359	43737	51204	59945	70178	82158	96184	112604	131827	154331
TOTAL	29.022	40114	49431	61503	77350	98466	126813	165510	218857	293148	397543	545400
% Foreign		0.20	0.24	0.29	0.34	0.39	0.45	0.50	0.56	0.62	0.67	0.72
Number of Tourists(Annual) Percentage Increase												
Foreign		372	122	2342	652	1382	772	92	102	272	92	392
Local		42	32	532	172	62	392	32	142	142	112	242
TOTAL			52	922	282	592	632	12	112	232	92	332

Table C.7 PROJECTED NUMBER OF TOURISTS, LOW GROWTH (by year, 1992-2002)

TOURIST FORECASTS		Low										
By Type of Accomodation		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Rooms:												
Deluxe (48 plus)		207	207	207	457	657	757	1007	1207	1207	1207	1307
Superior ($ to$80)		191	191	191	291	291	291	291	291	291	291	291
Belati 1-3		476	476	476	476	476	476	476	476	476	476	476
TOTAL		874	874	874	1224	1424	1524	1774	1974	1974	1974	2074
Incremental No. of Rooms		0	0	0	350	550	650	900	1100	1100	1100	1200
Beds:												
Deluxe (48 plus)	1.8	373	373	373	823	1183	1363	1813	2173	2173	2173	2353
Superior ($ to$80)	1.6	306	306	306	466	466	466	466	466	466	466	466
Belati 1-3	1.4	666	666	666	666	666	666	666	666	666	666	666
TOTAL		1345	1345	1345	1955	2315	2495	2945	3305	3305	3305	3485
Occupancy (Percentage)												
Bed Nights		%	%	%	%	%	%	%	%	%	%	%
Deluxe (48 plus)		0.15	56 0.20	75 0.30	112 0.40	329 0.45	532 0.60	818 0.60	1088 0.65	1412 0.65	1412 0.70	1521 0.75	1764
Superior ($ to$80)		0.50	153 0.50	153 0.55	168 0.55	256 0.55	256 0.60	279 0.62	289 0.65	303 0.65	303 0.70	326 0.75	349
Belati 1-3		0.45	300 0.45	300 0.50	333 0.52	347 0.52	347 0.55	347 0.60	400 0.65	433 0.70	466 0.70	466 0.75	500
TOTAL - Bed Nights (TOURIST PER DAY)		509	527	613	932	1135	1463	1776	2140	2181	2313	2613
Length of Stay (Days) (Total tourists)												
Deluxe (48 plus)	3.5	5829	7771	11657	34314	55498	85260	113417	147271	147271	158440	184047
Superior ($ to$80)	4.5	12394	12394	13633	20771	20771	22659	23415	24547	24547	26436	28324
Belati 1-3	5	21091	21091	24324	25297	25297	26756	29188	31621	34053	34053	36485.4
TOTAL		40114	42256	49614	80382	101565	134475	166020	203439	205872	219009	248816
Number of Tourists(Annual)												
Deluxe (48 plus)		5829	7771	11657	34314	55498	85260	113417	147271	147271	158440	184047
Superior ($ to$80)		12394	12394	13633	20771	20771	22659	23415	24547	24547	26436	28324
Belati 1-3		21091	21091	24324	25297	25297	26756	29188	31621	34053	34053	36485.4
TOTAL		40114	42256	49614	80382	101565	134475	166020	203439	205872	219009	248816
Number of Tourists(Annual)												
Foreign		8202	9173	14783	32402	57766	82623	105937	133960	134447	144265	165832
Local		31912	32083	34831	47980	43799	52052	60483	69479	71425	74824	82984.1
TOTAL		40114	42256	49614	80382	101565	134475	166020	203439	205872	219009	248816
			5%	18%	62%	26%	33%	23%	23%	1%	6%	14%
					0.2020	0.3545	0.4032	0.2741	0.2614	0.1547	0.1005	0.07661
							0.2076	0.3244	0.2336	0.2119	0.1721	0.134
FORECASTS:												
Number of Tourists(Annual)		1991 Base:	Foreign:		6000	Local:	30000	Total:	36000			
	Rate											
Foreign Growth Rate	35.00%	8202	11079	14965	20213	27303	34950	49816	67209	90696	122770	165832
Local	10.93%	31912	35112	38633	42507	46770	51460	56621	62299	68547	75421	82984.1
TOTAL	20.62%	40114	46191	53598	62721	74073	86340	106437	129508	159437	198191	248816
% Foreign		0.20	0.24	0.28	0.32	0.37	0.42	0.47	0.52	0.57	0.62	0.67
Number of Tourists(Annual) Percentage Increase												
Foreign		37%	32%	61%	121%	77%	43%	28%	26%	6%	7%	15%
Local		6%	3%	6%	37%	-8%	19%	15%	16%	3%	5%	11%
TOTAL			5%	18%	62%	26%	33%	23%	23%	1%	6%	14%

90

ANNEX D: EMPLOYMENT CREATION AND VALUE ADDED BY TOURISM

D.1 Overview and Methodology

The tourist forecasts in Annex C are used to assess the potential value of the tourism industry and its resulting economic impact. This was accomplished with two separate approaches. First, the value added by employment generation as a result of tourism through the increase in permanent full time jobs in hotels and resorts and related tourist infrastructure, such as dive centers and restaurants, was estimated. Estimates of indirect employment not directly associated with tourism but servicing the sector, for example, transport, taxis, and buses, was also included in the estimate of employment. Total number of new jobs created by the projected increase in tourism was then multiplied by an indicative average wage rate to calculate valued added from new employment. Permanent employment generation in a service industry like tourism is considered a good proxy for an indicative estimate of the increase in local economic activity. The study calculated incremental gains to regional GDP measured as estimates of increases in wage employment in the new hotel developments, dedicated tourist facilities, and related services. Second, indicative estimates of total gross revenues that could be generated from tourism under different scenarios of expected tourist arrivals was calculated.

D.2 Value Added from Employment Creation

The direct contribution by hotels and restaurants currently to estimates of regional GDP is not large. Table D.1 sets out estimates of GDP for Minahasa and Manado by industrial origin. Hotels and restaurants as a percentage share are .4% and 2% for Minahasa and Manado respectively. In current 1990 prices for Manado this represents about Rp 6,225 million and for Minahasa (1989) about RP 1,900 million. Nationally, tourism represents about 3% of Indonesia's total GDP.

As the regional economy expands, it is expected that employment in agriculture as a share in total employment will decline. It will be necessary for employment in the service sector to absorb a large share of these workers who will seek a higher levels of productivity and income outside of agriculture.

The tourist industry is a highly labor intensive industry with labor productivity rates much higher than agriculture. Considerable benefit will be derived in the study area from direct and indirect employment created to serve tourists. The direct employment benefits will mainly come from hotels, dive centers, restaurants, and other recreational facilities. Indirect employment opportunities include additional taxis and other transportation services, shops, and other commercial enterprises that serve tourists as well as the general business and commercial community of the study area.

91

Table D.1 REGIONAL GDP BY SECTORAL ORIGIN

Sector	Minahasa (% in 1989)	Manado (% in 1990)
Agriculture	46.0	3.6
Mining and Quarrying	0.5	0.07
Industry	7.2	4.0
Electricity and Water Supply	1.7	0.7
Trade	7.0	22.0
Hotels and Restaurants	0.4	2.0
Transport and Communication	11.7	26.1
Banking and Financial Services	4.1	12.3
Construction	4.2	5.1
Housing and Public Administration	11.6	19.2
Services	5.6	4.9
Total	100%	100%
Total GDP in RP million - constant 1983 market prices	329,287	193,834
Total GDP in RP million - current prices	482,845	311,298

Source: Minahasa Dalam Angka, 1990, Kantor Statistik Kapupaten,
Minahasa Monografi, Kotamadya Daeah Tingkat II, Manado, March 1992

D.3 Critical Assumptions

D.3.1 Hotels

The best tourist infrastructure information available to consultants was on employment and employment generation for hotels and diving centers. Hotel employment was based on an estimate of 2.2 employees per room. This is slightly higher than traditional planning estimates of 2 employee per room; however, the type of hotels planned (resort complexes with labor

9V

intensive golf courses) indicated that 2.2 employees may be a more realistic estimate. Further, resort-type developments tend to be labor intensive in terms of ancillary activities such as restaurants and entertainment located on the hotel site. Using mid estimates for 2002, about 5300 jobs will be created at a direct result of hotel development.

D.3.2 Dive Centers

Good data was obtained concerning the current diving centers and employment ratios from the dive center survey. Based on this data, an indicative ratio of about .7 employees per 100 dives was calculated. It is assumed it will take about 150 dive center staff to service the estimated 22,000 dives in 1992, a 20% increase over data for 1991/92 (See Table C.2). Given the expected carrying capacity of the reef (a maximum of about 130,000 dives), it is expected that about new 750 jobs will be created at the dive centers, which now employ about 150 people. This represents about a 20% increase in employment associated directly with ancillary tourist growth outside the hotels.

D.3.3 Additional Direct Employment

Additional direct employment from growth in tourist is difficult to measure. This category includs jobs created in restaurants, tourist shops, travel agencies, tourist entertainment, etc. For example, in Manado at present there are about 55 restaurants serving both local and international tourist visitors as well as permanent residents. The average number of permanent full-time paid employees per restaurant is about 5. Currently the total number of employees associated with restaurant service is about 275. This estimate appears somewhat low; however official statistics may not take into account informal family employees who may not be paid on a cash basis. Part-time employment is also difficult to estimate and would add to the actual employment created by restaurants. Based on tourist flows, it appears that about 20% of restaurant activity is associated with tourists, or about 55 employees.

Information on job creation in Bali indicates an employment ratio of 1 tourist-related job to every 4 hotel jobs. The study has been conservative in its estimation of increased employment because of the configuration of the resort-type hotels and the higher than average expected hotel-related employment. Study estimates have assumed that there are currently about 275 full-time jobs directly associate with tourism outside the hotel sector and that these will grow at about 20% per year in line with the estimates for dive shops and related facilities. Total job creation at the end of the study period is estimated to be about 1400 new jobs or about 15% of total job creation.

D.3.4 Indirect Employment

The indicative estimate from the Bali study was used to forecast employment not directly associated with tourism but servicing the tourist sector. This includes transport, taxis, and buses, as well as increase in demand for commercial activities by hotels as well as tourist themselves. This study assumes a 25% increase for indirect labor creation as a percentage of

direct labor creation. This represents about 20% of total job creation or about 1900 jobs in 2002.

D.3.5 Wages

Because hotel services make up over 50% of the job market, indicative wage rates for the service sector were based on estimates for hotel services. An annual wage rate of RP 1.5 million was used based on data collected from several hotels. Wage rates ranged from RP 100,000 per month to RP 160,000.

D.4 Results and Limitations

Study estimates indicate that about 9360 new jobs would be created in the study area by 2002 based on increases in tourist development in the mid-growth scenario. This is valued at about Rp 14045 million in current prices. These estimates are set out in Table D.2 with study estimates for the high and low scenarios. The range of employment creation is between about 6000 and 18170 permanent jobs.

To give this estimate perspective, value added in terms of employment creation measured by increase to total wages is taken as a percentage of an estimate of total GDP for the region (Manado and Minahasa) for 1990. The current estimate for the combined GDP is less than 1%. The increase share in GDP is estimated to increase to 2.3% on the mid estimate. If Manado is considered alone, this estimate rises to about 6%.

It is clear that there would be a multiplier effect in terms of wages in circulation that would buy more goods and services as a result of increased employment and job creation. Furthermore, construction employment was not considered as it was assumed that job created solely for tourist resort contraction would not be permanent. The value added estimates were based on the creation of permanent jobs. The estimates of value added to employment creation are meant to be indicative. The assumptions needed to make these estimates more exact would need further survey work and comparative analysis.

The main conclusion of the analysis is that tourism will contribute an increasing percentage of regional GDP. This could rise as high as 10%. The tourism industry over the study period is unlikely, however, to change the main structure and character of production of the region which relies heavily on agriculture, agribusiness and commerce. In terms of regional economic diversification and employment, tourism will provide an important increase in income but is unlikely to provide the main "engine" of growth for the region over the study period.

Table D.2 EMPLOYMENT CREATION FROM HOTELS AND RELATED TOURISM SECTOR IN CURRENT PRICES, 1992-2002

Forecast Scenario	Mid	High	Low
Current No. Employed, 1992	2900	2900	2900
Wage Value, 1992 RP million	4400	4400	4400
Incremental Employment 2002	9360	18170	6038
Incremental Wage Value, 2002 RP million	14045	22573	9090
Total Wage Value, 2002 RP million	18445	22573	13490
Percentage of Study Area GDP Wage Value only (1990) (GDP RP 800,000 million)	2.3%	2.8%	1.7%

D.5 Gross Revenue Generation

Expenditure patterns of the various tourist groups are based on available data from Bali (World Bank, 1985). It is assumed from these observations that about 50% of a tourist's daily expenditure is for accommodation, 20% is for food and beverages, and the remainder is divided fairly evenly between shopping, tours and transport, and entertainment and recreation.

Using this general principal, an average expenditure per tourist based on accommodation costs can be calculated. The calculation is based on a per room rate and adjusted by the average bed per room ratio to obtain a per capita figure. These results are set out in Table D.3.

These estimates are based on average expenditure per room occupant by category of room occupied (4-star, 1- to 3-star, or melati). Estimates for a guest in a 4-star room are RP 332,000 per day, for 1- to 3-star RP 150,000 and for melati, RP 57,000. Average expenditure per tourist shows an increasing trend over the study period because of the increasing number of 4-star based tourists within the total tourist profile, as this type of accommodation dominates the market.

Table D.3 AVERAGE TOURIST EXPENDITURES IN DOLLARS AND RUPIAH, PER PERSON PER DAY

	4 Star	1 to 3 Star	Melati
Cost Category	Per Room	Per Room	Per Room
Accommodation	$ 150/night	$ 60/night	$ 20/night
Food & Beverage	$ 60	$ 24	$ 8
Other: Shopping,tours.	$ 90	$ 36	$ 12
Total	$ 300	$ 120	$ 40
$ Per Person	$ 166	$ 75	$ 28.5
RP Per Person	RP 332,000	RP 150,000	RP 57,000

Maximum annual gross revenue resulting from tourism expenditures in the study area is estimated at about RP 419,500 million (1992 prices) in the final year of the study for the mid case scenario. This estimated value for the high case increases to RP 573300 million and for the low, RP 243000 million.

The study did not attempt to calculate net revenue streams in terms of estimating capital costs and operating costs of new facilities related to the private tourist investment. Nor did it calculate operating costs of existing establishment to establish whether these were good investments or to establish a rate of return on capital assets.

Concern is sometimes expressed about the balance of payments effect of tourist projects in terms of foreign exchange "leakage," in which a considerable percentage of foreign exchange generated by tourists is used for imports to satisfy tourists demands for luxury goods. This is a possible problem in very small economies were tourism represents a large proportion of foreign exchange earnings and where there is a premium value on foreign exchange reflected in an overvalued exchange rate. In these cases imports appear cheap relative to exports. This is clearly not the case for Indonesia in terms of the size of the economy, its diverse and robust export pattern based on raw materials and increasingly on manufactures, and the freely convertible Rupiah. In fact, the current exchange rate policy of staged devaluation of the rupiah (rupiah competitiveness) may encourage tourist development in terms of value for money with respect to competitors such as Thailand and the Philippines.

Further, the larger tourist investments in Manado and Minahasa are for the most part national investors, and it is assumed that the majority of the equity capital and possibly all the debt capital will be financed from domestic resources (in other words, there is apparently not capital flight). With the opening of the Jakarta stock market and other available international

96

financial instruments, the source of investment capital in such an open international market is not an issue.

The majority of the larger investment projects, though nationally financed, appear to be supported from outside the study region. This is understandable given the scale of the projects and the possible ability of local investors to absorb such risk. The Likupang Resort complex full investment cost is estimated at $250 million and the Tasik Ria complex, including the Manado Beach Hotel, about $200 million. Local investors will not necessarily reinvest in the area of the initial investment. They will seek, like any rational investor, the highest return on their capital assets. It is apparent, however, that a number of smaller hotels and resorts, particularly dive centers, are anticipating the tourist "boom" and investing in more and higher quality facilities. Assuming an open investment policy in the study region, local investors should be able to compete with non-regional investors for appropriate investments.

The results of the employment creation and the value added analysis for employment was summarized in Table D.2. The detailed results are presented in the following tables: Table D.4 for the mid forecast, Table D.5 for the high forecast, and Table D.6 for the low forecast.

97

Table D.4 EMPLOYMENT CREATION AND VALUE ADDED, MODERATE GROWTH (by year, 1992-2002)

TOURIST FORECASTS		Mid										
Employment Value		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Numbers of Employees												
Direct												
Hotels	2.2	1923	1923	2472.0	3132.0	3352.0	4342.0	5222.0	5222.0	5772.0	6452.6	7207.2
Tourist Infrastructure												
Diving Facilities		150	180	216	259.2	311.04	373.25	447.9	537.48	644.97	773.97	928.76
Other		275	330	396	475.2	570.24	684.29	821.15	985.37	1182.4	1418.9	1702.73
Total		2348	2433	3084.0	3867.2	4234.1	5400.3	6491.0	6745.7	7600.2	8645.5	9838.69
Indirect												
Commerical Transport	0.25	587	608.2	771.2	966.8	1058.5	1350.1	1623	1686.4	1900.1	2161.4	2459.67
TOTAL		2935	3041	3856	4834	5292.6	6750.4	8114.0	8432.1	9500.3	10807	12298.4
Value (Wages) Rp. millions	Year 1.5	4402	4562	5784	7251	7938.9	10126	12172	12648	14250	16210	18447.5
Taxes Rp. millions	0.1	440.2	456.2	578.4	725.1	793.89	1012.6	1217.2	1264.8	1425	1621	1844.75

TOURIST FORECASTS		Mid										
Employment Creation		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Numbers of Employees												
Direct												
Hotels	2.2	0	0	0	550	1210	1430	2420	3300	3300	3850	4529.0
Tourist Infrastructure												
Diving Facilities		0		30	66	109	161	223	298	387	495	624
Other		0		55	121	200	295	409	546	710	907	1144
Total		0		85	737	1519	1886	3053	4144	4398	5252	6298
Indirect												
Commerical Transport	0.25	0		21	184	380	472	763	1036	1099	1313	1574
TOTAL		0		106	921	1899	2358	3816	5180	5497	6566	7872
Value (Wages) Rp. millions	Year 1.5	0		159.4	1381.9	2848.9	3536.8	5723.5	7770.1	8246	9848.3	11808

Table D.5 EMPLOYMENT CREATION AND VALUE ADDED, HIGH GROWTH (by year, 1992-2002)

TOURIST FORECASTS		High										
Employment Value		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Numbers of Employees												
Direct												
Hotels	2.2	1923	1923	3132.0	3352.0	4702.0	5992.0	5992.0	6212.0	7422.0	7642.0	9407.2
Tourist Infrastructure												
Dining Facilities		150	180	216	259.2	311.04	373.25	447.9	537.48	644.97	773.97	928.76
Other		275	330	396	475.2	570.24	684.29	821.15	985.37	1182.4	1418.9	1702.73
Total		2348	2433	3744.0	4087.2	5444.1	7050.3	7261.0	7735.7	9250.2	9835.7	12038.7
Indirect												
Commerical Transport	0.25	587	608.2	936.2	1021.8	1416	1762.6	1815.5	1933.9	2312.6	2458.9	3009.67
TOTAL		2935	3041	4681	5109	7000.1	8812.9	9077.3	9669.6	11563	12295	15048.4
Value (Wages) Rp. millions	Year 1.5	4402	4562	7021.5	7663.5	10620	13219	13616	14504	17344	18442	22572.5
Taxes Rp. millions	0.1	440.2	456.2	702.15	766.35	1062	1321.9	1361.6	1450.4	1734.4	1844.2	2257.25

TOURIST FORECASTS		High										
Employment Creation		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Numbers of Employees												
Direct												
Hotels	2.2	0	0 0	1210	1430	2860	4070	4070	4290	5500	5720	7484.4
Tourist Infrastructure												
Dining Facilities		0	30	66	109	161	223	298	387	495	624	779
Other		0	55	121	200	295	409	546	710	907	1144	1428
Total		0	85	1397	1739	3316	4703	4914	5388	6902	7488	9691
Indirect												
Commerical Transport	0.25	0	21	349	435	829	1176	1229	1347	1726	1872	2423
TOTAL		0	106	1746	2174	4145	5878	6143	6735	8628	9360	12114
Value (Wages) Rp. millions	Year 1.5	0	159.4	2619.4	3261.4	6218	8817.3	9213.0	10102	12942	14040	18170.4

Table D.6 EMPLOYMENT CREATION AND VALUE ADDED, LOW GROWTH (by year, 1992-2002)

TOURIST FORECASTS		Low										
Employment Value		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Numbers of Employees												
Direct												
Hotels	2.2	1923	1923	1922.0	2692.0	3132.0	3352.0	3902.0	4342.0	4342.0	4342.0	4342.0
Tourist Infrastructure												
Diving Facilities		150	180	216	259.2	311.04	373.25	447.9	537.48	644.97	773.97	928.76
Other		275	330	396	475.2	570.24	684.29	821.15	985.37	1182.4	1418.9	1702.73
Total		2348	2433	2534.0	3427.2	4014.1	4410.3	5171.0	5865.7	6170.2	6535.7	7194.29
Indirect												
Commercial Transport	0.25	587	646.2	633.7	856.8	1003.5	1102.6	1293	1466.4	1542.6	1633.9	1798.57
TOTAL		2935	3041	3168.5	4284	5017.6	5512.9	6464.0	7332.1	7712.8	8169.6	8992.86
Value (Wages) Rp. millions	Year 1.5	4402	4562	4752.0	6426	7526.4	8269.4	9697.2	10998	11569	12254	13489.3
Taxes Rp. millions	0.1	440.2	456.2	475.20	642.6	752.64	826.94	969.72	1099.8	1156.9	1225.4	1348.93

TOURIST FORECASTS		Low										
Employment Creation		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Numbers of Employees												
Direct						—						
Hotels	2.2	0	0	0	0	770	1210	1430	1980	2420	2420	2420	2640
Tourist Infrastructure												
Diving Facilities		0	30	66	109	161	223	298	387	495	624	779
Other		0	55	121	200	295	409	546	710	907	1144	1428
Total		0	85	187	1079	1646	2963	2024	3510	3822	4188	4846
Indirect												
Commercial Transport	0.25	0	21	47	270	417	516	704	879	954	1047	1212
TOTAL		0	106	234	1349	2063	2578	3530	4397	4770	5235	6058
Value (Wages) Rp. millions	Year 1.5	0	159.4	350.63	2023.9	3124.3	3867.3	5295.1	6596	7167	7852.3	9087.16

90

ANNEX E: POTENTIAL IMPACTS ON THE TONDANO RIVER WATERSHED

E.1 Geography, Soils, Climate and Land Use

The city of Manado is located at the head of Manado Bay at the confluence of Tondano River which links the northern coastal areas of North Sulawesi to Lake Tondano, the Tondano River watershed and the hinterland (see Figure 1.1). Based on the North Sulawesi's administrative jurisdiction, the Tondano watershed encompasses Kecamatans Tondano, Kaas, Eris, Remboken, Langowan, Tompaso, Kawangkoan, parts of Airmdidi and Dimembe in Kabupaten Minahasa and some parts of Kecamata Wenang in Manado Municipality (RUTRK Minahasa, 1992). The geographical setting makes the Tondano River watershed, its ecosystem, natural patterns, and land use as well as the environmental impacts of the activities within the watershed's boundaries significant to the development of Manado and to other downstream areas up to the coastal waters of North Sulawesi. It is therefore important that the Tondano River watershed be taken into consideration. Figure E.1 is a map of the administrative and watershed boundaries.

The Tondano River watershed has an important function as a water catchment area. Lake Tondano is at the center of the watershed and the Tondano River flows from it to the coastal areas of North Sulawesi. The natural lake is situated at approximately 600 m above sea level. The southern boundaries of the lake are formed by rocky boulders, steep slopes and hilly estate crop plantations in Kecamatans Eris, Kakas and part of Remboken. The Tondano River is 44.4 km long and at the downstream end is joined by several rivers: Rurukan, Saduan, Dinamunan and Arung. Here, the geography gradually flattens and widens into plains where rice fields and flat agricultural land border the Tondano River at Kecamatans Remboken and Tondano.

The total area of the watershed is estimated to be 53,817 ha. Table E.1 shows that approximately 58% of the land is devoted to agriculture, of which 42% is planted with estate crops such as cloves and coconuts, and the rest is used for mixed agriculture of upland crops (cassava, corn, vegetables), shrubs, and bare lands. The existing land use patterns leave only 11% forest coverage in the area, so that the Tondano watershed is classified as "critical" and is gradually losing its capacity to catch rainwater. Current agricultural practices are causing serious problems with soil erosion, run-off and sedimentation downstream.

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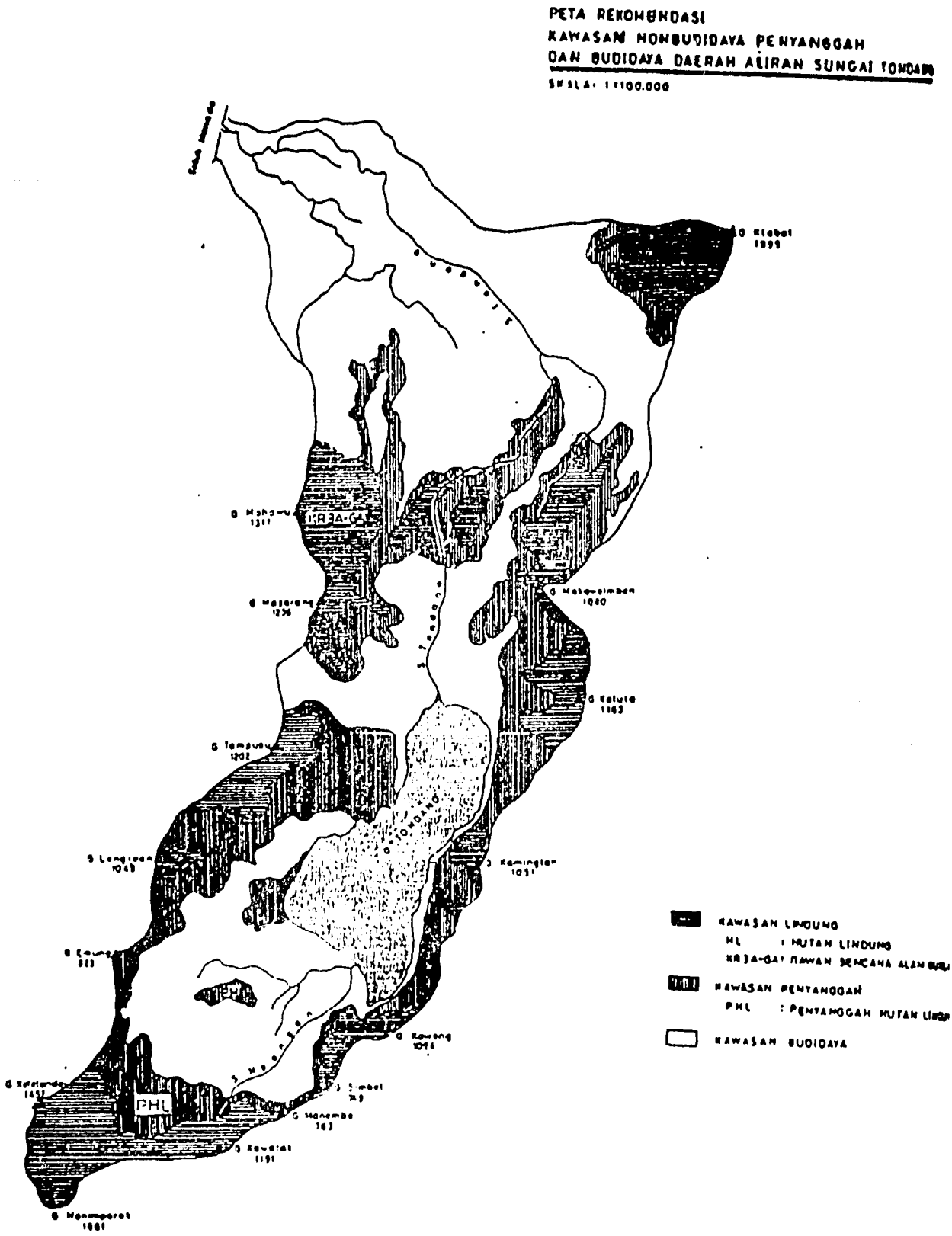

Figure E.1 Tondano River watershed

Table E.1 LAND USE IN TONDANO RIVER WATERSHED

Land Use	Area (ha)	Area (%)
Settlement	5,049.25	9.37
Rice fields	5,691.66	10.56
Estate Crops		
Cloves	5,213.36	9.67
Coconuts	10,544.35	19.60
Mixed	6,671.87	12.40
Upland Crops	8,732.00	16.23
Forest	3,544.95	11.29
Lake Tondano	4,278.35	7.95
PLTA Tonsea Lama and PLTA Tanggari	30.44	0.05
Others	4,061.11	7.55
Total:	53,817.34	100.00

Source : Puslit Unsrat, 1992

E.2 Major Activities in the Watershed and Environmental Impacts

E.2.1 Agriculture and Forestry

Cloves and coconuts have been major crops in the area occupying over 15,767 ha or approximately 29.27% of the total land use, mainly on the hilly areas of Toliang Oki, Tasuka, Totolan and Remboken. The clove plantations need clean tillage and bare ground underneath the clove trees. The situtation is similar in the coconut plantations, although some farms are mixed with upland crops such as corn, and recently with vanilla vines. The mixed farming, however, does not significantly improve the land covering since the secondary crops and vanilla vines do not cover much of the land.

In addition to these agricultural practices, the lack of appropriate land management, such as soil terraces to curb erosion, has made the watershed practically bare and extremely susceptible to soil degradation. The conditions are exacerbated by the high rainfall, land physiography, and the dominant soil types. According to Schmidt-Ferguson's climatological classification, the Tondano watershed falls into the wet climate category (types B1, C1 and D1) with an average rainfall ranging from 100-200 mm during 5-9 months of wet seasons. The watershed is also dominated by medium to high elevation contours (average of 16% slope) and the sandy soil types (Andosol, Regosol and Alluvial) which are sensitive to erosion and prone to landslides.

E.2.2 Soil Erosion and Sedimentation

Using the Universal Soil Loss Equation (USLE), the Puslit Unsrat calculated the rate of erosion and sedimentation around Lake Tondano. Table E.2 shows that clove plantations contribute 42.60 tons/ha/yr and are the major cause of soil erosion. This erosion rate clearly exceeds the conventional rule of the maximum "tolerable rate" of erosion that is 11.00 tons/ha/yr. In comparison, the secondary forest only generates about 0.70 tons/ha/yr of soil erosion. To show the severity of the problem of soil erosion, a simple calculation will show that clove plantations contribute 42.50 x 5,213 = 221,525 tons of soil loss/year.

Table E.2 LAND USE AND SOIL EROSION AROUND LAKE TONDANO

Type of Land Use	Erosion Rate (ton/ha/yr)
Ricefields	2.00
Corn and secondary crops	41.50
Coconut farm with land cover	0.80
Clove plantation with clean tillage	42.60
Secondary forest and shrubs	0.70
Forest	0.20

Source : SEL Γ' TA Tonsea Lama and Tanggari I

The soil erosion from the watershed areas has had definite hydrological impacts on Lake Tondano. As the main reservoir capturing approximately 25 streams within the catchment areas, the lake receives most of the run-off; soil particles as well as debris and organic matter are deposited as sediments at the bottom of the lake. In 1934, the maximum depth of Lake Tondano was measured at 40 m. Forty years later, in 1974, the depth decreased to 28 m and a recent measurement by the Indonesian Navy Research Team showed only 20-27 m in depth (NKLD, 1991).

E.2.3 Water Quantity

The impacts of the ecological degradation in the upper Tondano watershed may also be observed in the decreased flow of water in the Tondano River, which is the main outlet from Tondano Lake to the downstream areas. During the last eighteen years, the flow rate of the river has been gradually decreasing due to upland sedimentation. In 1974, the flow was measured at an average of 9.34 cubic meter/second; in 1978 and 1988 the flow decreased to 7.57 cubic meter/second and 6.64 cubic meter/second respectively (see Table E.3). In a recent study by Puslit Unsrat, the average minimum flow was measured at 4.34 cubic meter/second during the dry seasons, and 11.24 cubic meter/second during rainy seasons. The study suggested that without proper management of the watershed, the situation will cause

shortages of electrical energy and drinking water for water supply to Manado and Bitung in the near future. On the contrary, during the wet seasons (November-January) the raised water level due to run-off has created floods in the surrounding villages. The same study cited the observations of the local villagers along the river saying that the Tondano River seems to get wider and shallower, and tends to flood more often in rainy seasons.

Table E.3 TONDANO RIVER WATER FLOW

Month	Toulor Station (cubic meter/second)	Kawangkoan Station (cubic meter/second)
Year : 1989 *		
February	7.59	12.28
March	7.27	16.21
April	6.69	14.02
May	10.76	16.02
July	4.34	11.20
August	4.49	8.78
September	5.48	11.13
October	9.40	16.02
November	11.66	18.96
December	6.66	7.54
Year :1992 **		
February	5.38	–

Sources : *Mawara, 1989
**Puslit Unsrat, 1992

E.2.4 Water Quality

In 1979, Soerjani et al. measured the water quality of Lake Tondano and some segments of the Tondano River. In 1992 several measurements were made by the Puslit Unsrat on other river segments. Both studies indicated that generally the water quality of Lake Tondano and Tondano River conforms with the category A of the Baku Mutu Lingkungan (Environmental Quality Standard) suggested by Ministerial Decree No. Kep-02/MenKLH/1988. This information, however, has to be interpreted with caution since the measurements of the water quality are scattered. In the long run, the following potential impacts of some activities on water quality along the Tondano River should be anticipated.

95

First, the uncontrolled agricultural activities in the upstream areas could damage the fishing industry. Fisheries using floating nets for kowan (Ctenoparhyngodon adellus) at Lake Tondano, and pen culture (karamba) for carp (Ciprinus carpio) along Tondano river will slow the river flow. This condition could be worsened by the possibility of residual fertilizer and pesticide run-off to water sources due to the rather excessive application of chemicals for upstream agriculture, mainly horticulture at Tomohon. The residual fertilizer, even at low concentration levels, could induce eutrophication and growth of water weeds such as Hydrilla, Najas indica or Potamogeton, which in turn would threaten other water organisms. It was reported that the fisheries production at Lake Tondano has been steadily decreasing during the period of 1976 to 1987, from 3,027 tons/year to 1,084 tons/year or at an estimated rate of 0.4% per year (NKLD, 1991).

Second, the impacts of industry may cause chemical pollution. A marked change in the quality of water was found on a segment of the Tondano River adjacent to the wastewater discharge of a coconut processing plant at Kairagi (4 km from Manado). The measurements at this location showed that some water quality indicators (e.g., turbidity, BOD, ammonia, nitrate, sulfites, Fe, Mn, and organic oil) have exceeded the applicable standards. No dangerous heavy metals such as Pb and Hg have been detected. So far there is no existing information on effects of gold mining and other potentially dangerous industrial activities in the Tondano River watershed. Based on studies by Rompas (1991) in Bolang Mongondow, and PT Rasmanik Tonala (1990) in Gorontalo, gold mining has a potential danger of mercury pollution.

Third, further downstream, observations show that the concentration of some types of bacteria (primarily fecal-co"form) have increased due to the development of the cities of Tondano and Manado. Human activities such as residential neighborhoods, slum settlement, hotels, and small home industries increased the volume of liquid and solid waste disposal, which in turn affects the biological and chemical compounds. All of these will trigger the growth of bacteria, algae, and other microorganisms which will result in water quality changes.

E.2.5 Hydroelectric Dams

In 1990, North Sulawesi had an installed electric energy capacity of 85.52 MW with energy production at 127.2 gWh. Anticipating the development of urban Manado and industries at Bitung, the production is projected to increase to 511.7 gWh in the year 2200 at an average rate of 8.3% per annum. At present, the sources of electricity are four generators in Minahasa (88.8 mW), Tahuna (1.2 mW), Bolaang Mongondow (2.07 mW) and Gorontalo (15.09 W). In Kabupaten Minahasa, the hydroelectric generators (PLTAs) Tonsea Lama and Tanggari I are located in the Tondano River watershed and built along the Tondano river. Tonsea Lama was built during the Dutch occupation and Tanggari I was built around the 1970s.

The existing capacities of electricity production from the two PLTAs are estimated at 12.7 MW (Tonsea Lama) and 16.6 MW (Tanggari I). To meet future demand for electricity, the

96

capacities could be enhanced by building a series of hydroelectric dams to capture run-off water from the Tondano watershed, and simultaneously increase the water level of the Tondano river. The Government of Indonesia plans to build PLTA Tanggari II (19.0 mw) and Sawangan (17.5 mw) at downstream locations on the Tondano River.

The obvious constraint for generating more electrical energy in Tondano River watershed is the river's flow. A study indicated that when Lake Tondano reaches a scale of 692.27 low water level (LWL) the flow of the Tondano River is less than 16 cubic meter/second, which is not sufficient to generate enough electricity by PLTA Tonsea Lama and Tanggari I. As has been mentioned previously, the causes of the problem are soil erosion and sedimentation in the watershed and the excessive growth of water weeds in the water bodies along the Tondano River. To complicate matters, household and city garbage thrown into the river from Tondano disturb the operation of water turbines. It is estimated that roughly 5-6 tons of garbages per day have to be removed from the trash boom of PLTA Tonsea Lama (Puslit Unsrat, 1992). At present, the hydroelectric project works in Tonsea Lama and Tanggari I intend to solve the existing problems through some engineering works such as land clearing, dredging, channelizing and building a trash boom.

E.2.6 Environmental Impacts

Based on the environmental impact assessment conducted by PSL-Unsrat in 1991, no serious negative impacts have resulted from the on-going engineering works. This is because the impacts are "localized" at specific sites of the project area. Most of the physical impacts caused by dredging and operating heavy equipment, which result in increasing water turbidity, garbage accumulation along the river banks and sedimentation downstream; these are categorized as short-term impacts. In the long run, it is expected that more positive impacts will result from the projects.

Nevertheless, two potential impacts need more careful monitoring in the watershed. First, the hydroelectric plants are changing the morphology of Tondano River in ways that will slow the downstream flow and eventually change the nature of the Tondano River from a free-flowing riverine habitat to a lake habitat. The process may worsen the water quality even further. Second, the projects have an impact on social-economic and cultural aspects of the region, as well as on the biodiversity of Tondano River watershed. Under the Rencana Struktur Tata Ruang Propinsi Sulawesi Utara 1991 (North Sulawesi Spatial Planning Structure) the Tondano River watershed is categorized as a Kawasan Kritis (critical area) as well as a Kawasan Lindung (protected area). The ecosystem of Tondano River watershed is known for its diversity of flora and fauna, a number of which are categorized as protected species (see Table E.4).

E.3 Conclusions

The most significant impacts on the condition of the Tondano River above Manado are excessive erosion from hillside cultivation, solid and human waste discharges from

97

settlements, and hydropower plants. The most important, by far, is soil erosion and the resultant sedimentation; this problem, however, is not related to urban growth in Manado. Demand for power is directly related to urban growth in Manado and other cities in the region, notably the industrial zone at Bitung. The principal effects of hydropower development are habitat destruction and displacement of riparian communities, both of which can be minimized by decisions made in siting and designing hydropower projects. Dams also reduce the flow rate and volume of rivers, reducing their capacity to assimilate wastes discharged by riparian settlements, industries, and non-point discharges from agriculture. Water quality concerns should be integrated into plans for developing hydropower resources on the Tondano River to ensure that infrastructure improvements, regulatory measures, and changes in agricultural practices throughout the watershed are coordinated and are sufficient to protect the long-term health of the river.

Table E.4 SELECTED PROTECTED SPECIES IN TONDANO RIVER WATERSHED

Local/English Names	Scientific Names
Flora	
Pinang Yaki	Areca vestirria
Linggua	Pterocarpus indians
Cempaka	Elmerillia ovaliz
Nantu	Palaquium obstusifolium
Pakoba	Eugenia sp
Mammals	
Black monkey	Macaca nigrescen
Tarsius	Tarsius spectrum
Kuseh	Phalanger spectrum
Birds	
White egret	Egreta alba
Black peregrine	Elamus sp
Kingfisher	Pelargopsis sp
Sulawesi parrot	Taniguathus sp
Hoit	Ninox ochreata
Reptils	
Soa-soa	Hidrosaurus sp

UNITED STATES GOVERNMENT
MEMORANDUM

DATE: March 16, 1993

FROM: Timothy Alexander TA

SUBJECT: Studies for Publication as PRE/H Working Papers

TO: Mike Pulley

Following-up on discussions William Frej had with you recently, please find one original of the Beneficiary Impact Study, and an orginal & unbound copy of the Manado study for immediate publication as part of the PRE/H working paper series.

For your information, 3 originals and 1 unbound copy of the Manado Study were sent to PRE/H by DHL on January 22, 1993, ATTN:James Stein.

The Beneficiary Impact Study has a 5-page Executive Summary and 1-page Abstract. The Manado Study has a 7-page Executive Summary which is rather long. The results of the Manado Study can be further summarized by use of the Chart on page vii (which summaries priority environmental problems) and Tables 4.6 and 5.2 (which summarize recommended actions).

'99