PN-ABR 871

ENVIRONMENTAL ASSESSMENT DRAFT FINAL REPORT

8893

FOR

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
AND
COORDINATING COUNCIL OF THE PHILIPPINE ASSISTANCE PROGRAM

CAGAYAN DE ORO - ILIGAN CORRIDOR AIRPORT

Prepared by:

LOUIS BERGER INTERNATIONAL, INC.

in association with

LOCKWOOD GREENE INTERNATIONAL, INC.

GLOBETROTTERS ENGINEERING CORPORATION

TRANS-ASIA (PHILS.) INC.

CONSULTANT MANAGEMENT SERVICES, INC.

ERNST & YOUNG

Under
U.S. Agency for International Development
Contract No. 492-0452-C-00-0099-00
Philippine Assistance Program Support Project No. 492-0452

October, 1991

The completion of this study/report was funded by the United States Agency for International Development (USAID). The views, statements, and opinions contained in this report are the authors' alone and are not intended as USAID recommendations, conclusions or statements of USAID policy.

LOUIS BERGER INTERNATIONAL, INC.

PM 8910 [illegible] Center
Amorsolo St., Legaspi Village
Makati, Metro Manila, PHILIPPINES

Architects • Engineers • Economists • Planners

Telephone (63 (2) 88 06 50
82 06 90
817 0305
Telefax [illegible]

Ref. No.: MAR/152C/91-1992/rgt

October 18, 1991

Mr. Alex Sundermann P.E.
Project Officer/Office of Capital Projects
USAID/Manila
18F, Ramon Magsaysay Center
1680 Roxas Boulevard
Manila, Philippines

Subject: **DRAFT ENVIRONMENTAL ASSESSMENT**

Project: **DELIVERY ORDER NO. LBII-03**
FEASIBILITY STUDY AND MASTER PLANNING
CAGAYAN DE ORO - ILIGAN CORRIDOR AIRPORT
PHILIPPINE ASSISTANCE PROGRAM SUPPORT
CONTRACT NO. 492-0452-C-00-0099-00

Dear Mr. Sundermann:

Pursuant to Section III.D.5 of the Scope of Work for the subject Delivery Order Contract, we are pleased to submit herewith for your review and comment three (3) copies of the Draft Environmental Assessment for the Cagayan de Oro - Iligan Airport Study. In accordance with our previous discussions, we are concurrently distributing copies of this report as per the attached distribution list.

By copy of this letter, we request that the recipient agencies named on the attached list review this Draft Environmental Assessment and direct any comments or inquiries to the following office not later than November 8, 1991:

Undersecretary Mr. Rogelio L. Singson
Executive Director, CCPAP
Room 1400, 14F, Multi-storey Building
Central Bank Complex
A. Mabini Street, Ermita, Manila

17

Copies forwarded to the Environmental Management Bureau are for review by their staff and the Environmental Impact Assessment Review Committee in application for an Environmental Compliance Certificate (ECC) for the project.

Should you have any questions, or require further information, please feel free to contact this office.

Very truly yours,
LOUIS BERGER INTERNATIONAL, INC.

William J. Parente

WILLIAM J. PARENTE
PAPS Project Manager

M A Ross

MICHAEL A. ROSS
Environmental Specialist

Encls. 3 copies - Draft Environment Assessment
Distribution List

B

LOUIS BERGER INTERNATIONAL, INC.
PAPS PROJECT
REPORT DISTRIBUTION CHECKLIST NO. 039

REPORT TITLE : Draft Environmental Assessment – Feasibility Study and Master Planning for Cagayan de Oro – Iligan Airport
PROJECT NO. : GG152C

ITEM NO.	ADDRESSED TO	NO. OF COPIES	RECEIVED BY (Signature Beside Printed Name)	DATE
1.	Alex Sundermann, OCP/USAID, Manila	3		
2.	Michael I. Kingery, MDP/USAID, Manila	1		
3.	Alfonso Naanep, PAPS, Proj. Manager, USAID, Manila	5		
4.	Undersecretary Rogelio L. Singson, CCPAP	3		
5.	Pat Johnson, CCSC–CODA	2		
6.	Secretary Pete Nicomedes Prado, DOTC	1		
7.	George Esguerra, Director, DOTC	2		
8.	Gen. Oscar Alejandro, Chief, ATO	3		
9.	Josefina Esguerra, Acting Asst. Dir., NEDA, Pasig	2		
10.	Augusto Santos, Director, NEDA, Pasig	2		
11.	Ernesto M. Balangue, NEDA Region X	2		
12.	Gutierrez Mangansakan, Director, NEDA Region XII	2		
13.	Undersec. Delfin Ganapin, DENR/EMB, Quezon City	2		
14.	Rodrigo U. Fuentes, Director, EMB, Quezon City	6		
15.	J. P. Haitchcox, GEC, Chicago, USA	1		
16.	Ernesto de Castro, TAP, Makati	2		
17.	Harry Taylor, GHT, Mandaluyong	1		
18.	Joe Weiss, LBII–East Orange	1		
19.	Ronald F. Kornell, LBII–Bangkok	1		
20.	David Wallace, LBII, Makati	1		
21.	Steve Doerr, Team Leader, and members	5		
22.	PAPS Project Manager	1		
23.	PAPS Deputy Project Manager	1		
24.	LBII–PAPS Office	5		
	TOTAL	55		

BEST AVAILABLE DOCUMENT

C

TABLE OF CONTENTS

Page No.

CHAPTER 2 EXISTING ENVIRONMENT

Page No.

Page No.

Page No.

CHAPTER 4 ASSESSMENT OF ENVIRONMENTAL IMPACTS

Page No.

LIST OF TABLES

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES

LIST OF FIGURES

LIST OF PLATES

LIST OF PLATES

LIST OF APPENDICES

LIST OF APPENDICES

LIST OF ACRONYMS

1	ATO	AIR TRANSPORTATION OFFICE
2	A300	AIRBUS INDUSTRIES AIRCRAFT MODEL A-300
3	AFFF	AQUEOUS FLORO-FLORENE FOAM
4	BAC 1-11	BRITISH AEROSPACE CORPORATION AIRCRAFT, MODEL 1-11
5	BARC	BARANGAY AGRARIAN REFORM COMMITTEE
6	BLD	BUREAU OF LAND DEVELOPMENT
7	BMG	BUREAU OF MINES AND GEO-SCIENCES
8	BOD	BIOLOGICAL OXYGEN DEMAND
9	CARP	COMPREHENSIVE AGRARIAN REFORM PROGRAM
10	CDO	CAGAYAN DE ORO
11	CFR	CRASH, FIRE AND RESCUE
12	CGY	CAGAYAN DE ORO AIRPORT
13	CIADPP	CAGAYAN DE ORO-ILIGAN AREA DEVELOPMENT PLANNING PROJECT
14	CODA	COMMITTEE ON OFFICIAL DEVELOPMENT ASSISTANCE
15	DA	DEPARTMENT OF AGRICULTURE
16	DAR	DEPARTMENT OF AGRARIAN REFORM
17	DBST	DOUBLE BITUMINOUS SURFACE TREATMENT
18	DCIC	DIAMOND CEMENT AND INDUSTRIAL CORPORATION
19	DENR	DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
20	DME	DISTANCE MEASURING EQUIPMENT
21	DNL	DAY-NIGHT LEVEL (OF NOISE)
22	DO	DISSOLVED OXYGEN
23	DOH	DEPARTMENT OF HEALTH
24	DOTC	DEPARTMENT OF TRANPORTATION AND COMMUNICATION
25	DPWH	DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
26	DSWD	DEPARTMENT OF SOCIAL WELFARE AND DEVELOPMENT
27	DTI	DEPARTMENT OF TRADE AND INDUSTRY
28	EA	ENVIRONMENTAL ASSESSMENT
29	ECC	ENVIRONMENTAL COMPLIANCE CERTIFICATE
30	EIA	ENVIRONMENTAL IMPACT ASSESSMENT
31	EIS	ENVIRONMENTAL IMPACT STATEMENT
32	EMB	ENVIRONMENTAL MANAGEMENT BUREAU
33	FAA	FEDERAL AVIATION ADMINISTRATION
34	GOP	GOVERNMENT OF THE PHILIPPINES
35	GPP	GROSS PROVINCIAL PRODUCT
36	GRDP	GROSS REGIONAL DOMESTIC PRODUCT
37	GSAP	GROSS SERVICE AREA PRODUCT
38	HLURB	HOUSING AND LAND USE REGULATORY BOARD
39	ICAO	INTERNATIONAL CIVIL AVIATION ORGANIZATION
40	IEE	INITIAL ENVIRONMENTAL EXAMINATION
41	ILS	INSTRUMENT LANDING SYSTEM
42	INM	INTEGRATED NOISE MODEL (FAA)
43	IWRB	THE INTERNATIONAL WATERFOWL AND WETLANDS RESEARCH BUREAU
44	LGU	LOCAL GOVERNMENT UNITS
45	LMU	LAND MANAGEMENT UNITS
46	LBII	LOUIS BERGER INTERNATIONAL, INC.
47	MARO	MUNICIPAL AGRARIAN REFORM OFFICE
48	MCDO-SDP	METRO CAGAYAN DE ORO SPECIAL DEVELOPMENT PROJECT
49	MDP	MINDANAO DEVELOPMENT PROJECT
50	MGDS	MINES AND GEO-SCIENCES DEVELOPMENT SERVICE
51	MORESCO	MISAMIS ORIENTAL RURAL ELECTRIC SERVICE COOPERATIVE
52	MPDC	MUNICIPAL PLANNING AND DEVELOPMENT COUNCIL
53	NAMRIA	NATIONAL MAPPING AND RESOURCE INFORMATION AUTHORITY

LIST OF ACRONYMS

54 NAVAIDS	NAVIGATIONAL AIDS
55 NCSO	NATIONAL CENSUS AND STATISTICAL OFFICE
56 NCR	NATIONAL CAPITAL REGION
57 NGO	NON-GOVERNMENTAL ORGANIZATION
58 NPC	NATIONAL POWER CORPORATION
59 NRIP	NATIONAL ROAD IMPROVEMENT PROJECT
60 NSC	NATIONAL STEEL CORPORATION
61 NSDW	NATIONAL STANDARDS FOR DRINKING WATER
62 OCT	ORIGINAL CERTIFICATE OF TITLE
63 OIC	OFFICER-IN-CHARGE
64 PAGASA	PHILIPPINE ATMOSPHERIC, GEOPHYSICAL AND ASTRONOMICAL SERVICES ADMINISTRATION
65 PAL	PHILIPPINE AIRLINES
66 PAP	PHILIPPINE ASSISTANCE PROGRAM
67 PAPS	PHILIPPINE ASSISTANCE PROGRAM SUPPORT
68 PAPI	PRECISION APPROACH PATH INDICATOR
69 PARO	PROVINCIAL AGRARIAN REFORM OFFICE
70 PAWB	PROTECTED AREAS AND WILDLIFE BUREAU (DENR)
71 PD	PROJECT DESCRIPTION
72 PHILVOCS	PHILIPPINE BUREAU OF VOLCANOLOGY AND SEISMOLOGY
73 PHIVIDEC	PHILIPPINE VETERANS INDUSTRIAL DEVELOPMENT CORPORATION
74 PIE	PEOPLE'S INDUSTRIAL ENTERPRISES
75 POPCOM	COMMISSION ON POPULATION
76 RIC	REGIONAL INDUSTRIAL CENTERS
77 ROW	RIGHT OF WAY
78 RVR	RUNWAY VISUAL RANGE
79 SALS	SIMPLE APPROACH LANDING SYSTEM
80 SD 360	SHORT BROTHERS AIRCRAFT MODEL SD 360
81 SS	SUSPENDED SOLIDS
82 TCT	TRANSFER CERTIFICATE OF TITLE
83 TDS	TOTAL DISSOLVED SOLIDS
84 TOR	TERMS OF REFERENCE
85 USAID	UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
86 VFR	VISUAL FLIGHT RULE
87 VLT	VOLUNTARY LAND TRANSFER
88 VOR	VERY HIGH FREQUENCY OMNIDIRECTIONAL AIRCRAFT RADIO RANGE
89 VOS	VOLUNTARY TO SELL
90 XU	XAVIER UNIVERSITY

EXECUTIVE SUMMARY

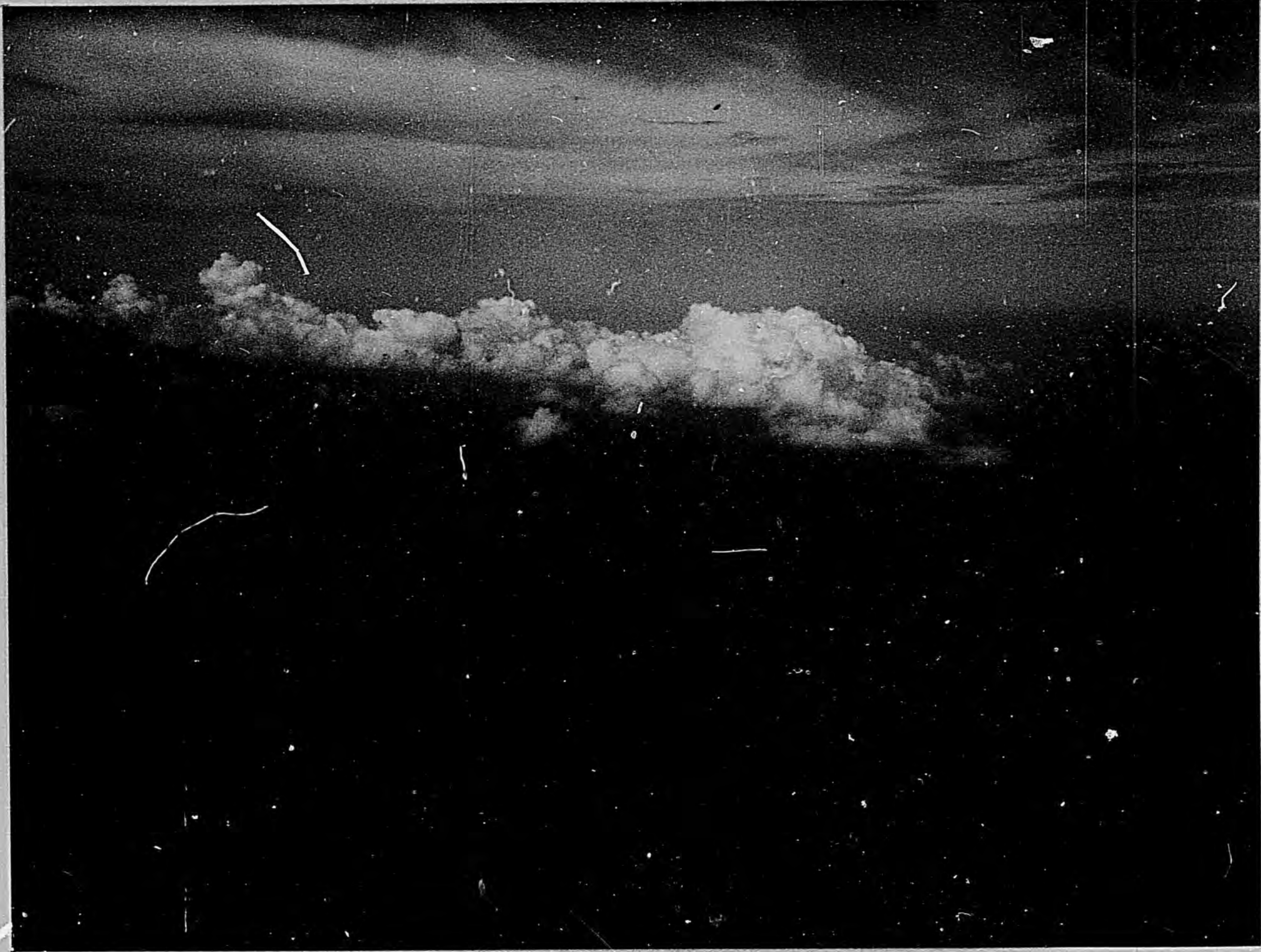
This draft Environmental Assessment (EA) evaluates the recommendations presented in the draft final report of the Feasibility Study and Master Planning, Cagayan de Oro-Iligan Corridor Airport project. As a component of the Philippine Assistance Program, the purpose of the Feasibility Study was to evaluate the existing air transportation system, establish forecasts of requirements to the year 2011 and provide recommendations for an airport facility meeting international standards that will support future growth and development within the Corridor and the twenty-year study time frame.

To satisfy the requirements of the funding agency, the U.S. Agency for International Development (USAID), and the Philippine environmental regulatory agency, the Environmental Management Bureau (EMB) of the Department of Environment and Natural Resources (DENR), this EA was prepared to provide baseline data deemed sufficient to support predictions and objective evaluation of potential project impacts. As a working document, the draft EA is designed to identify, for public review and comment, the net impacts derived from predicted environmental conditions with or without the project and recommend specific actions to mitigate these net impacts.

The Cagayan de Oro-Iligan Corridor is defined under the Terms of Reference for the project to include portions of Region X (Northern Mindanao) and Region XII (Central Mindanao), spanning sections of three provinces (Misamis Oriental, Lanao del Norte, and Bukidnon) and encompassing 19 municipalities and the two cities of Cagayan de Oro and Iligan. Both cities are described as major industrial and commercial centers, surrounded by rich agricultural lands. Presently, the total Corridor population is about three million, with a land area covering 1.8 million hectares. Available and project-generated forecasts indicate high rates of continued population growth, coupled with further industrial and agro-industrial development of the Corridor. The island province of Camiguin and most of the province of Lanao del Sur are also included within the service area provided by the existing airport facilities within the Corridor.

There are currently two commercial airports within the Corridor: the Cagayan de Oro (Lumbia) Airport, and the Iligan (Balo-i) Airport. Together they presently accommodate nearly 350,000 air passengers per year, a number expected to grow, under conservative assumptions, to about 650,000 by the end of the 20-year study period, in 2011. Unfortunately, both airports have terrain restrictions that rule out both significant expansion of existing operations, such as to accommodate wide-body aircraft, and night flights.

Based on the technical evaluation of all potential sites identified within the Corridor, including the two existing commercial airports, the basic recommendation of the Feasibility Study is for the construction of a new airport facility, conforming to international standards, within the municipality of Laguindingan (Plate ES-1). Preliminary designs for the recommended Laguindingan airport include a 2,500 meter long runway, approximately 14 kilometers of access road improvements and support facilities (Plate ES-2). All existing airport standards established



by the International Civil Aviation Organization (ICAO) can be accommodated at this proposed site. The recommended 09/27 (N 85°30'12") runway orientation will place aircraft approaches, and circling maneuvers over water, allowing for obstruction-free aviation operations.

As defined by the traffic forecasts generated by the Feasibility Study, the proposed project will serve to consolidate future air transport requirements of the Corridor and adjoining service area from two existing but constrained airport facilities to a new, unconstrained facility more centrally located within the Corridor. With the noted exception of increased cargo capacity with the introduction of wide body A300 aircraft service, and an increment of induced air traffic as a foreseen result of more numerous and convenient flight schedules, the projected traffic forecasts for the proposed Laguindingan facility reflect the summed value of forecasted demand on the existing airports rather the actual generation of new air traffic.

The principal project impacts are thus derived from this transfer of forecasted traffic, the physical construction and subsequent operational activities on the relatively undeveloped Laguindingan site. Located on an uplifted limestone terrace at an elevation of 50 meters above sea level, the proposed project site directly involves 167 hectares of marginal agricultural land with approximately 220 resident households, 70 percent of whom are described as tenant farmers of a 604 hectare property owned by the Diamond Cement and Industrial Corporation (DCIC) of the Ayala Land Corporation. This DCIC property includes an estimated 40 to 50 percent of the proposed Laguindingan airport property site. Along the adjoining coastline of Sulauan Point are extensive seagrass-dominated reef flats with fringes of critically sensitive coral reef and mangrove wetland habitats which apparently support a substantial subsistence fishery.

To evaluate the net environmental impacts of the proposed project, the organizational format of this Environmental Assessment includes:

- Chapter 1, Project Description;
- Chapter 2, Existing Environment;
- Chapter 3, Predicted Environmental Conditions Without Project;
- Chapter 4, Assessment of Environmental Impacts;
- Chapter 5, Mitigative Measures.

From the comparison of predicted environmental conditions with or without the proposed project, negative environmental impacts identified for the construction and operation of the recommended Laguindingan airport facility include:

- socio-economic impacts involving the dislocation of affected residents and tenant farmers from a coastal agricultural area that is in a legal process of both land distribution under the Comprehensive Agrarian Reform Program and zoning conversion to industrial use;

- physical environment impacts including increases in ambient noise levels due to aircraft operations and access road vehicular traffic, heightened demand on domestic water supplies and the carrying capacity for handling wastes, in the form of wastewater, solid and hazardous wastes. The calculated volumes of required earthwork will introduce the potential for increased siltation and runoff into the adjoining coastal waters;

- biological environment impacts described as the physical displacement of marginal terrestrial habitats and induced, secondary stress on coastal marine habitats;

- cumulative impacts that may influence the quality of the environment within the project's vicinity as well as within the general Corridor.

Mitigation of the negative impacts identified for the proposed project is possible, as summarized in Table ES-1 and discussed in detail within the body of this text. Implementation of these mitigation activities in an integrated action plan prior to and during the constructional and operational phases of the proposed project will further enhance the many positive socio-economic benefits ascribed to the project within the Feasibility Study. Of primary importance is the preventive approach to mitigation possible with proper and publicly reviewed land use planning and control within the impact vicinity of the airport site. Incorporation of mitigation measures in the form of an action plan within the proposed project's framework will, as, the overall conclusion of the draft Environmental Assessment, result in minimal net environmental project impact.

Table ES-1
SUMMARY OF PROJECT IMPACTS AND MITIGATION MEASURES

IMPACT	MITIGATION
Land Use and Planning	
Site conversion of existing agricultural land use to transportation/industrial use	Conduct public hearings to review and ratify proposed project plans within the framework of municipal, provincial and regional planning agencies to establish compatibility of existing and proposed land uses.
Disruption of the pending processes of land distribution under the Comprehensive Agrarian Reform Program and zoning conversion to industrial use of the OCIC property	Legal resolution of pending processes based on a review of the proposed project by the concerned public and private parties.
Closure of commercial air service to the existing Cagayan de Oro and Iligan airports	Develop a planning and management framework for future use of the existing airport facilities during the three to four year detailed design and construction management stage of the proposed project
Socio-Economic Conditions	
Dislocation of an estimated 220 project affected households	Implementation of the comprehensive "Relocation, Resettlement, and Community Development Program"
Displacement of employees and concessions of the existing Cagayan de Oro and Iligan airports	In collaboration with the planning process for future use of existing airports, a consensus will be established with concerned agencies, affected employees, concession holders and displaced project site residents regarding hiring and concession guidelines for the new Laguindingan airport facility.
Physical Environment	
Noise impacts of aircraft operations	Establish, as a preventive measure, land use zoning based on predicted noise generation of future airport operations
Noise impacts of construction traffic	Review, from a management perspective, transport potentials including barge transport of required cement, concrete aggregates and surplus cut materials. Near-site use of surplus cut materials will be evaluated.
Vehicular noise, operational phase	Implement shuttle bus service for the population centers of Cagayan de Oro and Iligan to consolidate employee and passenger generated traffic.

Table ES-1 (continued)

IMPACT	MITIGATION
Domestic water supply	Conduct further studies of groundwater quality and supply during the detailed design phase. Incorporate rain catchment tanks within the design of proposed airport facility structures.
Increased siltation during construction	Concentrate construction activities during the drier months from November to May. Stockpiled cut materi.. s will be provided with adequate diking and channels to reduce silt-laden runoff from entering coastal ecosystems. Cut slopes will be replanted with native grasses or drought-tolerant groundcover to reduce potential erosion.
Increased runoff during operation	In addition to design specifications for turf-lined drainage V-ditches and a detention pond, rip-rap treatment should be incorporated within the designed and designated drainage ways and runoff ravines to improve retention and infiltration.
Geological hazards	Con· ·ct seismic and geo-technical surveys during the detailed design phase in coordination with an on-going project of the DENR, Region X.
<u>Safety and Upset</u> Potential encroachment of conflicting land uses including construction in excess of obstruction height limitations, or in violation of light, glare and emission restrictions	 Establish a definitive airport site master plan with zoned land uses incorporating control measures based on forecasts of long-term airport requirements and recognized ICAO criterial standards.
Hazardous materials and operational accidents	Develop a comprehensive contingency plan involving on-site and off-site resources with tests of the proposed plan through regular drills and review evaluations. Establish and implement waste management procedures prior to construction.
Airport lighting confusion to mariners and coastal shipping	Due to the coastal siting of the project, prior to design and implementation of the airport lighting system, consultations will be held with concerned government agencies.
<u>Biological Environment</u> Displacement of marginal terrestrial habitats within the identified 167 ha project site	 Establish replacement habitats comprised of greenbelt acoustic barriers and master planned conservation areas

Table ES-1 (continued)

IMPACT	MITIGATION
Secondary, down-stream impacts on adjoining coastal marine habitats	Planning and land use controls will recognize as critical the marine habitats identified within this assessment and afford legislated protection, supported by public awareness programs
<u>Archaeological resources</u> Potential off-site disturbance of an identified historic site	The site of the structural remains of a Spanish-era watchtower near Sulauan Point is recommended for historic restoration and preservation land zoning.
<u>Cumulative Impacts</u> Unregulated growth and development within the Cagayan de Oro-Iligan Corridor	Incorporate the master planning process and proposals incorporated in concurrent studies[1]

[1]LBII, 1991. Feasibility Study and Industrial Master Planning, Cagayan de Oro-Iligan Corridor. Draft Final Report.

CHAPTER 1
PROJECT DESCRIPTION

CHAPTER 1

PROJECT DESCRIPTION

1.1 PROJECT SETTING

1.1.1 Location

The Cagayan de Oro - Iligan Corridor is located along the central coastline of northern Mindanao, the second largest island in the Philippine archipelago (Figure 1-1). As defined by the Terms of Reference (TOR) for the Feasibility Study and Master Planning, Cagayan de Oro - Iligan Corridor Airport Project (hereafter referred to as the Feasibility Study), the Corridor includes portions of Region X (Northern Mindanao) and Region XII (Central Mindanao) and extends from the municipality of Jasaan in the northeast to the municipality of Kolambugan in the southwest. The Corridor spans sections of three provinces, Bukidnon, Misamis Oriental, and Lanao del Norte, and includes 19 municipalities and two cities. The identified service area of airport facilities within the Corridor is more extensive and includes the provinces of Camiguin and Lanao del Sur, in addition to the three immediate provinces of Bukidnon, Misamis Oriental and Lanao del Norte (Figure 1-2).

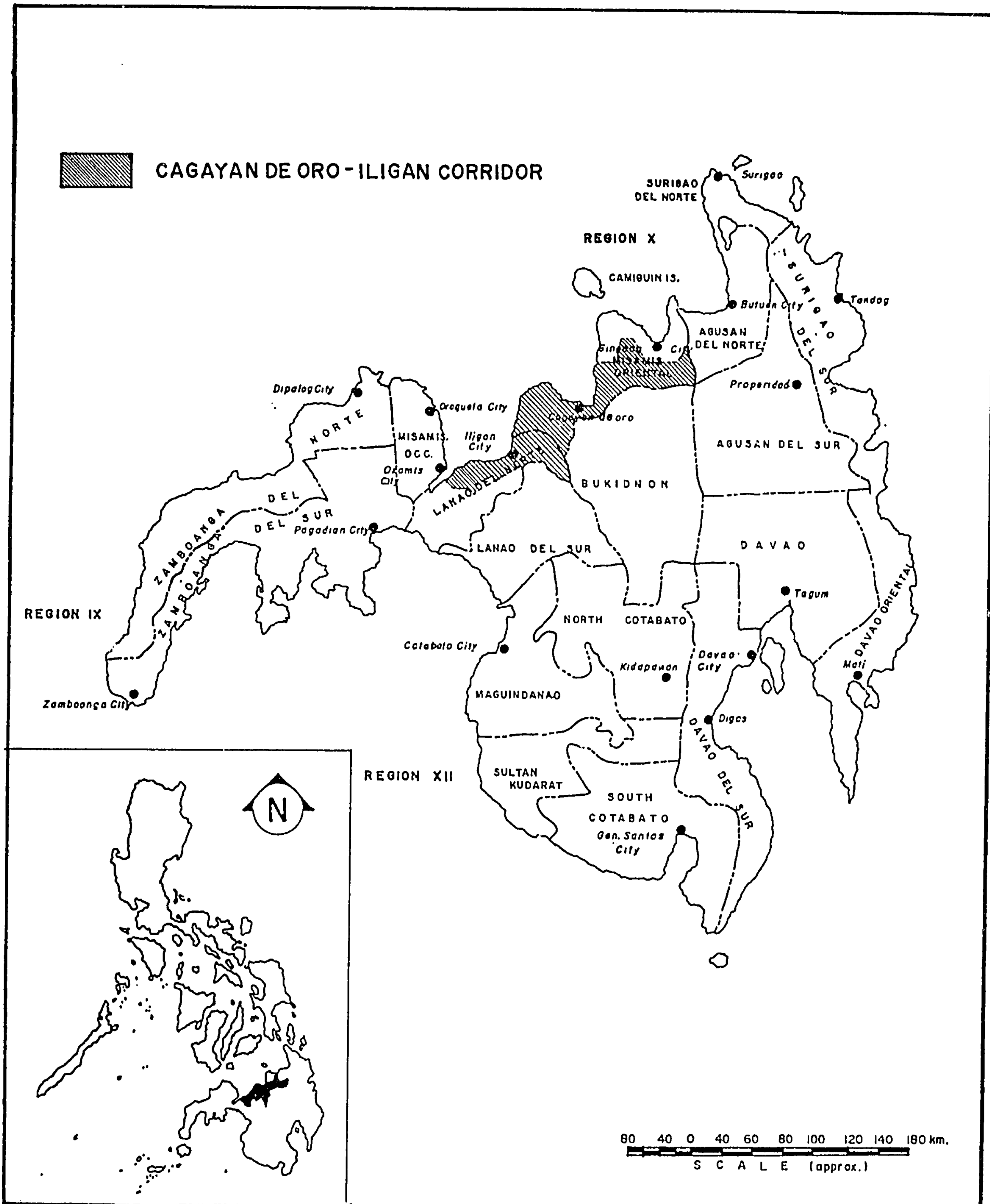
To serve the Corridor and the larger service area in accordance with the TOR, the construction of a new airport facility within the municipality of Laguindingan is recommended by the Feasibility Study. The siting of the proposed airport facility would be located approximately 35 km from Cagayan de Oro and 64 km from Iligan City, between the population centers of the Corridor (Figure 1-2).

1.1.2 Purpose

The Feasibility Study has been undertaken by the Committee on Official Development Assistance (CODA) as a component of the Philippine Assistance Program Support (PAPS) program. The Philippine Assistance Program (PAP) aims to promote equitable and sustainable economic growth in the Philippines. The principal goal is to alleviate poverty in the countryside through production-oriented activities outside the National Capital Region in support of the Philippine medium-term development plan for the period of 1987-1992. To be included in the PAP, a project should be located in one of the 16 "economic development zones", one of which is the Cagayan de Oro - Iligan Corridor.

A major task of the PAP is identifying productive investment projects and undertaking the necessary studies required to effectively carry them out. Both the identification of cost-effective programs and detailed pre-implementation studies are considered essential if the program is to be successfully implemented.

2



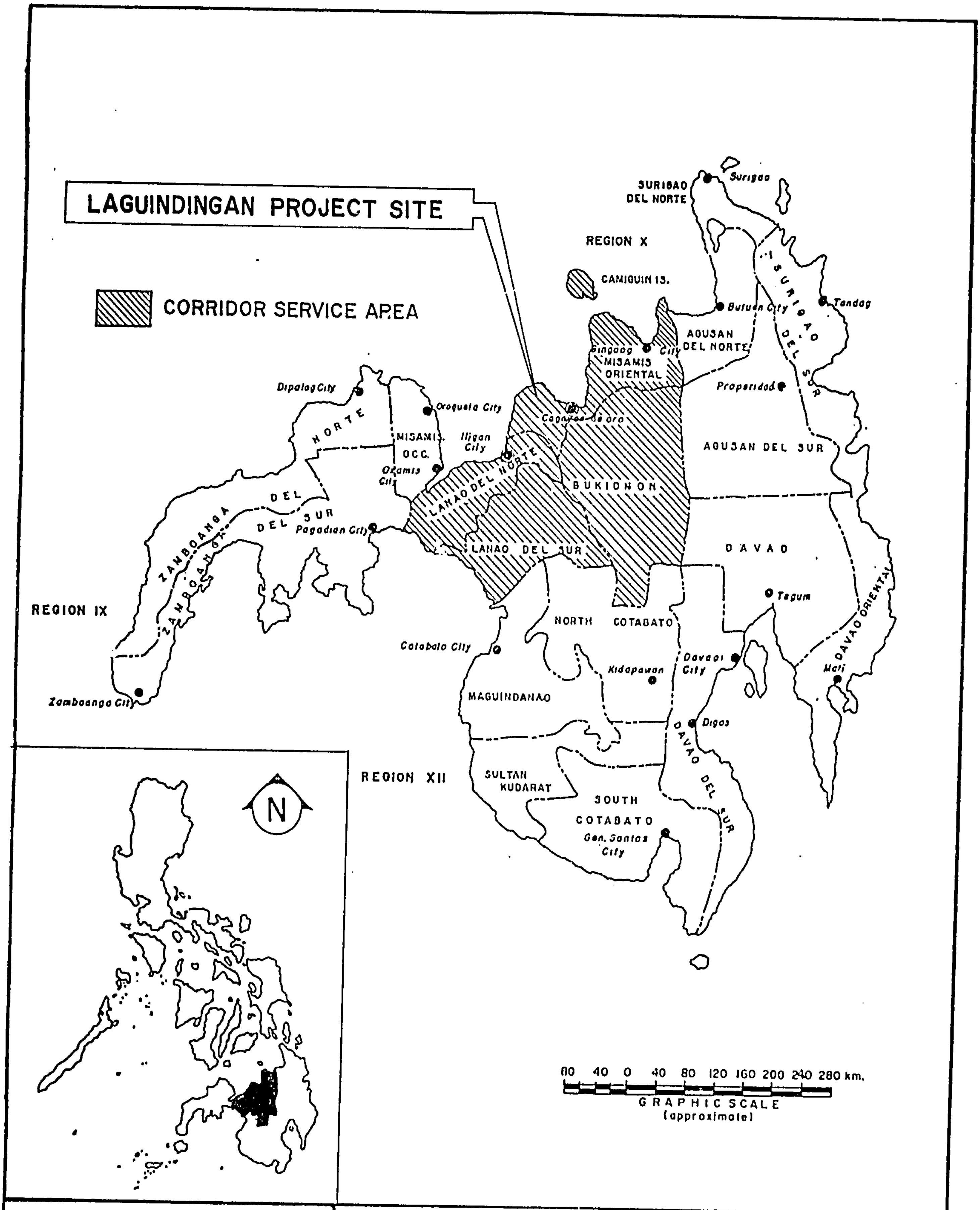
PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT
• GLOBETROTTERS ENG'G. CORP. SERVICES INC.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

CAGAYAN DE ORO-ILIGAN
STUDY CORRIDOR

FIGURE 1-1



PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0099-00 LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT CAGAYAN DE ORO - ILIGAN CORRIDOR AIRPORT SERVICE AREA	FIGURE 1-2

In support of the Government of the Philippines (GOP) policy to spread industrialization to rural areas with high potential for development, an objective of the PAPS program is to accelerate infrastructure improvements as a means of encouraging maximum private sector participation in new investments. The purpose of the Feasibility Study is to evaluate the existing air transportation system, establish forecasts of requirements to the year 2011 and provide recommendations for an airport facility meeting international standards that will support future growth and development within the Corridor and the twenty year timeframe. The Feasibility Study and Master Planning, Cagayan de Oro - Iligan Corridor Airport Project has been funded by the U.S. Agency for International Development (USAID), under Contract No. 492-0452-C-00-0099-00. The project proponent is:

Department of Transportation and Communication.
Air Transport Planning Division
12th Floor, PHILCOMCEN Bldg.,
Ortigas Ave., Pasig, Metro Manila

The purpose of this draft Environmental Assessment (EA) is to provide baseline data deemed sufficient to support predictions and objective evaluation of the potential impact of implementing the recommendations of the Feasibility Study. As a working document, the draft EA is designed to identify, for public review and comment, the net impacts derived from predicted environmental conditions with or without the project and recommend specific actions to mitigate these net impacts.

The format of this EA is adapted from a comparable study (Makar Wharf EA; LBII, 1991) recently completed for the Mindanao Development Project (MDP) of the PAPS program and is designed to address the impact assessment requirements of both US funding and GOP regulatory agencies. The draft format of the EA was included in the Scoping Sessions Report, submitted August 5, 1991, for public and agency review and comment.

1.1.2.1 US Regulations

US regulations[1] set out the requirements for environmental analysis for projects funded by USAID. Under these regulations one of three levels of study are required. The highest level, an Environmental Impact Statement (EIS) is only required when a project will have a significant impact on the global environment or on the environment of the United States. The next level is an Environmental Assessment (EA) which is required of any project which will have significant impact on the environment of the host country. Certain types of projects including penetration road building and road improvement projects, have been determined to generally have a significant impact and require EA submittal and review. The lowest level of study requires an Initial Environment Examination (IEE) followed by a "negative declaration" of no

[1] 22CFR216

5

significant impact or a "positive determination" that potentially significant impacts may occur. Based on the TOR, USAID has made a positive determination which necessitates preparation of an EA.

The US Foreign Assistance Act contains additional provisions for environmental protection. Specifically it contains a provision[2] that assistance be denied for the construction or upgrading of roads which pass through relatively undegraded forest lands, and one mandating special attention to biodiversity issues[3].

USAID has further prepared a policy paper on the environment and natural resources[4] in which the protection of tropical forests and biological diversity are stated as particular concerns. In addition to the tropical forests of the Philippines, coastal ecosystems, including mangrove swamps and coral reefs, are identified sources of biological diversity.

The existing US regulations[5] also identify the protection of endangered and threatened species and habitats critical to their survival as a particular concern. Tropical forests, mangrove swamps and coral reefs are all such habitats. Potential project impacts on Tribal Filipinos and ancestral land claims are an important additional area of USAID environmental concern. Archaeological and historical issues also have to be addressed.

The regulations provide that environmental assessments be reviewed and cleared by the Bureau Environmental Officer in Washington prior to project approval by an USAID overseas mission.

1.1.2.2 Philippine Regulations

Philippine regulations[6] require the preparation of an Environmental Impact Statement (EIS) for environmentally critical projects and a Project Description (PD) for projects which impact environmentally critical areas. Environmentally "critical areas" under Philippine regulations include:

- National parks, watershed reserves, wildlife reserves and sanctuaries
- Areas set aside as aesthetically potential tourist spots

[2]Section 118

[3]Section 119

[4]PN-AAV-464, April 1988

[5]22CRF216

[6]Council Resolution No. 4, Series of 1984, Revised Rules and Regulations Implementing P.D. 1586, Republic of the Philippines, Ministry of Human Settlements, National Environmental Council, 1986.

- Habitats of endangered or threatened species of indigenous Philippine wildlife
- Areas of unique archaeological or scientific interest
- Areas frequently visited and/or hard-hit by natural calamities including typhoons, tsunamis, earthquakes, storm surges and floods
- Areas with critical slopes
- Areas defined as prime agricultural land
- Aquifer recharge areas
- Water bodies
- Mangrove swamps
- Coral reefs

The Environmental Management Bureau (EMB) of the Department of Environment and Natural Resources (DENR) is responsible for the review and certification of EISs. An Environmental Compliance Certificate (ECC) is issued by EMB when a project proponent has satisfactorily complied with the requirements of the Philippine EIS system.

1.1.3 Stage in Planning Process

The Feasibility Study has identified a technically feasible, economically justified, socially sound, cost-effective plan for improving and upgrading air transport facilities to adequately serve the needs of the Corridor to the year 2011. The Preliminary Report of the Feasibility Study was submitted on July 11, 1991 and the Draft Final Report is scheduled for submittal on October 4, 1991.

Concurrent with the Feasibility Study, this EA was conducted in order to incorporate an environmental evaluation component into the overall plan for the proposed improvements. As part of the EA process, scoping sessions were held, from August 15-18, 1991, in Quezon City (National Capital Region), Cagayan de Oro (Region X) and Iligan (Region XII). Information derived from these scoping sessions, subsequent meetings and site specific surveys has been utilized to define the scope of the EA and identify the potential impacts of the proposed improvements.

ᴴ|

The Feasibility Study includes projections of the potential demands on the air transport system of the Corridor and provides recommendations, preliminary designs and cost estimates to meet the year 2011 demands. The Environmental Assessment has utilized this information to further define potential impacts of the proposed improvements and recommend mitigation measures that can be incorporated into the process of project implementation. An overall decision on the feasibility of the project will be made by the GOP.

1.2 EXISTING INFRASTRUCTURE AND FACILITIES

1.2.1 Philippine National Airport System

Aviation facilities are critically important for the economic development and transportation requirements of the Philippines, an archipelagic nation composed of more than 7000 islands. The country's national system presently consist of 87 airports (Figure 1-3), with:

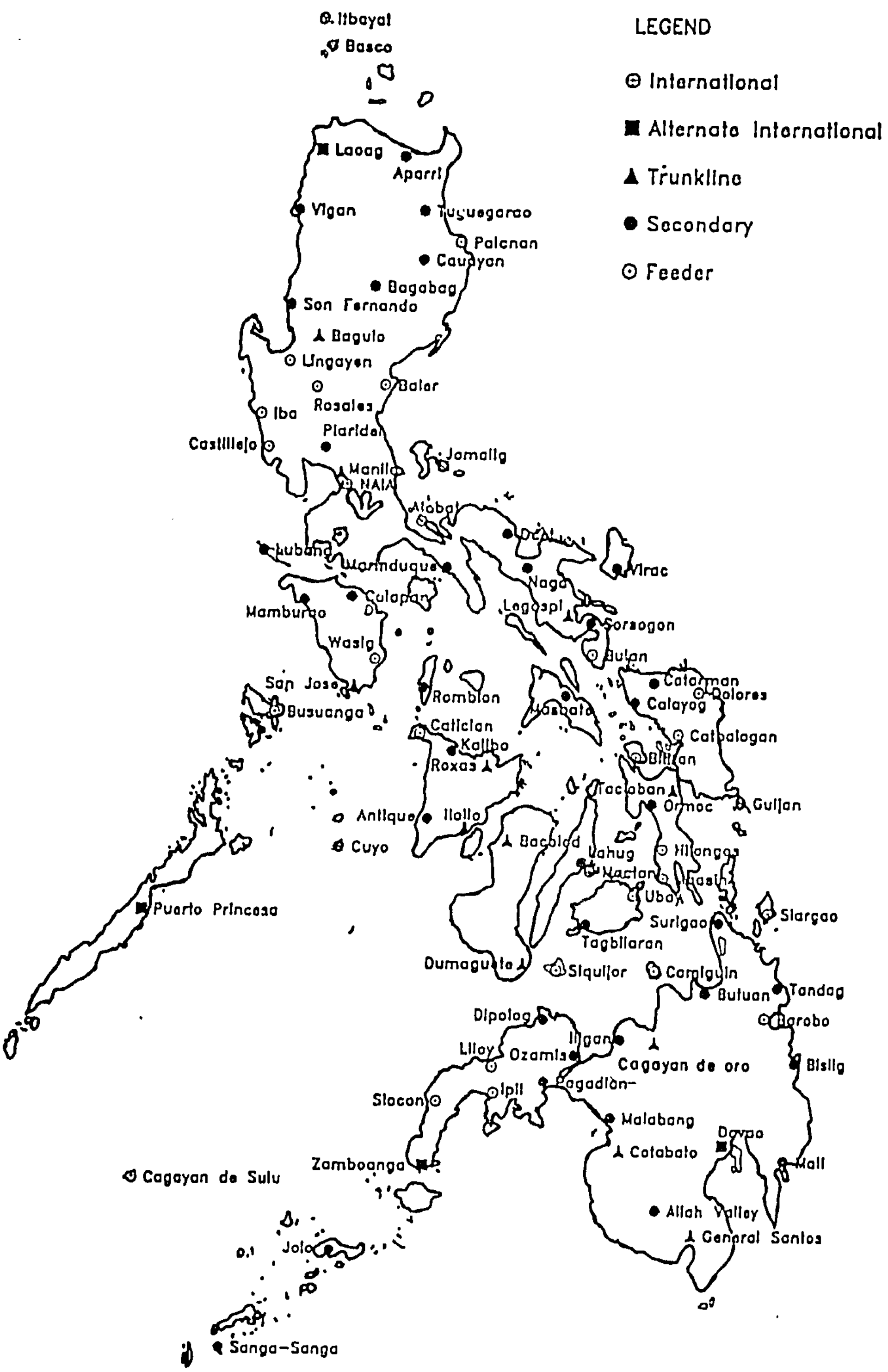
- two regular international airports;
- four alternate international;
- 11 trunkline;
- 38 secondary; and
- 32 feeder airports.

Regular international airports are those currently scheduled for international air travel, while the alternate international airports are usually used only in cases when regular international airports are closed to traffic. If traffic is heavy at the regular international airports, non-scheduled commercial aircraft, as well as general aviation international traffic, could be directed to the alternate airports upon securing proper clearances from responsible agencies of the government.

Next to the alternate international airports are the trunkline airports which serve regional centers, provincial capitals and chartered cities with high population concentrations and high levels of commercial, industrial, educational and institutional activities. To qualify as a trunkline airport, traffic should be about 75,000 passengers a year.

Secondary airports, those with air traffic from 20,000 to 74,999 passengers per year, serve the regional centers, provincial capitals and cities with moderate levels of commercial, industrial, educational and institutional activity.

Feeder airports serve areas with annual passenger traffic of less than 20,000 per year. This type of airport is usually found in areas where the economy is basically rural and where the levels of commercial, industrial, educational and institutional activity is low.



Source: Aeronautical Information Publication, Air Transportation Office

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 1-3
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT • GLOBETROTTERS ENG'G. CORP. SERVICES INC.	NATIONAL AIRPORT SYSTEM 1991	

Manila used to be the country's only regular international airport serving scheduled commercial international airline operations. In recent years, Mactan Airport in Cebu has been upgraded to a regular international airport, although it currently handles only a small volume of international traffic. The majority of international traffic is still handled at the Ninoy Aquino International Airport, Manila.

Considered as alternate international airports are Laoag, Puerto Princesa, Zamboanga and Davao. These airports have fully concreted runways with lengths sufficient to accommodate the type of aircraft used for international operations. Trunkline airports are located at Baguio, San Jose, Legazpi, Iloilo, Dumaguete, Bacolod, Roxas, Tacloban, Cotabato, General Santos, and Cagayan de Oro.

1.2.1.1 Scheduled Domestic Air Service

Since 1946, Philippine Airlines (PAL) has been the dominant company providing regularly scheduled international and domestic airline service in the Philippines. With the one airline policy initiated in March 1973, PAL has enjoyed a virtual monopoly position as the only authorized scheduled air carrier within the country. Some competition was allowed with the advent of the Aquino administration in 1986, but this has not been significant enough to challenge the dominant position of Philippine Airlines.

To carry passengers and cargo to 43 presently operating domestic airports as well as its international destinations, PAL uses the fleet configuration shown in Table 1-1.

Table 1-1
FLEET CONFIGURATION
PHILIPPINE AIRLINES

Aircraft Type	Number
B737	5
F50	7
BAC1-11	10
SD360	7
B747	7
A300	7
DC10	2
Total	45

Source: Philippine Airlines, 1991

The top 16 domestic routes in terms of weekly flight frequencies based on the May 21, 1991 schedule of PAL are shown in Table 1-2. The Manila-Cebu-Manila route is the busiest with 59 round trips (118 flights) assigned to this route weekly, using the wide-bodied Airbus A300 and the newly acquired, fuel efficient B737-300.

For domestic routes, PAL currently operates under the so-called hub system; PAL planes have for their base of operations two hubs, Manila and Mactan. Aircraft flying to various destinations originate and return to these hubs daily. A plane does not remain overnight in any other domestic station except for cases of aircraft trouble or other emergency situations.

After Manila, the Mactan Airport is the second most important in the country and plays a unique role in the country's overall air transportation system. Besides being a major commercial, industrial, educational and tourism center, Cebu is also a connecting point for passengers flying to Mindanao destinations not serviced directly from Manila.

Table 1-2
WEEKLY FLIGHT FREQUENCY OF SELECTED DOMESTIC ROUTES

Route	Weekly Frequency	Aircraft Used
Manila-Cebu-Manila	59	A300/B737
Manila-Bacolod-Manila	28	B737/BAC1-11
Manila-Iloilo-Manila	28	B737/BAC1-11
Manila-Cagayan de Oro-Manila	18	B737
Cebu-General Santos-Cebu	18	F50
Cebu-Zamboanga-Cebu	18	BAC1-11/F50
Cebu-Tagbilaran-Cebu	17	SD360
Cebu-Dumaguete-Cebu	16	SD360
Manila-Davao-Manila	14	A300
Manila-Tacloban-Manila	14	B737
Cebu-Davao-Cebu	14	BAC1-11
Cotabato-Iligan-Cotabato	14	SD360
Zamboanga-Iloilo-Zamboanga	14	F50
Cebu-Butuan-Cebu	12	SD360
Cebu-Dipolog-Cebu	11	F50
Manila-Zamboanga-Manila	10	B737

Source: Philippine Airlines Domestic Schedule, effective May 21, 1991

Table 1-2 also lists the type of aircraft servicing the selected domestic routes. At present the only domestic routes on which the A300 is used are Manila-Cebu-Manila and Manila-Davao-Manila. The B737 services a total of 11 major routes. Complimenting the B737 on these routes and other heavy traffic routes is the BAC1-11 aircraft. The shorter routes are assigned to the turboprop aircraft, involving the Fokker F50 and the Short Brothers SD360. The capacity of selected aircraft in current domestic service is included in Table 1-3.

Table 1-3
CAPACITY OF SELECTED AIRCRAFT

CLASSIFICATION	REPRESENTATIVE AIRCRAFT	AIRCRAFT TYPE	PASSENGER CAPACITY (seats)	CARGO CAPACITY (kg)
Class 1	Fokker 50	turboprop	54	5,685
Class 2	Boeing 737	narrow-body jet	141	15,625
Class 3	Airbus 300	wide-body jet	246	32,770

Source: Philippine Airlines

1.2.2 Air Transport Infrastructure of the Cagayan de Oro-Iligan Corridor

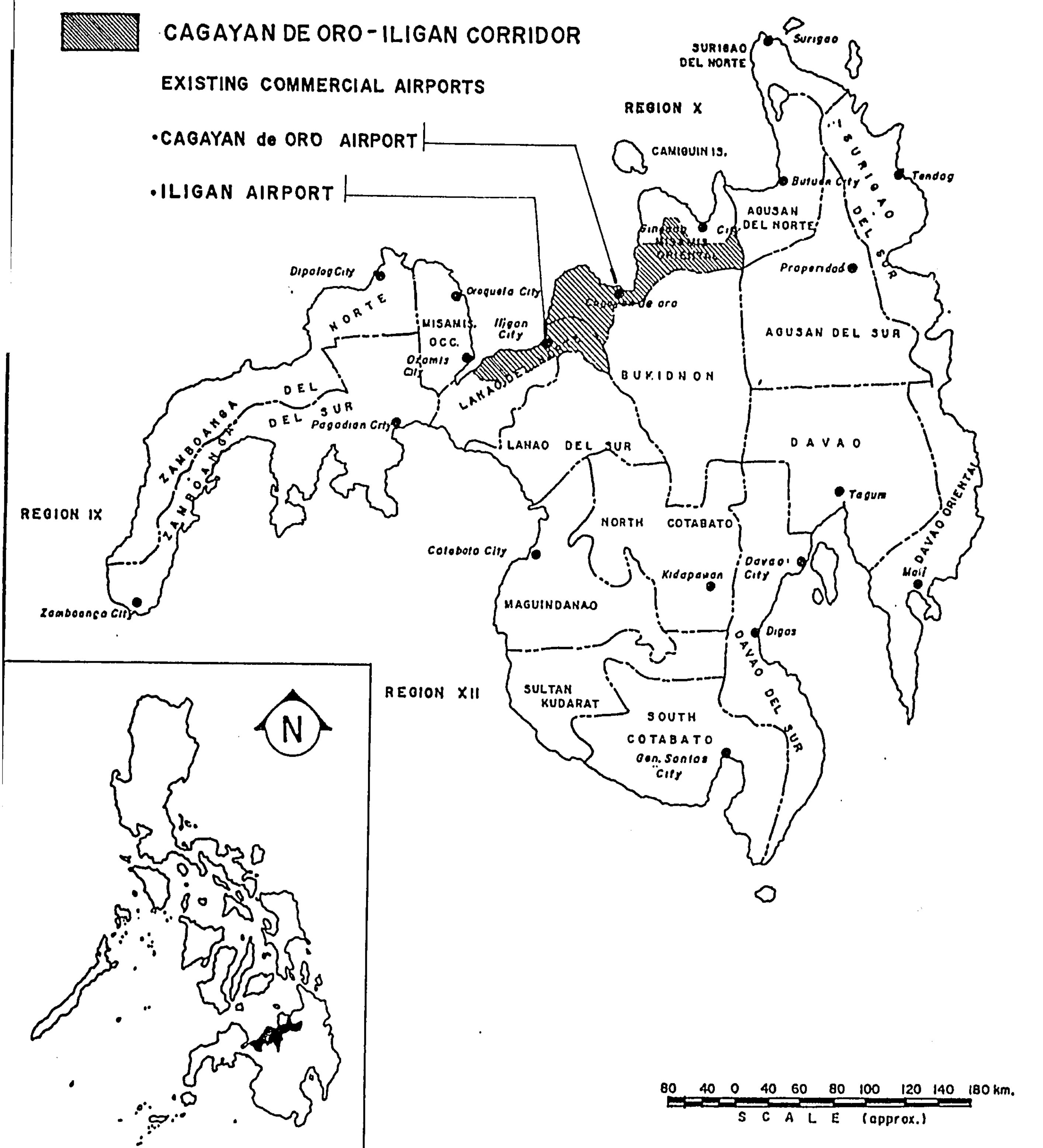
Commercial air transport service is currently provided at two airports within the Corridor: Cagayan de Oro Airport, located in Barangay[7] Lumbia of Cagayan de Oro City and Iligan Airport, located in the town of Balo-i (Figure 1-4). Both of these airports are operated by the Air Transportation Office (ATO) of the Department of Transportation and Communications (DOTC).

1.2.2.1 Cagayan de Oro (Lumbia) Airport

The airport facility in Lumbia began operations in 1954 and is presently the largest and principal air transport facility in Northern Mindanao (Figure 1-5). It is located about 11 km south-southeast of Cagayan de Oro, and has a runway 2200 m long capable of accommodating aircraft as large as a B-737 which the Philippine Airlines (PAL) presently uses in service to and from Manila. Cagayan de Oro Airport (CGY) is classified by the ATO as a trunkline airport and is currently served by PAL with a weekly total of 29 flights:

- 18 turnaround B737 jet flights from Manila

[7]A barangay constitutes the basic political unit in the Philippine local government system, as a component of the municipality or city where they are geographically situated.



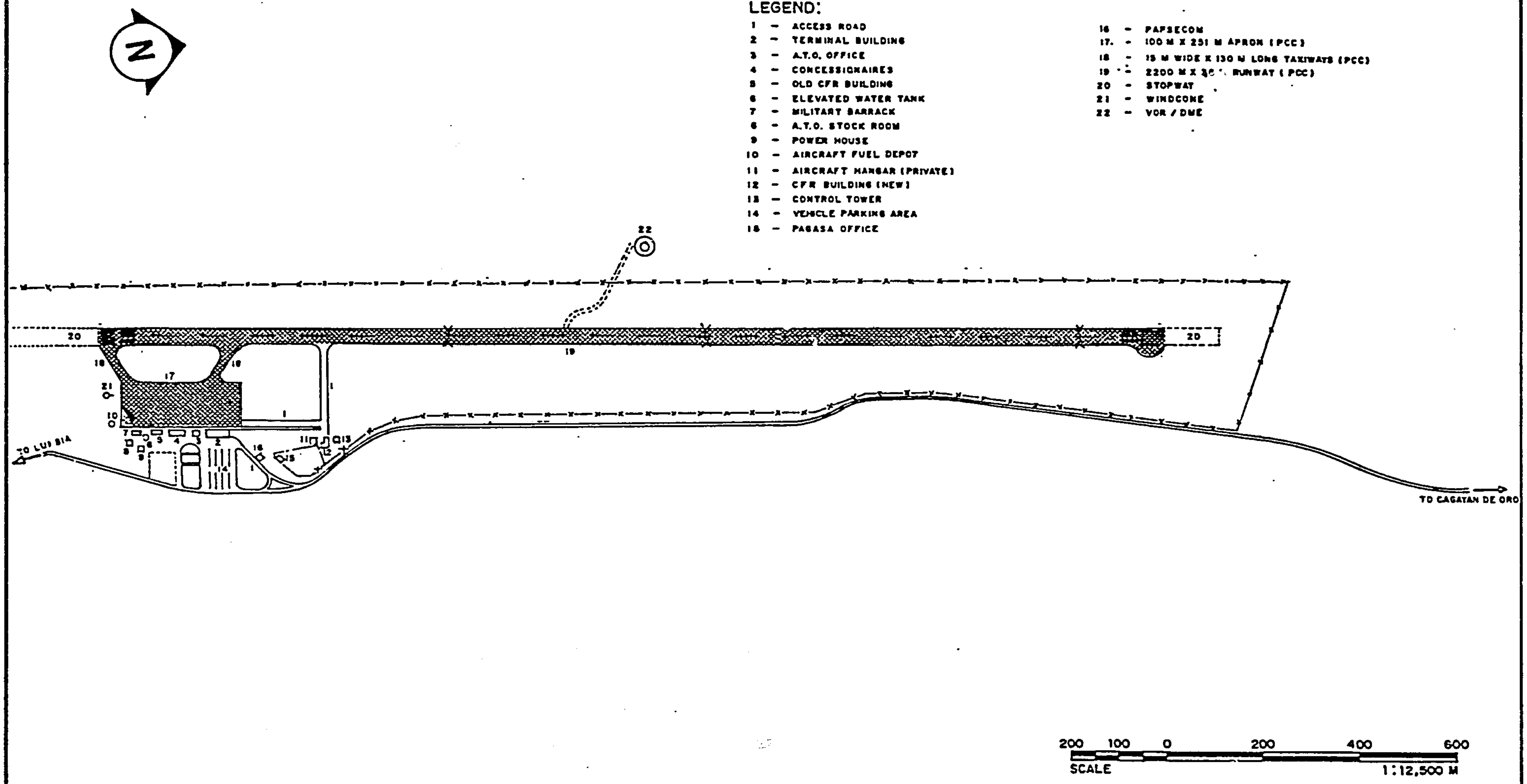
PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT
• GLOBETROTTERS ENG'G. CORP. SERVICES INC.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

EXISTING COMMERCIAL AIRPORTS
CAGAYAN DE ORO - ILIGAN CORRIDOR

FIGURE 1-4



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492 - 0452 - C - 00 - 0099 - 00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT

LAYOUT PLAN OF EXISTING CAGAYAN DE ORO AIRPORT

FIGURE 1-5

- 7 turnaround BAC1-11 jet flights from Cebu
- 4 transiting (through) BAC1-11 jet flights from Cebu to Davao

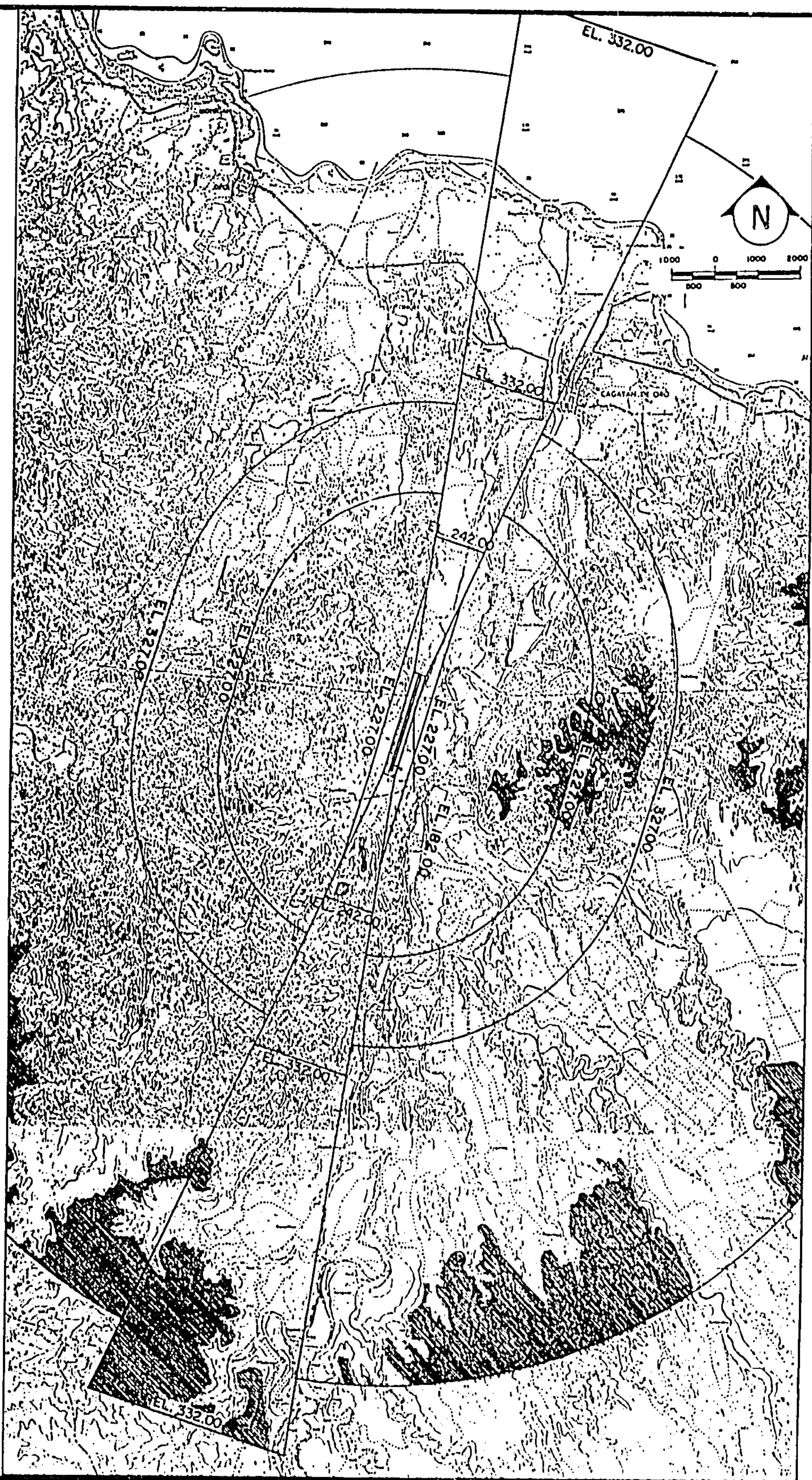
The airport is being operated from sunrise to sunset with a personnel complement of 95 employees (56 regular and 39 casual).

The airport is located on an inland plateau at an elevation of 186 m above mean sea level and covers an area of about 150 ha. The primary topographical feature of the area surrounding the airport is rapidly rising terrain south and east of the airport (Figure 1-6). The northerly approach to the airport (Runway 19[8]) is clear, with the outer approach (where the approach slope is zero percent) over the waters of Macajalar Bay. The southerly approach, on the other hand, is severely restricted by high terrain, limiting landings on Runway 01 to circling approaches.

General air operations in the vicinity of the airport are constrained by the high terrain, with only very limited maneuvering south of the airport. Due to terrain constraints, PAL conducts no night operations at the airport. The key constraint in terms of aircraft take-off performance is high terrain approximately 2,500 m south of the airport. This terrain (hill obstruction) is approximately 70 m above the elevation of the runway, and exceeds by approximately 20 m the ICAO-recommended inner approach slope. According to PAL, this terrain obstacle results in a six ton weight penalty on its B737-300's for departures to the south. The terrain also affects instrument flight operations. Even with the presence of a VOR/DME (Very High Frequency Omnidirectional Radio Range/Distance Measuring Equipment) facility and the programmed installation of an Instrument Landing System (ILS), PAL restricts low visibility operations due to the terrain's adverse effect on missed approaches, circling procedures, and safety.

The weather conditions at the Lumbia facility also affect the quality of air service being offered by PAL at the airport. Thunderstorms are frequent from May to October, with storms reported at the Philippine Atmospheric, Geophysical and Astronomical Service Administration (PAGASA) weather station (located within the airport premises) 15-25 days per month during this period. Low visibility weather is common from November to January, and causes most of the weather-related flight cancellations in the airport. Philippine Airlines reports that 18 flights, or 1.3 percent of the total, were canceled due to bad weather conditions at the Lumbia facility in 1990 (Table 1-4).

[8] Airport runways are traditionally identified by orientation



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0432-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

AIRSPACE OBSTRUCTION IDENTIFICATION FOR CAGAYAN DE ORO AIRPORT

FIGURE 1-6

16

Table 1-4
CANCELED FLIGHTS AT CORRIDOR AIRPORTS
(1991)

AIRPORT	NUMBER OF CANCELED FLIGHTS BY CAUSE					
	WEATHER	AIRCRAFT MAINTENANCE STATUS	AIRPORT STATUS	SECURITY, PEACE AND ORDER	OTHERS	TOTAL
Cagayan de Oro	18	9	0	14	6	46
Iligan	34	93	10	10	5	153

Source: Marketing Planning Department, Philippine Airlines

1.2.2.2 Iligan (Balo-i) Airport

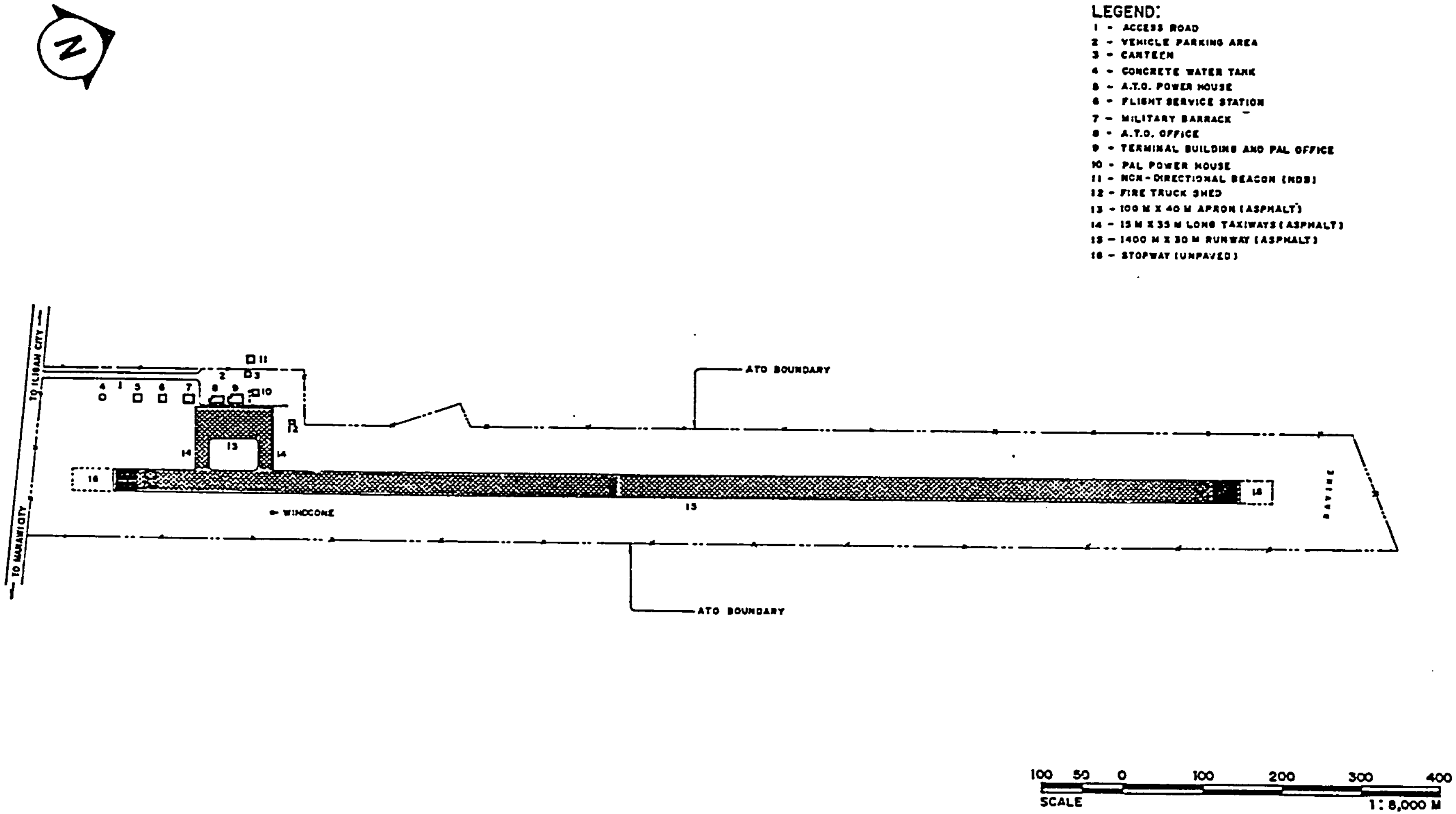
The existing airport for Iligan and vicinity is presently served only by medium-size turboprop aircraft to and from Cotabato. The Iligan Airport facility covers 26.8 ha and is located 17.4 km south-southeast of Iligan. The north-south oriented runway is 1400 m long (Figure 1-7).

Iligan Airport (IGN) is classified as a secondary airport by the National Airport System. It is presently served by PAL with 14 turnaround SD360 turboprop flights per week from Cotabato. It used to have transiting (through) Fokker 50 turboprop flights from Cebu to Cotabato which were discontinued in the early part of 1991 due to very low traffic demand. ATO operates the airport from sunrise to sunset with 23 personnel (3 regular and 20 casual).

The airport is also located on an inland plateau at an elevation of 396 m above mean sea level. The primary topographical feature of the airport area is rapidly rising terrain in the southeast, northeast, and southwest quadrants of the airport (Figure 1-8). This terrain significantly affects air operations and has in fact, resulted in several fatal air accidents around the airport. The northerly approach to the airport (Runway 20) is clear even for straight-in approaches, while the southerly approach (Runway 02) is severely restricted by high terrain with landings limited to circling approaches.

No official weather data is recorded at the airport, as the nearest PAGASA weather station is the one situated at Cagayan de Oro Airport, approximately 57 kms away by air. However, it is reported that visibility conditions often limit flight operations especially in the afternoons. At present, PAL schedules its only commercial service to this airport, two daily flights to and from Cotabato, during the morning in order to avoid poor weather during the afternoon. The airport presently accommodates only VFR (visual flight rule) traffic, which requires airport closure when the cloud ceiling is lower than 300 m above the ground and horizontal visibility is less than 1.5 km.

17



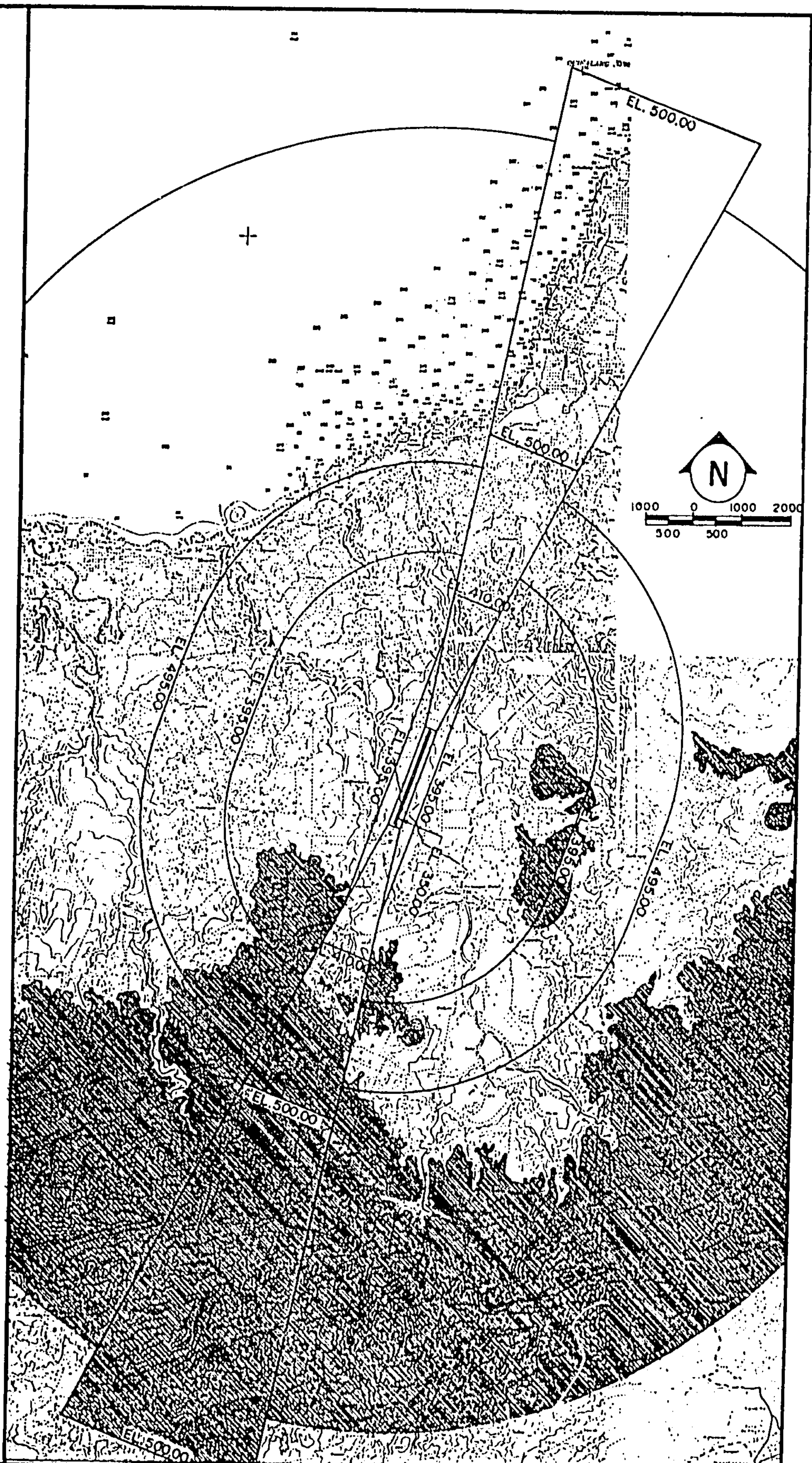
PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
- LOCKWOOD GREENE INT'L.
- ERNST & YOUNG INT'L.
- GLOBETROTTERS ENG'G. CORP.
- TRANS-ASIA (PHIL.) INC.
- CONSULTANT MANAGEMENT SERVICES INC.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT

LAYOUT PLAN OF EXISTING ILIGAN AIRPORT

FIGURE 1-7



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

AIRSPACE OBSTRUCTION IDENTIFICATION FOR ILIGAN AIRPORT

FIGURE 1-8

Philippine Airlines reports that 34 flights (3.9 percent of total) were canceled due to poor weather conditions at the Balo-i facility in 1990 (Table 1-4).

1.2.2.3 Commercial Air Traffic

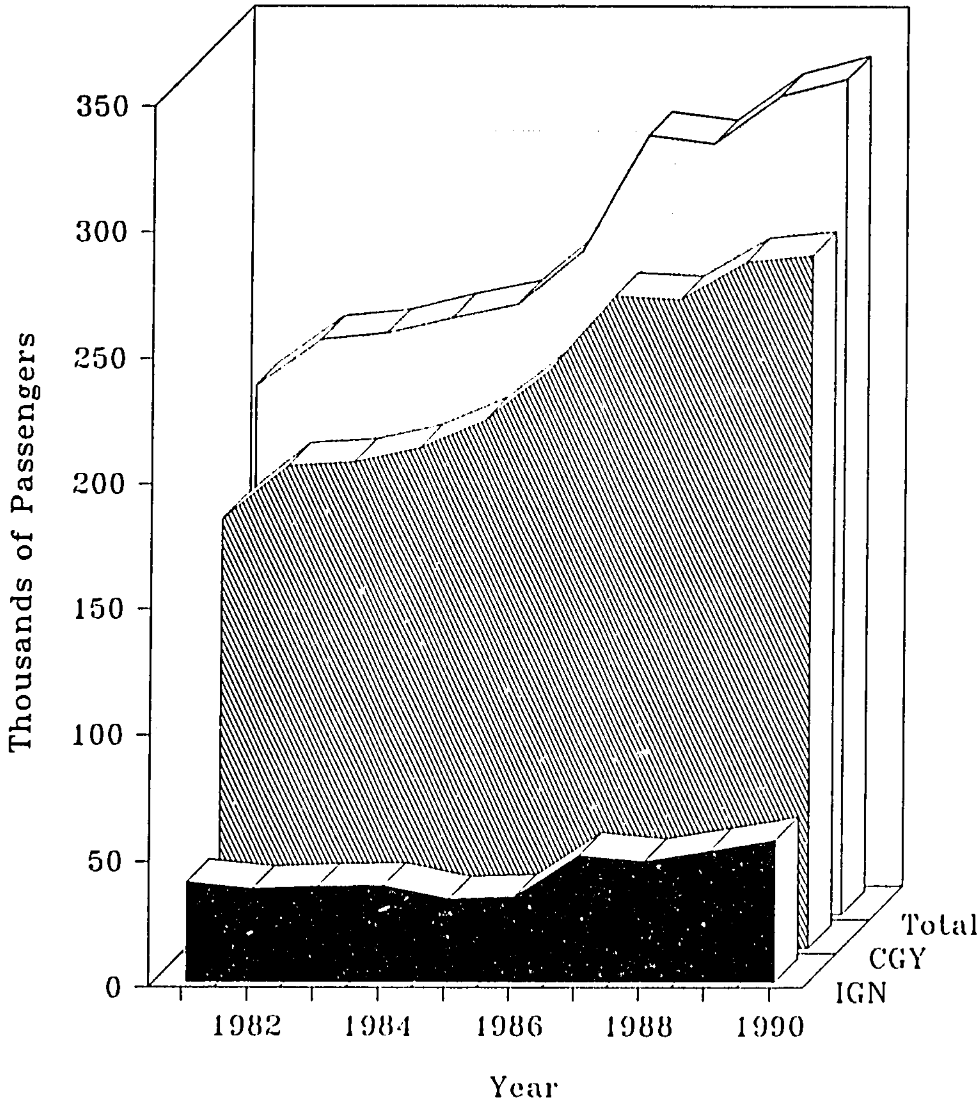
Air traffic, including passengers, cargo and aircraft movements of recorded PAL flights for the period from 1980 to 1990 are summarized in Tables 1-5 and 1-6 and graphically presented in Figures 1-9 and 1-10.

Table 1-5
COMMERCIAL AIR TRAFFIC AT ILIGAN (IGN) AND CAGAYAN DE ORO (CGY) AIRPORTS
(1981-1990)

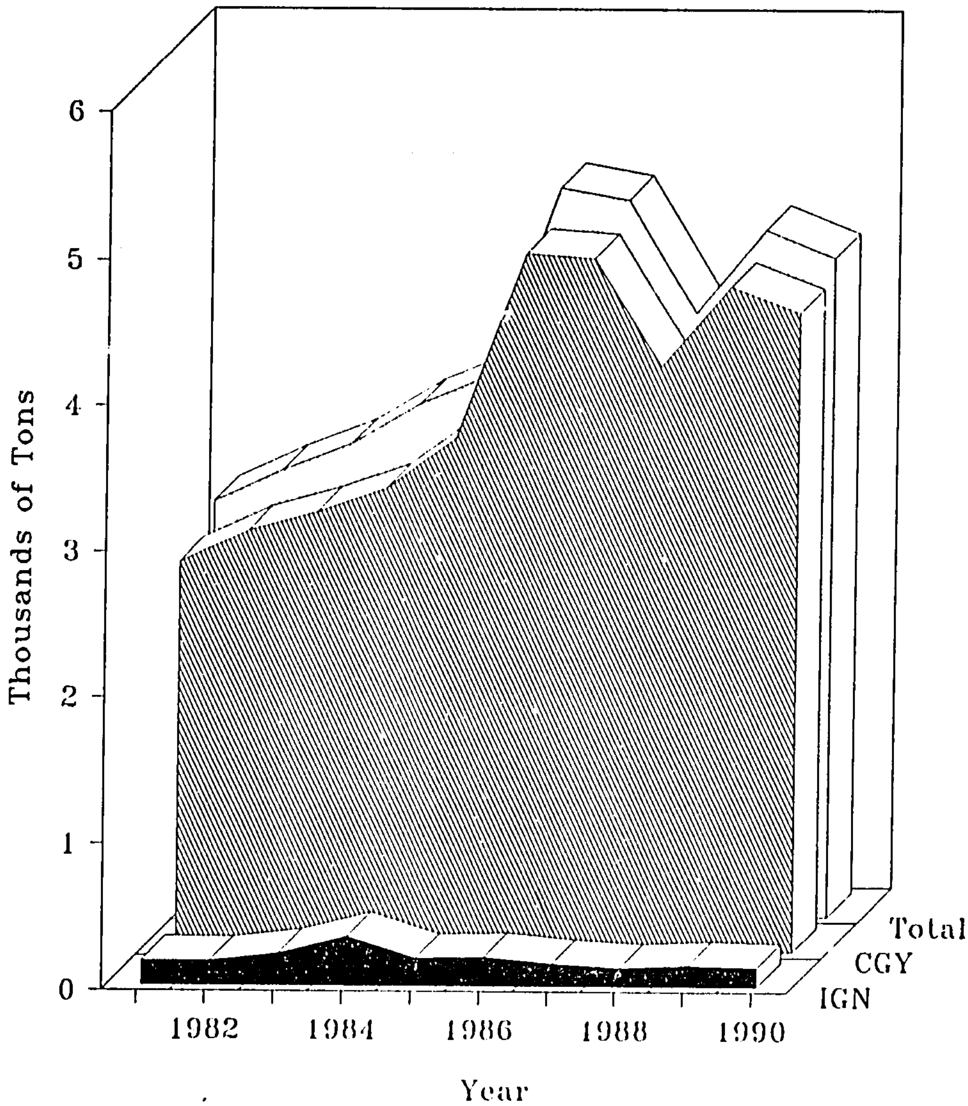
Year	Passengers					
	IGN	Growth (%)	CGY	Growth (%)	Total	Growth (%)
1981	39,629		170,830		210,459	
1982	37,129	-6.3	191,682	12.2	228,811	8.7
1983	38,095	2.6	193,326	0.9	231,421	1.1
1984	38,357	0.7	199,031	3.0	237,388	2.6
1985	32,932	-14.1	209,833	5.4	242,765	2.3
1986	33,791	2.6	229,969	9.6	263,760	8.6
1987	50,501	49.5	259,306	12.8	309,807	17.5
1988	48,343	-4.3	257,973	-0.5	306,316	-1.1
1989	52,414	8.4	272,899	5.8	325,313	6.2
1990	56,849	8.5	275,476	0.9	332,325	2.2
	Air Cargo (kilograms)					
Year	IGN	Growth (%)	CGY	Growth (%)	Total	Growth (%)
1981	170,247		2,653,512		2,823,859	
1982	171,427	0.7	2,867,141	8.0	3,038,570	7.6
1983	222,332	29.7	2,998,630	4.6	3,220,962	6.0
1984	339,108	52.5	3,160,360	5.4	3,499,468	8.6
1985	192,629	-43.2	3,501,528	10.8	3,694,157	5.6
1986	202,643	5.2	4,775,440	36.4	4,978,083	34.8
1987	157,275	-22.4	4,741,907	-0.7	4,899,182	-1.6
1988	131,708	-16.3	4,002,158	-15.6	4,133,866	-15.6
1989	146,358	11.1	4,554,577	13.8	4,700,835	13.7
1990	134,318	-8.2	4,378,036	-3.9	4,512,354	-4.0

Source: Philippine Airlines

20



PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 1-9
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	AIR PASSENGER TRAFFIC (1981 - 1990)	



PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 1-10
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	AIR CARGO TRAFFIC (1981 - 1990)	

22

Table 1-6
COMMERCIAL AIRCRAFT MOVEMENTS
(1980-1990)

YEAR	ILIGAN	CAGAYAN DE ORO
1980	1,302	2,349
1981	1,129	2,191
1982	972	3,160
1983	1,050	2,260
1984	1,071	2,308
1985	894	2,368
1986	840	2,589
1987	1,522	2,973
1988	1,697	2,737
1989	1,838	2,879
1990	1,677	2,775

Source: Philippine Airlines

At the Iligan Airport (IGN), the number of passengers increased from 39,629 in 1981 to 56,849 in 1990 for an annual growth rate of 4.1 percent. There was a significant increase in the number of passengers from 33,791 in 1986 to 50,501 in 1987, an increase of about 50 percent, which can be attributed to the increase in flight frequency and schedule convenience introduced in 1987. Negative growth occurred in the years 1982, 1985 and 1988 at IGN and in 1988 at the Cagayan de Oro Airport (CGY). In both 1982 and 1985, flight frequencies were reduced which could account for the decrease in passengers at Iligan. PAL attributes the 1988 decrease at both IGN and CGY to public reaction to the December 1987 plane crash of the Cebu-Iligan flight.

The number of passengers utilizing the Cagayan de Oro Airport is approximately five times of Iligan Airport. As in the case of IGN, the annual growth rate for 1987 was a relatively high, 12.8 percent. The average growth rate over the years 1981 to 1990 was 5.5 percent. In 1990, passengers at CGY (Region X) and IGN (Region XII) accounted for about 72% and 32% of those in their respective regions. The combined passengers of the Corridor airports account for approximately a 20% share of the total air passengers in Mindanao.

Air cargo transport at IGN is much lower than at CGY. In 1990, it was 134 metric tons at IGN, and 4,378 metric tons at CGY. The average growth rate over the years 1981 to 1990 at the Corridor airports is 5.3 percent. IGN and CGY cargo is about 83% and 6% of the total shipped in Region X and Region XII, respectively. Total cargo shipped to/from these two airports in 1990 was calculated to be 10.2% of that in all of Mindanao.

1.2.2.4 Other Aircraft Movements

Many aircraft movements at Corridor airports are not commercial passenger flights. Other aircraft operations include charter operations, such as those provided by Pacific Airways, cargo flights such as those provided by Aboitiz Air Transport Corp., corporate aviation such as the National Steel Corp. flights at the Iligan Airport or San Miguel Corp. helicopter operations, as well as military flights.

These types of flights presently represent approximately 120% of commercial aircraft operations at the two Corridor airports.

1.2.3 Road Infrastructure

The concrete paved Agusan-Misamis Oriental-Lanao coastal highway (National Highway 1) provides an improved road transport system through the Corridor. This highway has made travel more convenient and efficient to areas east and west of the Corridor. The eastern portion of this highway connects Cagayan de Oro City to the cities of Gingoog, Butuan and Surigao while the western portion provides linkage to Iligan, Marawi City, the rest of Lanao del Norte and Zamboanga City.

At present, access to Iligan Airport is thru the Iligan-Marawi City road while that of Cagayan de Oro Airport is thru the Cagayan de Oro-Talakag road. There are no current access problems to these two airports as the respective roadways are capable of accommodating existing road traffic demands.

One provincial gravel road (paved for a short distance where it passes the Laguindingan High School) and one municipal road lead north from National Highway 1 toward the proposed Laguindingan site. Throughout the northern part of the peninsula extending to Sulauan Point are numerous unpaved municipal and barangay roads connecting the many small settlements.

1.2.4 Other Transportation Infrastructure

In the Cagayan de Oro-Iligan Corridor, water transportation is one of the main transport modes available to inhabitants and industries of the area. Regular and reliable sea ferry services are available from the ports of Iligan and Cagayan de Oro for Cebu and Manila destinations. Cebu is the common transit point for passengers and cargoes proceeding to Manila or from Cebu proceeding to various other destinations. The Cagayan de Oro-Manila shipping route is served by six of the country's major domestic shipping lines, with Negros Navigation, Sweet Lines and William Lines having once a week shipping connections to Manila, and Lorenzo Shipping, Escaño and Sulpicio Lines, having twice a month schedules for this route. The Cagayan de Oro-Cebu route is served by 14 departures weekly from the port of Cagayan de Oro. The Iligan-Manila route is served by at least three departures weekly while the Iligan-Cebu route is served by five departures weekly.

Public transportation (bus service) is available to most population centers of Mindanao from Cagayan de Oro and Iligan. Public ground transportation, including the ubiquous jeepney, has been greatly facilitated by the completion of National Highway 1, which parallels the coastline of Northern and Central Mindanao. Five major bus companies are based in Cagayan de Oro, three more are based in Iligan. There are more than 100 trucking operators, serving virtually all of Mindanao, based within the Corridor.

There is no existing public rail transportation system in Mindanao. Previous proposals, dating back more than 20 years, conceptualized an island-wide Mindanao Railway, the planning for which is still in the pre-feasibility stage.

1.3 PROJECT ALTERNATIVES

In addition to the two existing airport facilities at Lumbia and Balo-i, six alternative project sites were identified within the Corridor and evaluated by the Feasibility Study. The existing facilities and alternative sites were evaluated, in accordance with the TOR, for the feasibility of providing a 2,500-3,000 m runway with a maximum slope of one percent with supportive facilities and services in concurrence with international standards set by the International Civil Aviation Organization (ICAO). The evaluation process of the Feasibility Study included technical, financial, economic, social and environmental criteria for the efficient and safe handling of forecasted air transport requirements of the Corridor to the year 2011.

Three forecast scenarios were established to cover the uncertainty in future development in the airport service area. These scenarios are:

- High growth in economic activities;
- Moderate growth in economic activities; and
- Low growth in economic activities.

The traffic demand forecast for the *high case* takes into account potential infrastructure developments which could induce the movement of population and employment opportunities to the Cagayan de Oro-Iligan Corridor.

The moderate growth of *base case* of the traffic demand forecast was performed based on the assumption that future economic growth would occur along existing patterns.

For the *low case*, a decline in population and economic growth rates is assumed.

As a preliminary option, a "no action" alternative was evaluated following a standard practice of feasibility analysis and project justification. The following sections provide a brief summary of the detailed evaluations included in the Feasibility Study.

1.3.1 No Action

The "no action" alternative as interpreted here refers to continued commercial air service at the existing airports. As noted below, already underway at the existing Cagayan de Oro and Iligan airport facilities are development plans which include maintenance as well as capital improvement activities.

Based on this alternative, the existing airports serving the Corridor will remain constrained by terrain obstacles, weather conditions and runway lengths which limits aircraft accommodation and current levels of service. The continued operation of these facilities at the present level of service can be extended into the foreseeable future. The programmed DOTC improvements will enhance the operation of the airport facilities, add to the safety of passengers, and lead to more efficient cargo handling.

The programmed improvements to the existing airports will take place on publicly-owned property dedicated and developed for airport use. Implementation of the initial improvements has begun.

A review of the planned improvements for the Cagayan de Oro and Iligan Airports under the no action alternative revealed no significant environmental impacts associated with their implementation.

1.3.1.1 DOTC Airport Development Plan, Cagayan de Oro Airport

The DOTC's Airport Development Plan for the Cagayan de Oro Airport through 1997 includes the following improvements:

- Construction of new passenger terminal building (existing terminal to be used as a cargo terminal)
- Improve water system
- Runway extension (to 2,350 m) and widening (to 45 m)
- Expand apron (to 100 x 400 m)
- Overlay the runway with asphalt

26

- Asphalt paving of vehicle parking lot
- Overlay existing apron and taxiways with asphalt
- Install ILS and Approach Lights at Runway 19
- Install PAPI (Precision Approach Path Indicator) on both runways
- New security fence and
- Purchase of CFR (Crash, Fire and Rescue) vehicle.

The costs for these programmed improvements totals approximately 135 million pesos (excluding the cost of the ILS and CFR vehicle).

1.3.1.2 DOTC Airport Development Plan, Iligan Airport

The DOTC's Airport Development Plan for the Iligan Airport (1991-1995) includes the following improvements:

- A new passenger terminal
- A new aircraft parking apron (100 x 150 m)
- A new connecting taxiway to the apron (23 m wide)
- Overlay the runway with asphalt
- Provide a new perimeter security fence
- A new parking area and access road at the new passenger terminal
- A new VOR/DME
- Install PAPI on both runways
- Purchase of a CFR vehicle.

The costs for these programmed improvements totals approximately 50 million pesos (excluding the cost of the VOR/DME and CFR vehicle).

1.3.2 Alternative Sites for Improvement

Preliminary identification and evaluation of potential airport sites was performed through examination of Corridor contour maps, supplemented by field inspections. Elevation variation information formed the basis of the site screening process as any potential airport site would have to be relatively flat in order to meet the runway slope criterion. The contour maps that were utilized were at a 1:50,000 scale, with 20 m contour intervals, published by National Mapping and Resource Information Authority (NAMRIA).

The Corridor's terrain is extremely rough, characterized by steep slopes, deep river valleys and rapidly rising elevation from the shore to the interior mountains. The map survey indicates that, with the exception of the Lumbia site, there are no sufficiently level inland sites between the two cities for economically acceptable construction of a 2,500-3,000 m runway with a maximum one percent slope.

All potential commercial airport sites within the Cagayan de Oro-Iligan Corridor are located along the coastline (Figure 1-11). These sites are discussed below in order of geographic location, starting at the eastern end of the Corridor.

- <u>Area Immediately West of Cagayan de Oro</u>

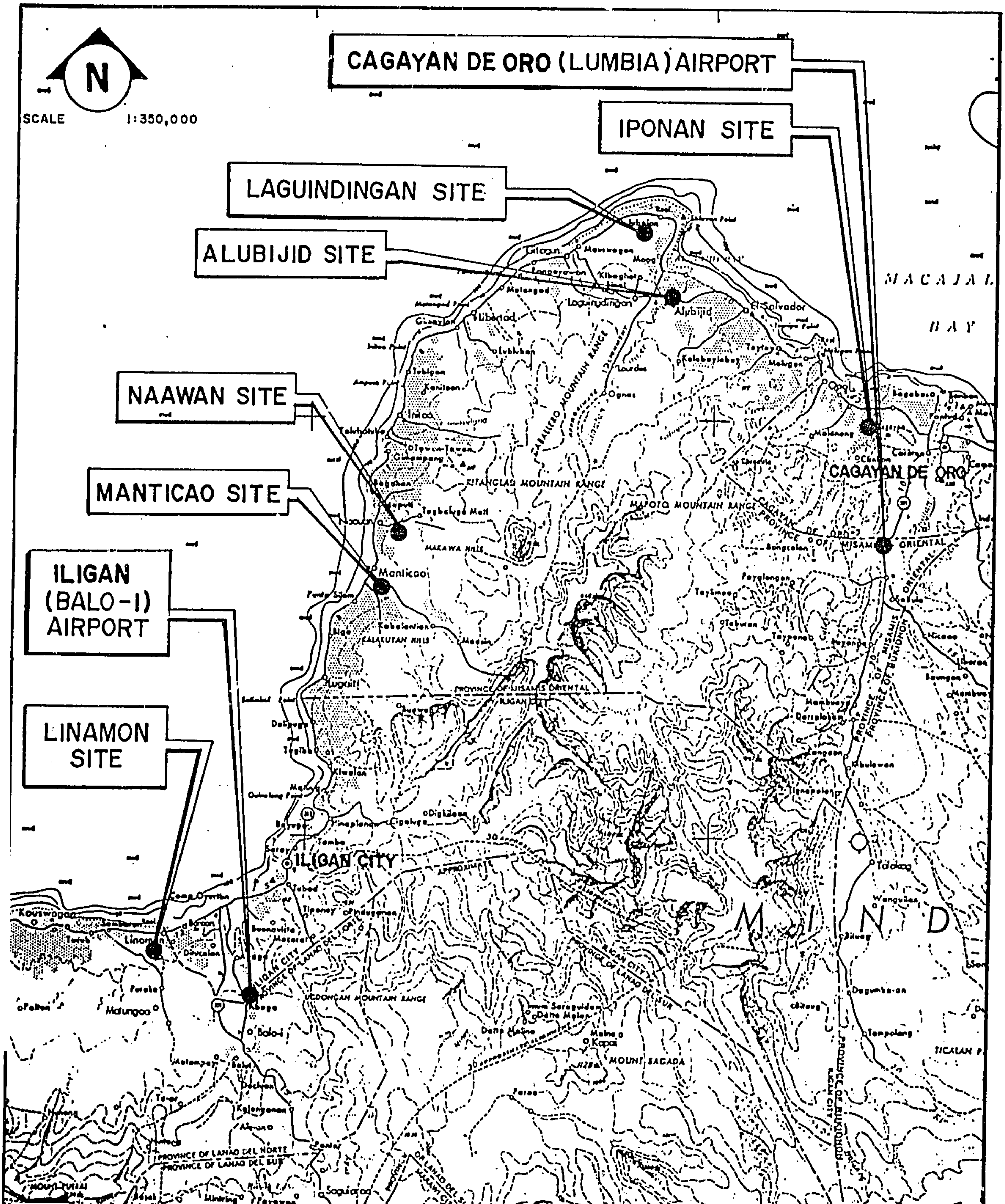
  Although there is a level terrain immediately west of the Cagayan River, extensive urban and residential development is present in this area. This area was therefore considered unsuitable for airport development due to anticipated social and environmental impacts.

- <u>Iponan</u>

  The first potential site west of Cagayan de Oro is located approximately six km from the city on the west bank of the Iponon River. A 3,000 m runway with a generally north/south orientation could be located in the relatively flat river valley. The valley is presently used for rice paddies and livestock pasture, and includes light density residential development primarily along the river on the east side of the valley. A runway at this site could be aligned to avoid most of the existing residences and to avoid the rising terrain to the west and to the southeast.

- <u>Iponan to Alubijid</u>

  The 15 km stretch of shoreline between Iponan and Alubijid, which includes the municipalities of Opol and El Salvador, is characterized by moderately rising terrain. Land elevation reaches a minimum of 60 m within 3,000 m of the shore at all points in this region, so construction of a runway would involve massive volumes of earthwork and the resulting runway would have serious terrain-related operational constraints. Location of an airport in this area was therefore considered infeasible.



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0089-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

SITES EVALUATED BY FEASIBILITY STUDY

FIGURE 1-11

- Alubijid

The municipality of Alubijid, approximately 25 km west of Cagayan de Oro, is located in a generally level river valley, at the mouth of the Alubijid River. Although construction of a 3,000 m runway would be possible at this site, it would require relocation of the entire town, major rerouting of the national highway and diversion of the river. Location of an airport was therefore considered infeasible at this site due to social and environmental impacts, in addition to the costs of compensation and relocation.

- Laguindingan

Laguindingan is located approximately 29 km north/north west of Cagayan de Oro.

A 900 m long light aircraft landing strip established along a north/south alignment was formerly located near the tip of Sulauan Point, approximately five km north of the national highway. However, a 2,500-3,000 m runway on a north/south alignment along the east face of the point would not be feasible due to an excessive cross-slope. The terrain rises to over 60 m elevation within 300 m of the shore in this area and to over 100 m immediately south of the site.

It has been suggested that a runway following the alignment of the former landing strip could be partially built on fill extending north from the point into the sea; however, the sea reaches a depth of approximately 80 m within 2,000 m of the shore, so this alternative was considered infeasible for both cost and environmental reasons.

At a second site, slightly to the west of Sulauan Point, the elevation contours along the north face of the peninsula generally parallel the shoreline, and the terrain is not as steep as along the east face near the former landing strip. A runway could be constructed parallel to the north face, along approximately the 50 m elevation contour. A runway with an east/west orientation at this site would offer over-water, unobstructed approaches to both ends of the runway. The high terrain to the south would not be within the runway approach zones, as it is for any runway in the Corridor with a north/south orientation. Therefore, this second Laguindingan location was considered a technically feasible site.

- Alubijid to Gitagum

The national highway diverts slightly inland in the seven km stretch between Alubijid and Gitagum, climbing to an elevation of over 100 m. The terrain in this area is generally rough and there are no sites sufficiently level for airport construction.

- Gitagum to Naawan

The 25 km stretch along the eastern shore of Iligan Bay between Gitagum and Naawan includes the municipalities of Matangad, Libertad, Tubigan and Initao. It is characterized by steeply rising terrain, generally reaching well over 100 m elevations within 3,000 m of the shoreline. The few river valleys are only several hundred meters wide and are unsuitable for construction of a runway. The are no technically feasible airport sites in this area.

- Naawan

The Talabaan River valley, the location of the town of Naawan, is approximately 28 km north of Iligan. The valley is the largest expanse of flat land along the eastern shore of Iligan Bay. The valley, however, is only 1.5 km wide (north to south), with steeply rising terrain to over 100 m immediately north and south of the valley floor. Terrain at the west end of the valley rises abruptly to over 600 m in elevation within five km of the end of the valley. The valley was therefore not considered as a feasible airport location.

- Manticao

Manticao, located approximately four km south of Naawan, is also located in a valley. The longest branch of the valley runs in a generally north/south orientation. However, the valley floor is not flat, rising over 90 m within 3,000 m of the shore. Additionally, the valley is extremely narrow (less than 300 m wide at a point 2,500 m from the shore), with very steep sides. Manticao was therefore not considered a feasible airport location.

- Manticao to Iligan

The approximately 24 km stretch between Manticao and Iligan, which includes the municipalities of Lugait, Santa Filomena and Manoulog, is characterized by very steep and rough terrain, rising to well over 100 m within 1,000 m of the shore. There were no feasible airport sites identified within this area.

- Linamon

The Linamon site lies approximately 17 km west of Iligan at an elevation of 87 m above sea level, in the municipality of Linamon. Earthwork and grading for the construction of a new airport at this site was begun in 1982 but not completed. As proposed, it was to replace the Balo-i airport facility to eliminate the inconvenience of canceled flights due to adverse weather conditions reported to be frequent at Balo-i's higher elevation.

1.3.3 Site Selection Process - Screening

A site selection process was used in determining the preferred location within the Corridor for the development of airport facilities. The airport site selection process included three sequential steps:

- First Stage Screening - Potential New Airport Sites

  All potential new airport sites in the Corridor are analyzed with respect to technical criteria; all feasible sites are identified.

- Second Stage Screening - All Technically Feasible Sites

  All technically feasible airport sites, including both new sites identified in the first stage screening process and existing airport sites, are compared with respect to cost and benefit criteria; final candidate sites are identified.

- Final Airport Development Program Site Selection

  The preferred location(s) for the Corridor's airport development program are identified.

After the evaluation of all potential sites, feasible sites and preferred locations for the Corridor's airport development program using site selection criteria discussed in detail in the Feasibility Study, the Laguindingan site was found to be the only location suitable for a new airport within the Corridor (Table 1-7). The site can accommodate an international standard airport facility with the capacity to significantly improve the air transport service of the Corridor, to the year 2011.

In summary, the key findings of the Feasibility Study screening process include:

- The two existing airports at Lumbia and Balo-i, with relatively minor upgrade/expansion, can accommodate continuation of present service patterns over the study period. The level of service provided at these existing facilities would diminish as demand increased.

- Due to terrain and operational constraints neither of the existing airports can be upgraded economically to accommodate full international standard commercial air service, including night operations and wide body jet operations.

- The Laguindingan site was found to be the only location suitable for a new airport within the Corridor. The site can accommodate a full service, unconstrained, international standard airport facility able to support all weather, 24-hour operation of wide body jet aircraft.

Table 1-7
SUMMARIZED SCREENING PROCESS
CAGAYAN DE ORO - ILIGAN CORRIDOR AIRPORT SITING

IDENTIFIED POTENTIAL AIRPORT SITES	FEASIBLE SITES IDENTIFIED THROUGH FIRST STAGE SCREENING	FINAL CANDIDATE SITES IDENTIFIED THROUGH SECOND STAGE SCREENING	PROJECT SITE FOR EA/EIS STUDY
Alubijid	Balo-i	Balo-i	Laguindingan
Balo-i	Iponan	Laguindingan	
Iponan	Laguindingan	Lumbia	
Laguindingan	Linamon		
Linamon	Lumbia		
Lumbia			
Manticao			
Naawan			

First Stage Screening - comparison of technical factors for an airport sufficient to meet the long-term commercial aviation needs of the Cagayan de Oro-Iligan Corridor.

Second Stage Screening - comparison of estimated development and operations cost and relative benefits between paired clusters of existing and potential airport sites.

1.3.4 Implementation Timeframe

The airport development strategy recommended by the Feasibility Study is to implement the construction of a new airport at Laguindingan in the short-term future. Construction of the new airport would be implemented as soon as possible, avoiding some of the programmed DOTC investments to upgrade facilities at the existing airports in Lumbia and Balo-i.

For the economic analysis of the Feasibility Study, the projected start of airport construction is 1993, with completion by 1995. Based on this schedule, the opening year of the new airport would be 1996.

As soon as the new airport is completed all commercial operations would be concentrated there, with no further commercial operations are anticipated at the two existing airports. The policy of Philippine Airlines (PAL) is to generally consider commercial service areas to extend over 200 km from an operational airport.

1.4 RECOMMENDED IMPROVEMENTS, LAGUINDINGAN

1.4.1 Layout and Description

The General Site, Airport Layout and Profile Plans are shown in Figures 1-12 to 1-14, respectively. The proposed airport is located in the municipality of Laguindingan and would occupy portions of the barangays of Liberty, Tubajon, and Moog.

Based on the required physical facilities and clearances, the area of the land needed for the proposed development is 167.085 ha, an area necessary to operate and maintain an airport within the safety guidelines of ICAO and/or the U.S. Federal Aviation Administration (FAA).

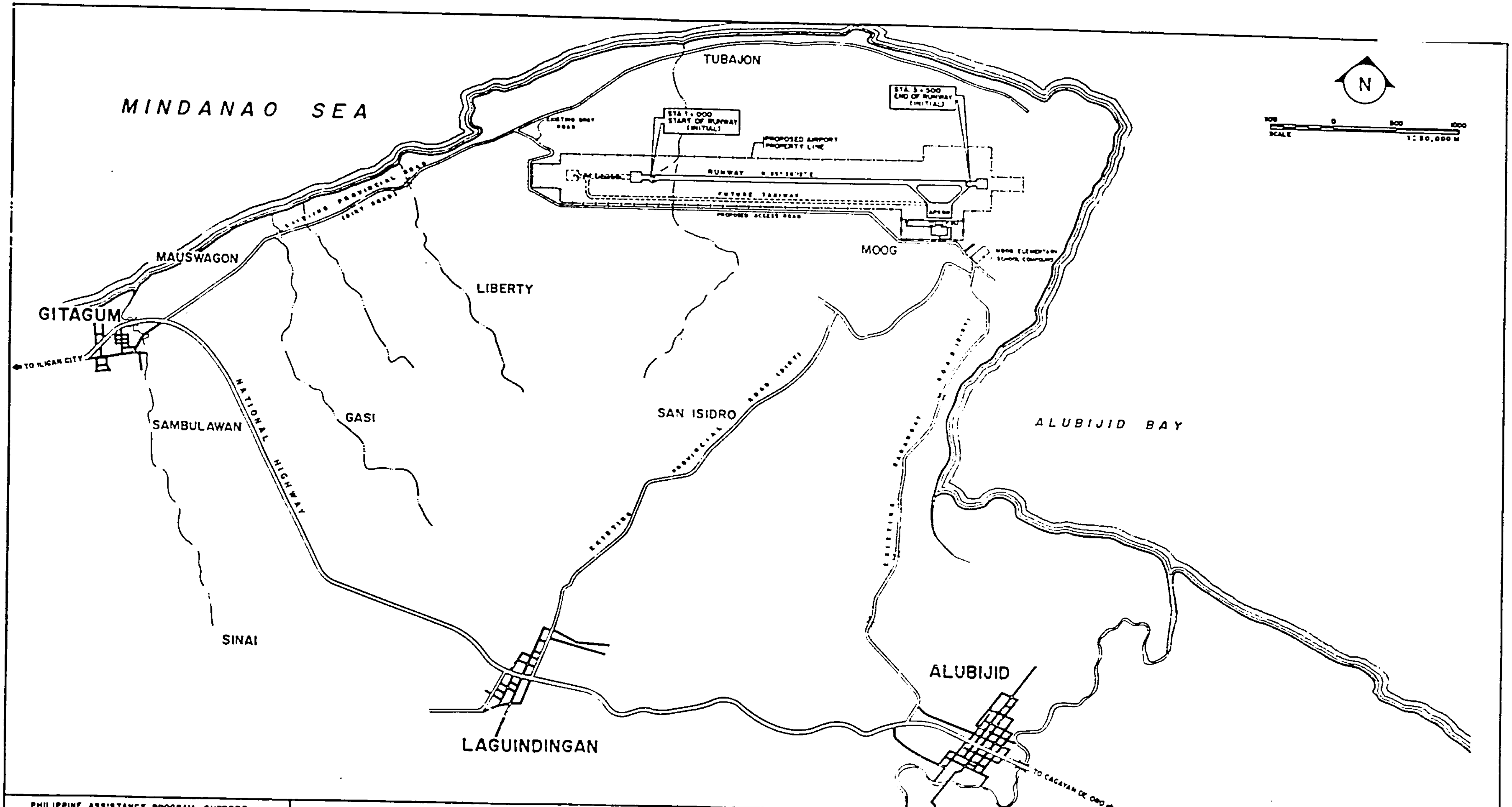
As designed, the facility would have a single runway with turnaround pad at the west end, two stub taxiways, an apron, a passenger terminal building, cargo terminal building, crash, fire and rescue building, control tower, operation and maintenance building, and power and pump house.

The facility would also have an elevated concrete water tank as storage for potable water, a fuel farm facility with two double-walled 20,000 gallon capacity above ground tanks, a drainage system, and a septic sewer system. Fuel delivery to the apron would be provided by an underground hydrant system.

A parking lot that would accommodate 240 vehicles during the initial phase with available space for future expansion is also provided within the new airport perimeter. Parking stalls for vehicles of airport employees are also provided and located adjacent to each facility.

The proposed 09/27 runway is oriented in an east-west direction with a bearing N85° 30' 12"E. The terminal facilities are located in the level area southeast of the site in order to reduced the amount of earthworks.

A 4.5 km barangay road from the national highway in Alubijid to Moog and a 3.5 km portion of provincial road from Gitagum to Tubajon would be improved and paved to serve as access roads of the airport. An additional 4.5 km access road parallel to the airport boundaries along the southern perimeter would also be developed to complete the loop road from Alubijid to Gitagum.



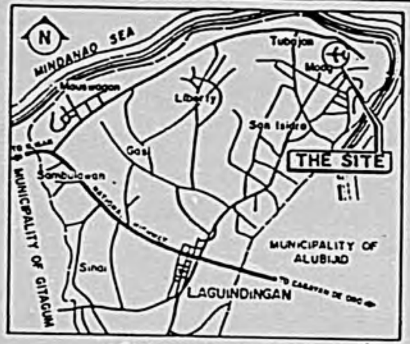
PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DELOPMENT
CONTRACT NO - 492-0462-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
- LOCKWOOD GREENE INT'L.
- ERNST & YOUNG INT'L.
- GLOBETROTTERS ENG'G CORP.
- TRANS - ASIA (PHIL.), INC.
- CONSULTANT MANAGEMENT SERVICE, INC.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT

GENERAL SITE PLAN

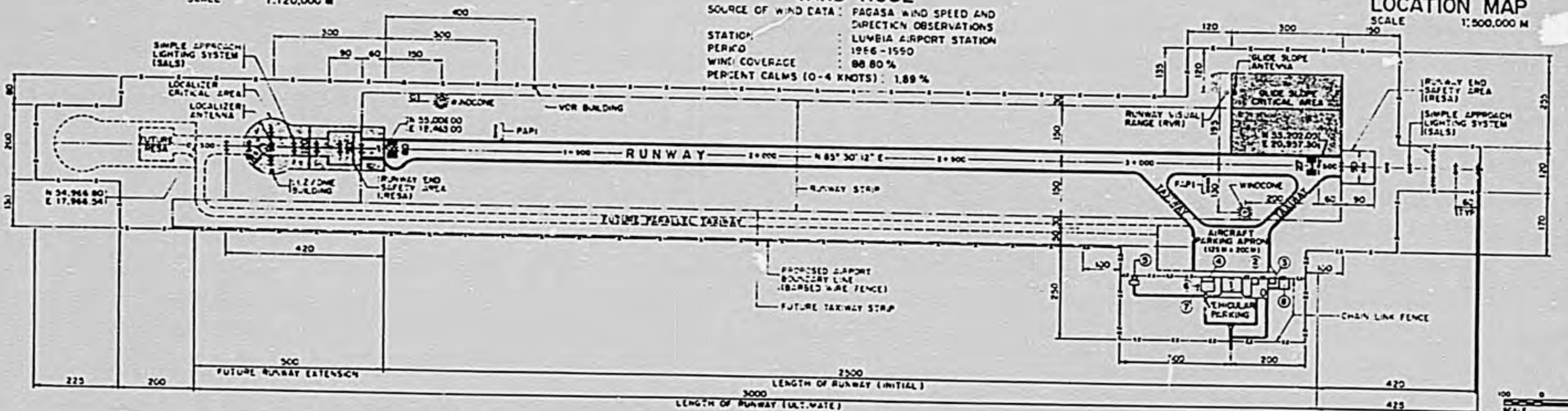
FIGURE 1-12



VICINITY MAP
SCALE 1:120,000 M

WIND ROSE
SOURCE OF WIND DATA : PAGASA WIND SPEED AND DIRECTION OBSERVATIONS
STATION : LUMBIA AIRPORT STATION
PERIOD : 1986 - 1990
WIND COVERAGE : 98.80 %
PERCENT CALMS (0-4 KNOTS) : 1.89 %

LOCATION MAP
SCALE 1:500,000 M



RUNWAY DATA TABLE		
ITEM	RUNWAY 09 / 27	
	INITIAL	ULTIMATE
RUNWAY LENGTH	2500 m	3000 m
AVERAGE RUNWAY GRADIENT (%)	0.243 %	0.236 %
WIND COVERAGE (%), 20 KNOTS	98.80 %	98.80 %
RUNWAY CATEGORY	PRECISION-CAT I	PRECISION-CAT I
PAVEMENT STRENGTH	63,000 KG-DT	63,000 KG-DT
APPROACH SURFACES	50:1/50:1	50:1/50:1
RUNWAY LIGHTING	HIRL, REIL	HIRL, REIL
RUNWAY MARKING	PRECISION-CAT I	PRECISION-CAT I

AIRPORT DATA TABLE			
ITEM		INITIAL	ULTIMATE
AIRPORT REFERENCE POINT (ARP) ELEVATION		32.00 m	34.46 m
AIRPORT REFERENCE POINT (ARP)	LATITUDE	08° 37' 01.67"	08° 37' 01.03"
	LONGITUDE	124° 21' 21.30"	124° 21' 13.75"
AIRPORT REFERENCE CODE (ICAO)		4D	4E
MEAN ANNUAL TEMPERATURE		26.5°C	26.5°C
NAVIGATIONAL AIDS		VOR, ILS(CAT-II) SALS, RVR, PAPI, LIGHTED WINDCONE, DME	
TAXIWAY / APRON LIGHTING		HIGH INTENSITY TAXIWAY AND APRON EDGE LIGHTS	
TAXIWAY MARKINGS		TAXIWAY ℄ AND TAXI-HOLDING POSITION MARKING	
AIRPORT PROPERTY		167.085 Ha	167.085 Ha

AIRPORT FACILITIES			
NO.	BUILDING DESCRIPTION	INITIAL	ULTIMATE
1	PASSENGER TERMINAL BUILDING	40 m x 60 m	40 m x 75 m
2	CARGO TERMINAL BUILDING	18 m x 18 m	18 m x 30 m
3	CRASH, FIRE AND RESCUE (CAT-8) BLDG	18 m x 18 m	–
4	OPERATIONS AND MAINTENANCE BLDG	15 m x 25 m	–
5	CONTROL TOWER	15 m x 15 m	–
6	POWER AND PUMP HOUSE	6 m x 10 m	–
7	ELEVATED CONC WATER TANK (CAP)	10,000 Gals	–
8	AIRCRAFT FUEL FARM (CAP)	40,000 Gals	–

PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO. 492-0452-C-00-0099-00

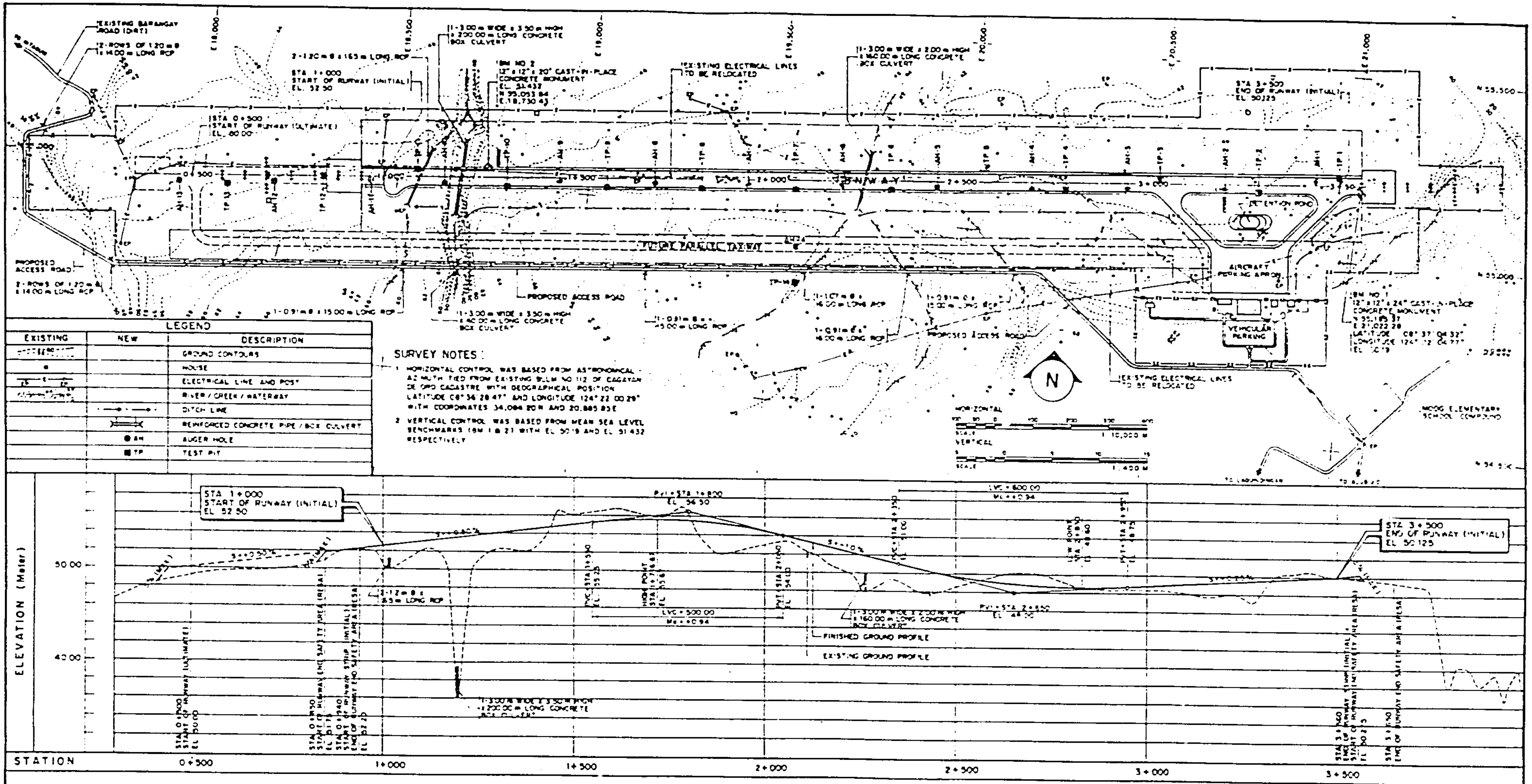
LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • ERNST & YOUNG INT'L. • GLOBETROTTERS ENG'G CORP. • TRANS-ASIA (PHIL.), INC. • CONSULTANT MANAGEMENT SERVICES, INC.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT

AIRPORT LAYOUT PLAN

FIGURE 1-13

36



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO. 492-0452-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L • TRANS-ASIA (PHIL.), INC.
• ERNST & YOUNG INT'L • CONSULTANT MANAGEMENT SERVICES, INC.
• GLOBETROTTERS ENG'G CORP.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT

PLAN AND PROFILE

FIGURE 1-14

The eastern link of the proposed access road, from Alubijid to Moog, will need at least 3-box type and 2 circular concrete pipe culverts. Eight circular concrete pipes and one box-type culverts are needed along the western link, from Gitagum to Tubajon. The two existing timber bridges along the west link should also be replaced with new concrete bridges.

The Control Tower Building is remotely sited from other facilities so that all traffic patterns and the final approaches to the runway and taxiways would remain continuously visible from the tower's elevation.

For security and access control purposes, the airport would be surrounded with a combination of chainlink and barbed-wire fences.

Navigational aids (NAVAIDS) for the airport would include lighted windcones, Very High Frequency Omni-Directional Radio Range (VOR), Instrument Landing Systems (ILS), Simple Approach Landing System (SALS), Runway Visual Range (RVR), Precision Approach Path Indicator (PAPI) and Distance Measuring Equipment (DME).

1.4.2 Construction

Construction of the proposed airport is projected to last about 36 months. The general construction schedule of the project is shown in Table 1-8. Temporary construction structures includes security fencing, a security shed at the construction camp entrance, equipment and material storage sheds, field offices for the contractors and consultants, and temporary housing for migrant workers.

Construction vehicles would be stored on site when not in use, and a portable generator would be brought to the site in order to provide needed back-up power for equipment and lighting. An aggregate crusher plant and concrete batch plant would be installed on site. The schedule of equipment that is anticipated to be needed is included in Table 1-9.

The detailed engineering design, land acquisition and relocation works for the project is expected to start in year 1992. The project could to be completed by year 1996, subject to timely review of project, securement of an Environmental Compliance Certificate (ECC) and corresponding USAID environmental approvals, and provision of funding.

Earthwork is the major item in the construction of the new airport. It constitutes an estimated 47 percent of the total construction cost. The quantity of excavation for this project is approximately 1.9 million cu. m., while borrow fill is estimated at 0.46 million cu. m. (Table 1-10).

During airport construction, both skilled and unskilled labor would be required. The Cagayan de Oro-Iligan Corridor labor pool is expected to be able to supply the required workers, although some highly technical positions, such as concrete paving machine, batch plant, and

Table 1–8
GENERAL CONSTRUCTION SCHEDULE

YEAR: 1993 (months 1–12), 1994 (months 13–24), 1995 (months 25–36)

I. MOBILIZATION AND CONSTRUCTION OF FIELD OFFICES, ETC.	1–2
II. CIVIL WORKS	
1. Earthworks	3–23
2. Pavements	
a) Runway	9–26
b) Apron	18–25
c) Taxiway	22–25
d) Roads	3–5; 19–30
e) Vehicle Parking	27–30
3. Site Improvements	
a) Drainage Works	3–6; 16–19
b) Security and Perimeter Fencing	17–24; 31–32
c) Landscaping	31–34
III. BUILDING WORKS (INCLUDING EQUIPMENT INSTALLATION)	
1. Passenger Terminal Building	20–30
2. Control Tower	22–29
3. Cargo Terminal Building	23–28
4. CFR Building	23–28
5. Operating and Maintenance Building	22–29
6. Power and Pump House	24–26
IV. NAVAIDS AND VISUAL AIDS	27–32
V. UTILITIES	3–5; 23–32
VI. CLEARING, DEMOBILIZATION AND TURNOVER	35–36

Source: LBII, 1991. Draft Final Report, Feasibility Study and Master Planning, Cagayan de Oro–Iligan Airport, Volume I.

Table 1–9
CONSTRUCTION EQUIPMENT SCHEDULE

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
I. Directs																																		
1. Bulldozer	1	3	3	4	4	4	6	6	6	6	6	6	3	3	3	2	2	2	2	2	2	2	2	2	2									
2. Backhoe				1	1	1	2	2	4	4	4	4	2	2	2	1	1	1	1	1	1	1	1	1										
3. Payloader				1	1	1	1	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1									
4. Grader						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
5. Road Roller								1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1								
6. Plate Compactor								8	8	8	8	8	8	12	12	12	12	12	8	8	4	4	4	4	4	4								
II. Concreting Equipment																																		
1. Batch Plant					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1								
2. Transit Mixer					3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	3	3	3	3	2	2								
3. Concrete Paver					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1								
4. 2-Bagger Mixer			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
5. Concrete Pump												1	1	1	1	1	1	1	1	1	1	1	1	1										
6. Concrete Vibrator			2	2	2	2	2	2	2	4	4	4	4	12	12	12	12	12	12	8	8	8	8	8	8	4	4	2	2					
III. Materials Handling																																		
1. Mobile Crane						1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	1	1							
2. Cargo Truck										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1									
3. Trailer/PM									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4. Dump Truck			1	1	1	1	4	4	6	6	10	10	10	10	10	10	5	5	5	2	2	2	2	1	1									
5. Water Lorry		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1								
6. Forklift										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IV. Support Equipment																																		
1. Air Compressor							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					1	1	1						
2. Gen set, 200 KVA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
3. Welding Machine								1	1	1	1	1	1	4	4	4	8	8	8	8	8	2	2	2	2	1	1	1						
4. Service Pick-up	1	1	1	1	1	1	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	3	3	2	2	1	1	1	1	1	1	1	1
5. Dewatering Pump							1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	1	1	1	1								
6. Asphalt Distributor													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						

Source: LBII, 1991. Draft Final Report, Feasibility Study and Master Planning, Cagayan de Oro–Iligan Airport, Volume I.

Table 1-10
CONSTRUCTION COST ESTIMATE
LAGUINDINGAN SITE
(Financial Costs in Thousands of Pesos)

Item	Description	Unit	Quantity	Cost Components			Financial less Taxes	Financial Cost
				Foreign	Local	Taxes		
1.	Earthworks							
	• Clearing/grubbing	ha	85	958	1,008	491	1,966	2,457
	• Stripping	m^3	36,610	769	972	382	1,741	2,123
	• Excavation	m^3	1,891,910	69,413	72,596	34,339	142,009	176,348
	• Borrow fill	m^3	458,359	33,918	38,860	16,602	72,778	89,380
	• Sub-grade preparation	m^2	201,950	303	343	162	646	808
2.	Runway, 45m wide	lm	2,500	46,225	46,227	23,113	92,452	115,565
3.	Apron, 125m x 200m	m^2	25,000	14,675	14,665	7,335	29,340	36,675
4.	Taxiway, 23m wide	lm	413	4,796	4,796	2,398	9,592	11,990
5.	Control Tower							
	• Building, 5 storey	m^2	325	1,419	1,726	690	3,145	3,835
	• Equipment	lot	1	1,312	1,248	640	2,560	3,200
6.	NAVAIDS							
	• VOR (relocation)	lot	1	0	344	76	344	420
	• ILS (relocation)	lot	1	0	369	81	369	450
	• PAPI	lot	1	1,630	1,407	759	3,037	3,796
7.	Airfield Visual Aids							
	• Runway edge lights	lot	1	2,649	2,279	1,232	4,928	6,160
	• Approach lights	lot	1	1,634	1,406	760	3,040	3,800
	• Lighted wind cone	ea	2	50	42	24	92	116
8	CFR Facilities							
	• Building	m^2	250	1,092	1,327	531	2,419	2,950
	• Equipment	lot	1	3,280	3,120	1,600	6,400	8,000
9	Airport Buildings							
	• Passenger terminal	m^2	2,400	14,515	17,657	7,061	32,172	39,233
	• Operations	m^2	525	2,292	2,788	1,115	5,080	6,195
	• Cargo terminal	m^2	360	1,853	2,253	901	4,106	5,007
	• Power plant	m^2	60	259	315	126	574	700
10.	Site Improvements							
	• Drainage	lot	1	1,288	1,496	696	2,784	3,480
	• Access road, 7.3m wide	km	13	16,323	18,969	8,823	35,292	44,115
	• Service roads, 6.1m wide	km	1	770	894	416	1,664	2,080
	• Perimeter fence	lm	9730	632	1,412	477	2,043	2,520
	• Landscaping/turfing	lot	1	295	2,061	589	2,356	2,945
11.	Vehicle Parking	m^2	8,200	1,205	1402	648	2,507	3,255
12.	Utilities							
	• Power supply	lot	1	595	930	335	1,525	1,860
	• Water supply	lot	1	474	740	266	1,214	1,480
	• Sewer	lot	1	128	200	72	328	400
	Total Construction Cost			224,752	243,851	112,740	468,603	581,343
	Contingencies, 10%			22,475	24,385	11,274	46,860	58,134
	Engineering & Supervision, 8%			17,980	19,508	9,019	37,489	46,507
	Land Acquisition	ha	167		45,090	5,010	45,090	50,100
	Relocation Cost	ea	190		1,414	353	1,414	1,767
	Total Amount			265,207	334,248	138,396	599,456	737,582

Source: LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro - Iligan Corridor Airport Draft Final Report.

41

crusher operators may need to be brought in from Manila or Cebu. The manpower requirements of the project are shown in Table 1-11.

Required construction materials include portland cement, aggregates, wood, glass, steel and other metals. Water would also be used, as well as diesel fuel, gasoline and electricity. Locally available construction materials include embankment borrow materials, fine and coarse aggregates, lumber, water etc. The supply of portland cement is not anticipated to be a problem as there are three existing cement factories in Iligan City. The required quantity of cement to construct the new airport, including structures and access roads, is estimated at 940,000 bags, while the quantity of required aggregate is estimated at 50,000 cu.m.

1.4.3 Operation and Maintenance

The operation and maintenance of the new airport would be the responsibility of the Air Transportation Office (ATO), an independent government authority or possibly a private contractor.

1.4.3.1 Operation

The new airport at Laguindingan would be provided with lighting for nighttime operation and could provide unconstrained operations, 24 hours a day.

Based on the traffic forecasts for the new airport, the manpower, supplies and materials as well as equipment requirements will foreseeably be met on a phased basis to keep the airport in continuous, efficient and cost-effective operation. For example, according to ICAO standards, the CFR Emergency Unit of the airport would have a Category 6 firefighting capability on the opening date of the airport in 1996, as the critical aircraft is the B737. This capability will be elevated to Category 8 upon the introduction of the A-300 in either the year 2007 (base case traffic forecast) or the year 2002 (high case traffic forecast). It is assumed that majority of the technical personnel of the airports of Cagayan de Oro and Iligan will be absorbed at Laguindingan airport facility after a screening of personnel skills and a determination of operational requirements.

1.4.3.2 Maintenance

Runway maintenance is critical for an airport facility in terms of its ability to operate safely and in terms of pavement life. The FAA method of design reportedly provides a concrete pavement for an airport with a 20-year life free from major maintenance. Throughout the design life of the airport pavements, the expected maintenance would include the resealing of joints or sealing of cracks that may occur in later years of pavement life.

Table 1-11
CONSTRUCTION MANPOWER REQUIREMENTS

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
I. Directs																	
1. Gen. Foreman								1	1	1	1	1	1	1	1	1	1
2. Foreman			1	1	1	1	1	2	2	2	2	2	3	3	3	3	3
3. Leadman	1	2	2	3	3	3	5	5	5	5	5	5	5	5	5	5	5
4. Carpenter	10	10	10	10	15	15	15	20	20	25	25	25	25	25	30	30	30
5. Mason			5	5	5	5	5	5	10	10	10	10	15	15	15	15	25
6. Pipefitter/Plumber		5	5	5	5	5	5	5	5	10	10	10	10	10	10	10	10
7. Weldor															8	8	12
8. Rigger															10	10	10
9. Painter																	
10. Steelman															20	20	20
11. Electrician		3	3	3	3	3	3	3	5	5	5	5	8	8	8	8	12
12. Tinsmith															10	10	10
13. Rebarman								5	5	20	20	20	50	50	50	50	50
14. Laborer	10	20	20	30	30	30	30	50	50	50	50	80	80	80	100	100	100
Sub-Total	21	40	46	57	62	62	64	96	103	128	128	158	197	197	270	270	288
II. Indirects																	
1. Project Manager			1	1	1	1	1	1	1	1	1	1	1	1	[illegible]	1	1
2. Field Supervisor	1	1	1	1	1	2	2	3	3	3	3	3	3	3	3	3	3
3. Engineering			1	1	1	2	2	6	6	6	6	6	6	6	6	6	6
4. Support Personnel																	
4a Timekeeping	1	1	1	1	1	1	2	2	2	4	4	4	4	4	4	4	4
4b Accounting			1	1	1	1	1	2	2	2	2	4	4	4	4	4	4
4c Warehousing					1	1	1	2	2	4	4	4	4	4	4	4	4
5. Equipment Management	1	6	10	12	15	15	17	19	25	25	30	30	30	30	30	30	30
Sub-Total	3	8	15	17	21	23	26	35	41	45	50	52	52	52	52	52	52
TOTAL/MO.	24	48	61	74	83	85	90	131	144	173	178	210	249	249	322	322	340

MONTH	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
I. Directs																	
1. Gen. Foreman	1	1	1	1	1	1	1	1	1	1	1	1					
2. Foreman	3	3	3	3	3	3	3	2	2	2	2	1	1				
3. Leadman	5	5	5	5	5	5	5	5	5	3	3	3	1	1			
4. Carpenter	25	25	25	20	20	20	20	20	20	20	10	10	5	5			
5. Mason	25	25	25	15	15	15	10	10	10	5	5	5					
6. Pipefitter/Plumber	10	10	10	10	10	10	10	2	2	2	2	2					
7. Weldor	12	12	12	8	8												
8. Rigger	10	10	10	5	5	5											
9. Painter				5	5	5	10	10	10	10	8	8	8	8	8		
10. Steelman	20	20	20	20	10	10											
11. Electrician	12	12	12	12	12	3	3	3	3	2	2	2	2	2	2	2	
12. Tinsmith	10	10	10	10	10	10	10										
13. Rebarman	50	50	20	20	20	10	10	5	5	5	5	5					
14. Laborer	100	100	100	100	100	100	100	50	50	50	30	30	10	10	10	10	10
Sub-Total	283	283	253	234	224	197	182	108	108	100	68	67	27	26	20	12	10
II. Indirects																	
1. Project Manager	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
2. Field Supervisor	3	3	3	3	3	3	3	3	2	2	2	1	1	1			
3. Engineering	6	6	6	6	6	6	6	6	4	4	4	4	2	2	1	1	
4. Support Personnel																	
4a Timekeeping	4	4	4	4	4	4	4	4	4	2	2	2	1	1	1	1	
4b Accounting	4	4	4	4	4	4	4	4	4	2	2	2	2	1	1	1	
4c Warehousing	4	4	4	4	4	4	4	4	4	2	2	1	1	1	1	1	1
5. Equipment Management	30	30	25	25	25	15	15	10	10	10	10	5	5	4	3	3	3
Sub-Total	52	52	47	47	47	37	37	32	29	23	23	16	13	11	7	7	4
TOTAL/MO.	335	335	300	281	271	234	219	140	137	123	91	83	40	37	27	19	14

Source: LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Corridor Airport, Draft Final Report.

42

The terminal building and other facilities would also require routine maintenance. The coastal location of the facilities would tend to accelerate the normal weathering process.

As proposed, the perimeter fence is a combination of chainlink and barbed-wire fence which would be subjected to rusting and vegetative over growth. This would, in turn, require regular preventative maintenance, clearing and replacement of damaged portions.

Non-built areas (areas with neither pavement nor buildings) inside the airport would be subjected to natural erosion due to increased runoff from built-up areas. This can be controlled by maintaining the designed drainage system and providing protective vegetative ground cover.

The Double Bituminous Surface Treatment (DBST) provided to shoulders of the runway, aircraft parking apron, and taxiways would also need routine maintenance due to scaling of asphalt materials. An overlay may be periodically required to strengthen the shoulder pavement.

1.4.4 Abandonment Plans

Temporary structures established during construction, such as the construction camp, equipment sheds, construction headquarters, temporary housing for workers and temporary fences would be removed when no longer needed. The batching and aggregate crusher plant would likewise be removed after construction. Presumably, all reusable materials would be gathered by the construction contractor and reused.

The existing airports at Lumbia and Balo-i would continue to operate until the new facility is opened. The earliest projected opening year of the proposed Laguindingan airport facility is 1996. At that time, the two existing airports within the Corridor could be abandoned. Future use of these sites would be determined by the government, as the land is under public ownership. Whether existing structures would be removed or reused would be based on the sites final disposition. In this report, it is assumed that the existing Lumbia site could be developed into an agro-industrial or housing area while the existing Balo-i site could be converted into an agricultural area.

CHAPTER 2
EXISTING ENVIRONMENT

CHAPTER 2

EXISTING ENVIRONMENT

2.1 INTRODUCTION

2.1.1 Methodology

Environmental studies were conducted to provide a baseline description of the proposed project siting and to provide background information sufficient to substantiate the prediction of future environmental conditions with or without project implementation. Based on a generic Environmental Assessment (EA)/Environmental Impact Statement (EIS) format adapted from the on-going Mindanao Development Project, research studies were identified to address the implications of the principal Feasibility Study recommendation - the construction of an international standard airport facility within the municipality of Laguindingan in the short-term future.

The methodology for collecting data on the various components of the existing environment varied with the parameters studies. Initially, literature surveys, site reconnaissances and contacts with appropriate government agencies and non-government organizations were undertaken. Where it was determined that insufficient secondary data was available to adequately describe the existing environment, additional primary data was collected through field studies. In addition, some "ground truthing" of the secondary data was undertaken.

A description of specific methodologies undertaken for each of the environmental parameters studied is included in Appendix A. The Contact List is provided in Appendix B and a List of References is found in Appendix C.

2.1.2 Length of Project

In order to make predictions about the environmental conditions in the future, with or without the project, a definition of "project length" was determined. Feasibility Studies concurrently being undertaken define the air transport needs to the year 2011 and traffic projections were forecasted to that date based on the TOR.

If constructed and properly maintained, the service life of the new airport will extend beyond this timeframe. It is difficult, if not unrealistic, to attempt to make predictions regarding environmental conditions over 20 years, particularly in a rapidly developing area like the Cagayan de Oro - Iligan Corridor. Consequently, predictions will be based on five year projections as recommended in the Environmental Management Bureau (EMB) annotated outline for the Environmental Impact Statement (EIS) Model.

2.1.3 Study Area

The study area for the description of the existing environment and subsequent predictions of impacts was defined by the environmental parameters being described and their perceived potential to be affected by or to affect the proposed project. The definition of the study areas incorporated public recommendations presented during the preliminary scoping sessions as well as modifications based on field observations. The areas studied included:

- the project site and access roads;
- the project vicinity, the directly affected barangays and municipality of Laguindingan;
- the Cagayan de Oro - Iligan Corridor.

The areas studied for each environmental parameter and methodology applied is included in Appendix A.

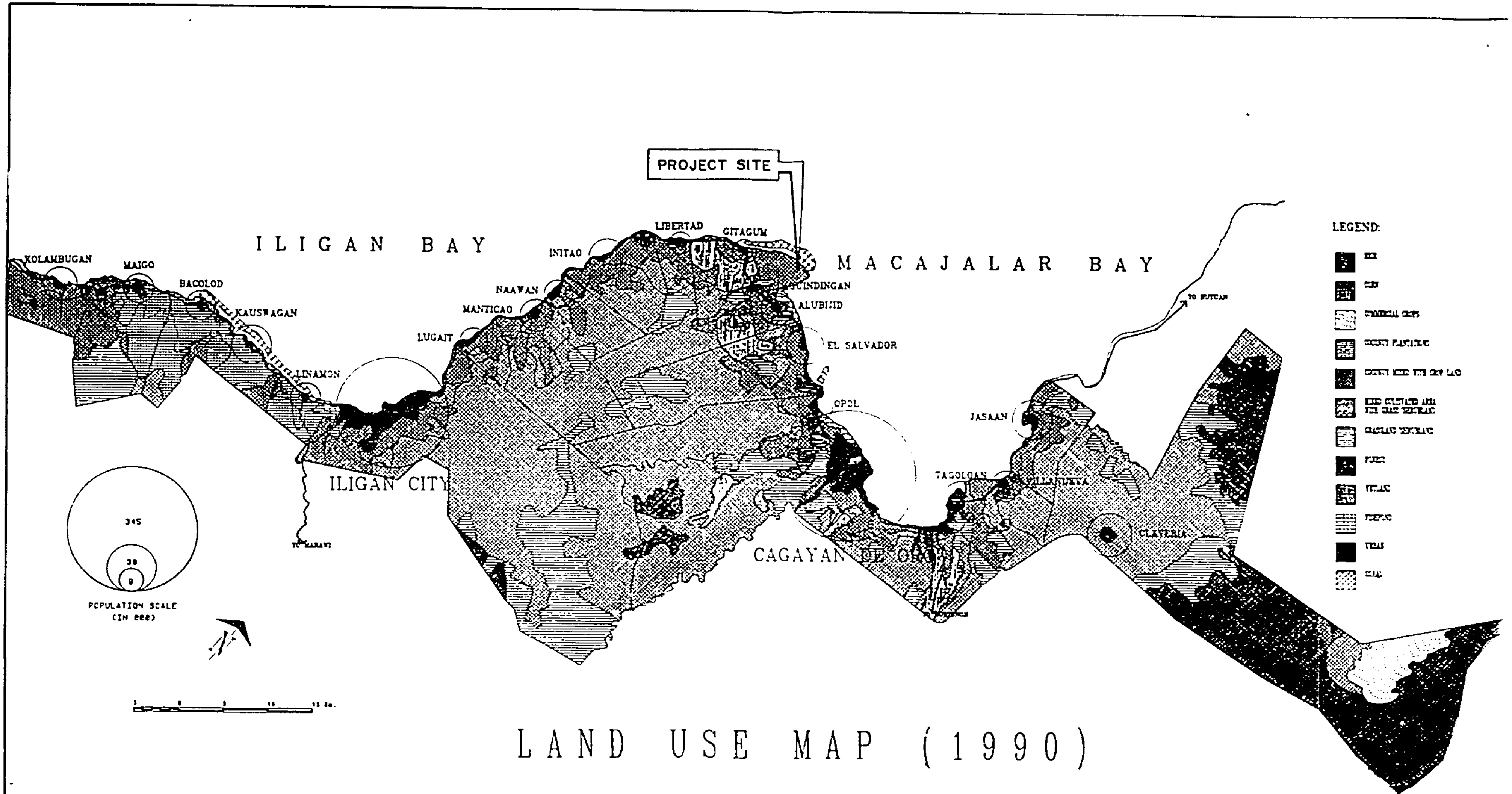
2.2 LAND USE AND PLANNING

2.2.1 The Corridor - An Overview

The Cagayan de Oro - Iligan Corridor lies within two provinces, Lanao del Norte and Misamis Oriental as well as two regions, Region X and Region XII (Figure 2-1). Located along the coastal area facing the Iligan and Macajalar Bays, the Corridor extends from the inland municipality of Claveria in Misamis Oriental in the east, to the municipality of Kolambugan, Lanao del Norte in the west. The Corridor includes two chartered cities, Cagayan de Oro and Iligan, as well as 19 municipalities, five of which are part of Lanao del Norte.

The two cities, Cagayan de Oro and Iligan, are major industrial, processing and trade centers. These cities and adjacent industrial centers are complemented by a rich agricultural and natural resource base in surrounding areas. Cagayan de Oro and Iligan, as two regionally proximate growth centers, have an existing economic base of heavy industries as well as available area for expansion of manufacturing and processing. This spatial layout creates the potential for intra-regional linkages and complementary growth which are expected to extend to the surrounding areas.

The distribution of present land use, by province, city and region, is provided in Table 2-1, and is graphically presented in Figure 2-1. Development within the Corridor tends to parallel the coastline, along the alignment of National Highway 1, with the highest concentration of urban and industrial use near the metropolitan core areas of Cagayan de Oro and Iligan. With an



SOURCE LBII,1991 FEASIBILITY STUDY AND INDUSTRIAL MASTER PLANNING
CAGAYAN DE ORO - ILIGAN CORRIDOR

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO. 492-0462-C-00-0099-00	ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT	FIGURE 2-1
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT • GLOBETROTTERS ENG'G. CORP. SERVICES INC.	LAND USE MAP (1990)	

increasing predominance of agriculture, pasture and forestry use in the upland areas, the relative intensity of land use tends to decrease inland.

Table 2-1
DISTRIBUTION OF PRESENT LAND USE/VEGETATION BY CITY, PROVINCE AND REGION (ha)

LAND USE/VEGETATION	CAGAYAN DE ORO		MISAMIS ORIENTAL		REGION X		LANAO DEL NORTE		REGION XII	
Agricultural Areas	15,843	(37.02%)	124,016	(43.08%)	829,018	(28.02%)	68,629	(22.2%)	695,511	(29.9%)
Grass/Shrub Areas	16,347	(38.27%)	105,195	(36.55%)	788,365	(26.65%)	120,644	(39.02%)	878,276	(37.71%)
Forest Areas	8,251	(19.28%)	56,666	(19.69%)	1,220,104	(41.24%)	85,549	(27.67%)	574,675	(24.67%)
Wetland Areas	227	(0.50%)	600	(0.21%)	76,220	(2.58%)	7,781	(2.52%)	113,993	(4.89%)
Miscellaneous Land Type[1]	2,095	(4.90%)	1,361	(0.50%)	44,992	(1.52%)	26,601	(8.6%)	64,853	(2.78%)
Built-up areas	(1,751)	(0.50%)	(1,361)	(0.50%)	(11,127)	(0.38%)	na	na	na	na
TOTAL	42,790	100%	287,838	100%	2,958,699	100%	309,204	100%	2,327,308	100%

[1] Miscellaneous land type includes built-up/urban areas, waterbodies, riverwashes and quarries, beaches and ridges.
Source: LBII, 1991. Preliminary Feasibility Study and Industrial Master Planning, Cagayan de Oro-Iligan Corridor Project.

The sectoral distribution of gross service area product (GSAP) is provided in Table 2-2. Based on these figures, agriculture accounts for nearly 39 percent of the 1987 GSAP, followed by trade (32%) and manufacturing (13%).

Table 2-2
STRUCTURE OF GROSS SERVICE AREA PRODUCT
(Million Pesos in 1987 Prices)

PROVINCE	AGRI-CULTURE	MANU-FACTURING	MINING, UTILITIES CONTS.	TRADE	PUBLIC ADMIN.	TOTAL	DIST. (%)
Misamis Oriental	2,035.6	1,679.1	828.4	5,041.7	1,552.3	11,137.1	35.3
Bukidnon	6,484.8	459.9	705.4	2,212.3	318.2	10,180.6	32.2
Lanao del Norte	1,143.2	1,644.6	712.1	1,530.0	481.0	5,510.9	17.4
Lanao del Sur	2,640.8	308.5	196.4	1,449.4	171.4	4,766.5	15.1
Dist. (%)	38.9	13.0	7.7	32.4	8.0	100.0	
Total	9,663.6	3,783.6	2,245.9	8,784.0	2,351.5	26,828.6	100.0

Source: LBII, 1989. National Road Improvement Project.
Note: Statistics not available for Camiguin Province.

If manufacturing, mining.quarrying, utilities and construction are combined, the overall share of the industrial sector is 20.7 percent. Available statistics for Region X of growth in the three primary economic sectors (agriculture, industry, services) is included in Table 2-3, based on the gross regional domestic product (GRDP).

Table 2-3
GROSS REGIONAL DOMESTIC PRODUCT (GRDP)
REGION X

	1983		1987		1988		GRDP GROWTH RATES (%)		
	VALUE	PERCENT	VALUE	PERCENT	VALUE	PERCENT	1983-85	1985-87	1987-88
GRDP	4505	-	5248	-	5570	-	- 1.49	9.56	6.14
Agriculture	1736	39	2245	43	2253	41	2.0	11.49	0.36
Industry	1058	23	1311	25	1523	27	- 6.60	19.18	16.17
Services	1711	38	1692	32	1794	32	- 2.01	1.48	6.03

Source: NEDA, 1989. 1990 - 2020 Regional Physical Framework Plan (RPFP), Region X.
Note: Values in millions of pesos, at 1972 prices.

2.2.2 The Proposed Project Site, Laguindingan

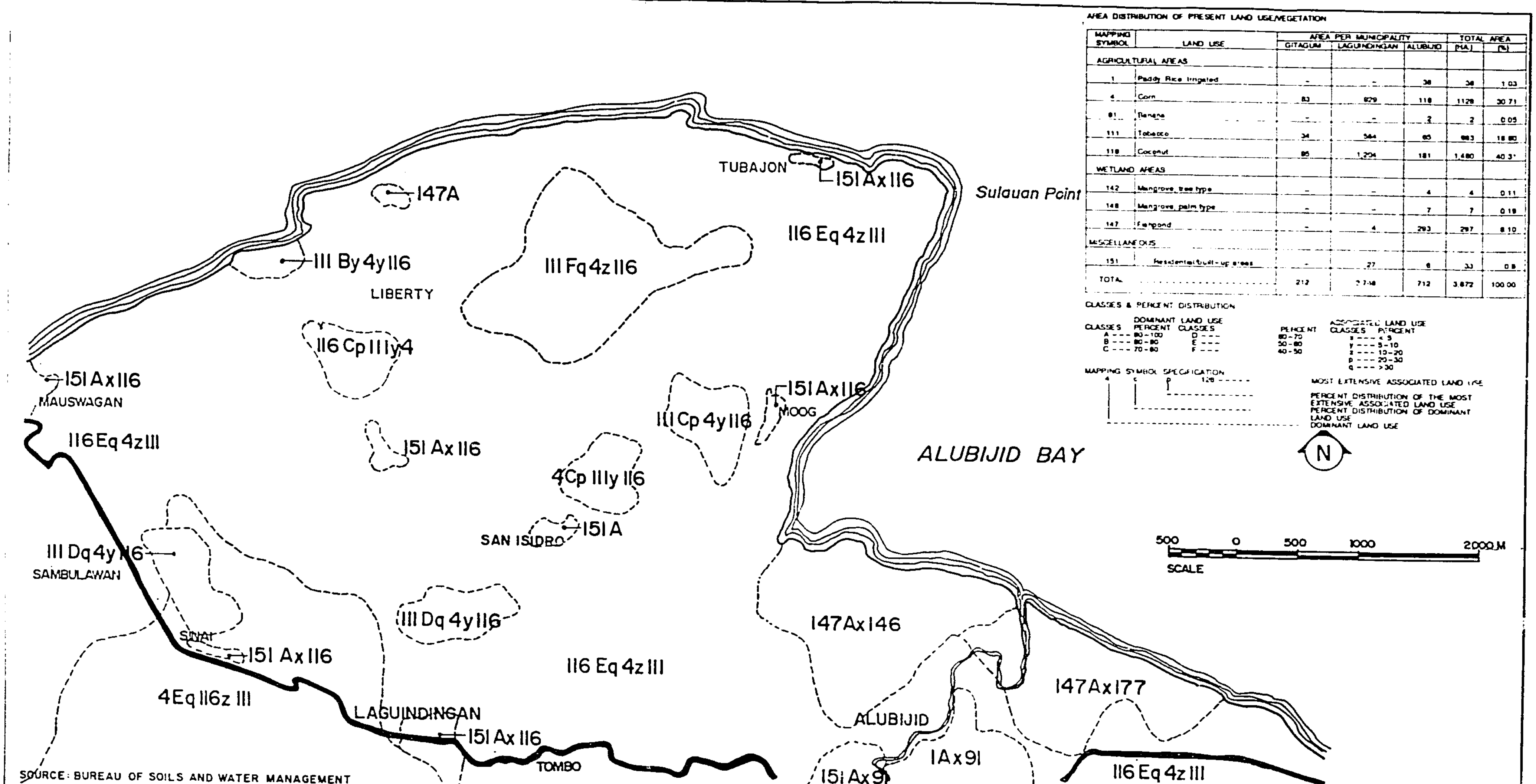
Laguindingan, the municipality in which the proposed airport site is located, is considered a satellite community of Cagayan de Oro. Incorporated in 1963, Laguindingan is ranked (1988) as a fifth class municipality, with annual municipal revenues in the range of one million pesos. To date, the municipality is described as agricultural with over 90 percent of the total land dedicated to agriculture (Table 2-4) and current industries consisting of only two small corn mills servicing local agricultural production requirements. The proposed project site is zoned for agricultural use per Municipal Ordinance No. 198, Series of 1989. Field surveys support that current land use of the identified site is entirely agricultural.

Based on the Land Use Map (Figure 2-2), about 90.7 percent (3,330.5 ha) of the studied vicinity of the proposed airport site is devoted to the cultivation of various agricultural crops while the identified wetland areas (209 ha) are generally developed as fishponds. The dominant agricultural crop in the area is coconut (1,480 ha) which is generally intercropped with corn (1,128 ha). Recently, the farmers in the area switched to the cultivation of tobacco (683 ha) as their most important summer cash crop. Another important agricultural crop in the study area is irrigated rice (38 ha), near the town of Alubijid.

Table 2-4
GENERAL LAND USE, MUNICIPALITY OF LAGUINDINGAN

LAND USE CLASSIFICATION	EXISTING LAND USE (1989)		PROPOSED LAND USE (1990-2000)	
	AREA (HA)	% TOTAL	AREA (HA)	% TOTAL
Built-Up, Urban	266.04	7.80	337.89	9.96
Forest Land	5.90	0.18	5.90	0.18
Grass Land, Pasture	48.50	1.40	48.50	1.43
Agricultural	3,073.08	90.55	3,001.23	88.43

Source: Municipality of Laguindingan, Town Plan, 1990 - 2000.
Note: Total Reported Land Area of Laguindingan - 3,393.52 ha.



AREA DISTRIBUTION OF PRESENT LAND USE/VEGETATION

MAPPING SYMBOL	LAND USE	AREA PER MUNICIPALITY			TOTAL AREA	
		GITAGUM	LAGUINDINGAN	ALUBIJID	(HA.)	(%)
AGRICULTURAL AREAS						
1	Paddy Rice Irrigated	-	-	38	38	1.03
4	Corn	83	929	118	1128	30.71
91	Banana	-	-	2	2	0.05
111	Tobacco	34	584	65	683	18.60
116	Coconut	95	1,204	181	1,480	40.31
WETLAND AREAS						
142	Mangrove, tree type	-	-	4	4	0.11
146	Mangrove, palm type	-	-	7	7	0.19
147	Fishpond	-	4	293	297	8.10
MISCELLANEOUS						
151	Residential/built-up areas	-	27	6	33	0.9
TOTAL		212	2,748	712	3,672	100.00

CLASSES & PERCENT DISTRIBUTION

DOMINANT LAND USE

CLASSES	PERCENT	CLASSES	PERCENT
A	90 - 100	D	60 - 70
B	80 - 90	E	50 - 60
C	70 - 80	F	40 - 50

ASSOCIATED LAND USE

CLASSES	PERCENT
x	< 5
y	5 - 10
z	10 - 20
p	20 - 30
q	> 30

MAPPING SYMBOL SPECIFICATION

4 C p 128

128 — MOST EXTENSIVE ASSOCIATED LAND USE

p — PERCENT DISTRIBUTION OF THE MOST EXTENSIVE ASSOCIATED LAND USE

C — PERCENT DISTRIBUTION OF DOMINANT LAND USE

4 — DOMINANT LAND USE

PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT
• GLOBETROTTERS ENG'G. CORP. SERVICES INC.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

PRESENT LAND USE AND VEGETATION MAP

FIGURE 2-2

Recently (July 5, 1991), the municipality passed three resolutions (Nos. 40-42, Series of 1991, Appendix D-1) for a proposed zoning conversion of a 604 ha property owned by Diamond Cement and Industrial Corp. (DCIC, Ayala Corp.) from agricultural to industrial use. This zoning conversion application is pending, as is the processing of land distribution of the DCIC property under agrarian reform statures, both of which are described in subsequent sections.

2.3 SOCIO-ECONOMIC CONDITIONS

The proposed airport site (Figure 2-3)includes portions of three barangays within the municipality of Laguindingan, namely, barangays Moog, Liberty, and Tubajon. Before focusing on the socio-economic conditions in these three communities, this section briefly describes the wider setting of the defined Cagayan de Oro-Iligan Corridor as well as the municipality of Laguindingan. Sources of information include published statistics and projections incorporated in the Feasibility Study and Industrial Master Planning Project for the Cagayan de Oro - Iligan Corridor (LBII, 1991), in addition to statistics and projections derived from the feasibility study for this airport project.

2.3.1 Cagayan de Oro-Iligan Corridor

2.3.1.1 Population Characteristics

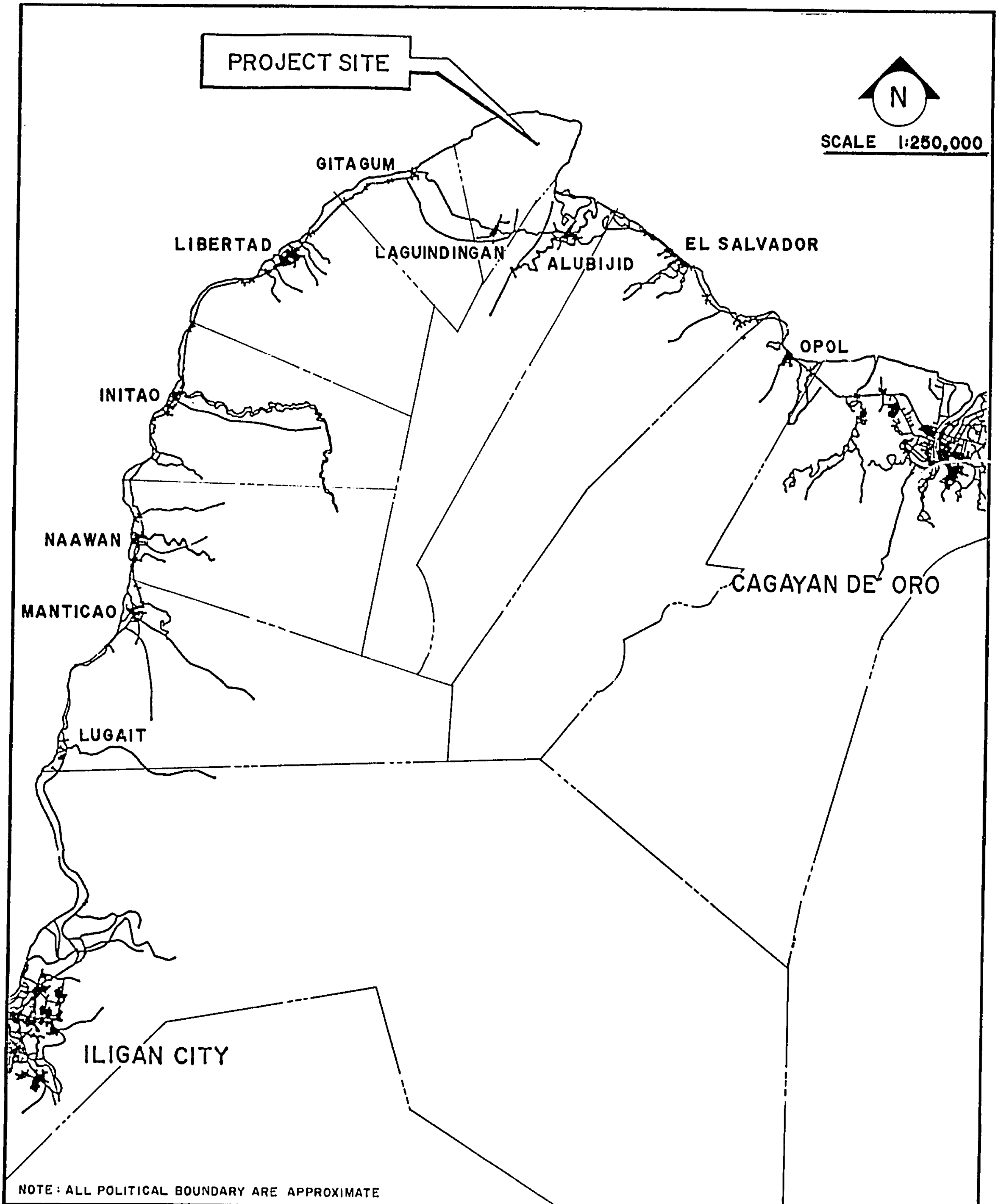
The population trends in the Corridor area are:

- The estimated population of the cities and municipalities located in the provinces of Misamis Oriental and Lanao del Norte is 931,259 as of 1990, while the total population of these two provinces is 1,479,143. Population has been rapidly growing during the recent years, averaging 3.2 percent annual growth over the last decade (Table 2-5). The total population of the Corridor is approximately three million.

- Among the fastest growing areas in the Corridor are Cagayan de Oro (4.8 percent growth) and the adjacent municipalities of Tagoloan (5.3 percent) and Opol (2.6 percent) in Misamis Oriental, and Iligan (3.4 percent) and municipality of Kauswagan (2.2 percent) in Lanao del Norte (Table 2-6).

- Cagayan de Oro is the most heavily populated area (823 persons/sq. km.). Misamis Oriental and Lanao del Norte all have densities of more than 200 persons/sq km. The corridor is more densely populated than most areas in Mindanao.

52



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

LOCATION MAP

FIGURE 2-3

53

Table 2-5
POPULATION IN THE SERVICE AREA

PROVINCE	1980	% DIST.	1990	% DIST.	COMPOUND ANNUAL GROWTH %	1990 POPULATION DENSITY ($/km^2$)	NUMBER OF HOUSEHOLDS
Misamis Oriental	694,500	30.8	865,051	29.9	2.2	316	160,056
Bukidnon	635,283	28.2	843,959	28.2	2.9	102	151,252
Camiguin	57,348	2.5	64,247	2.2	1.1	220	12,062
Lanao del Norte	463,141	20.6	614,092	20.6	2.9	199	112,330
Lanao del Sur	404,076	17.9	59,9637	20.1	4.0	186	98,109
Total	2,254,348	100.0	2,986,986	100.0	2.9	169	533,809

Source: National Census and Statistics Office (1980, 1990)

2.3.1.2 Housing, Public Services and Utilities

The situation in the Corridor area is:

- Cagayan de Oro is constrained by a shortage of available/affordable housing.

  It presently has squatter problems associated with rapid population growth, immigration and dislocation of families from hinterland areas of other provinces. There is a reported deficiency of 98,000 housing units. An additional 6,000 units are projected to be needed up to 1992 under the Metro Cagayan de Oro Special Development Project.

- The surrounding province of Misamis Oriental has a backlog of 14,000 housing units and an additional 2,500 will be needed up to 1992.

  The establishment of more firms and industries in the Corridor, particularly at the PHIVIDEC Industrial Estate (Misamis Oriental) and the Regional Industrial Center (Lanao del Norte), will require the relocation of some families while increasing the attractiveness of immigration for others. Thus, additional housing will need to be available and accessible for these families.

- Public services and utilities are inadequate to meet present and projected needs.

  Health facilities and personnel are concentrated in the urban areas (Table 2-7). No centralized sewerage and wastewater disposal systems exist in the Corridor, and untreated effluents are discharged directly into coastal waters. Power supply is dependent on hydroelectric sources which have been insufficient due to recent

Table 2-6
POPULATION OF CITIES AND MUNICIPALITIES OF MISAMIS ORIENTAL, AND LANAO DEL NORTE, 1980 AND 1990
(Medium Assumption Projection)

CITY/MUNICIPALITY	LAND AREA (SQ.KM.)	POPULATION 1980	POPULATION 1990	DENSITY (PERSONS/ SQ.KM.)	% AVE. ANNUAL GROWTH (1980-1990)
MISAMIS ORIENTAL	3,570.1	694,499	865,051	242.3	2.5
Cagayan de Oro City	412.8	228,784	339,598	822.7	4.8
Alubijid	63.0	15,543	19,531	310.0	2.6
Claveria	894.9	29,276	31,130	34.8	0.6
El Salvador	136.7	20,578	26,721	195.5	3.0
Gitagum	37.5	9,701	10,994	293.2	1.3
Initao	116.5	21,983	23,113	198.4	0.5
Jasaan	87.2	23,517	29,146	334.2	2.4
Laguindingan	39.4	12,137	15,503	393.5	2.8
Libertad	37.5	7,820	8,487	226.3	0.8
Lugait	22.5	10,855	11,973	532.1	1.0
Manticao	112.6	17,406	21,443	190.4	2.3
Naawan	88.5	12,294	13,345	150.8	0.9
Opol	158.0	16,254	20,473	129.6	2.6
Tagoloan	87.2	22,166	33,919	389.9	5.3
Villanueva	48.8	11,972	17,122	350.9	4.3
Sub-Total	2,343.1	460,286	622,498	265.7	3.5
LANAO DEL NORTE	3092.0	463,141	614,092	198.6	3.2
Iligan City	730.5	168,117	226,568	310.5	3.4
Bacolod	104.8	13,517	14,637	139.7	0.8
Kauswagan	53.9	13,938	16,961	314.7	2.2
Kolambugan	223.0	19,409	22,533	101.0	1.6
Linamon	38.8	9,545	13,449	346.6	4.1
Maigo	40.6	12,613	14,613	359.9	0.1
Sub-Total	1,191.6	237,139	308,761	259.1	3.0

Source: National Census and Statistics Office (1980, 1990)

Table 2-7
HOSPITALS, BARANGAY HEALTH STATIONS, AND MEDICAL PERSONNEL IN THE CAGAYAN DE ORO-ILIGAN CORRIDOR

MUNICIPALITY	NO. OF HOSPITALS *	NO. OF HOSPITAL BEDS	NO. OF BARANGAY HEALTH STATION	MANPOWER IN GOVERNMENT HOSPITALS AND RURAL HEALTH UNITS				
				PHYSICIAN	NURSE	MIDWIFE	DENTIST	SANITARY INSPECTOR
Claveria			8	1	2	8	1	
Jasaan	1	20	5	1	1	6		
Villanueva			3	1	1	5		
Tagoloan			3	1	1	4		
Cagayan de Oro	10	790	NA	152	224	100	NA	NA
Opol			5	1	1	5	2	
El Salvador			6	1	1	7	1	
Alubijid			6	1	1	7		
Laguindingan			3	1	1	4	1	1
Gitagum			4	1	1	2		
Libertad			2	1	1	3		
Initao	2	41	5	5	7	5	3	
Naawan			5	1	1	5		
Manticao			5	1	1	6		
Lugait			3	1	1	4	2	
Iligan	9	429	20	12	43	23	3	
Linamon			4	1	2	6	1	1
Kauswagan	1	10	7	2	1	8	1	1
Bacolod			5	1	2	5	1	1
Maigo			7	1	2	6	1	1
Kolambugan	4	130	1	10	20	22	2	1

Sources: Provincial Development Staff, "Misamis Oriental: Provincial Socio-Economic and Planning Profile 1988", Misamis Oriental
DTI-Iligan City

* Note: Private and Public Hospitals

56

drought conditions and widespread watershed degradation. Telecommunications are unreliable and there are very few telephone lines available. There is one major highway (National Highway 1) along the Corridor coastline from Cagayan de Oro to Iligan. Most other roads in the area are incomplete or unpaved.

2.3.1.3 Education

Trends in education indicate that:

- Northern Mindanao's literacy rate has been increasing from 83.8 percent in 1980 to 88.3 percent in 1990.

- In Misamis Oriental, the participation rate is 90 percent at the elementary level, and 68 percent at the secondary level.

- The majority of the college and university graduates in Northern Mindanao acquired business and education degrees. Tertiary graduates in commerce and business management accounted for 32 to 42 percent of the total, while nearly one fourth of the tertiary graduates had teacher training and education degrees. A smaller portion of the graduates were in arts and sciences, engineering and technology, indicating a limited pool of locally trained, technically skilled personnel available for projected industrial growth.

2.3.1.4 Employment and Livelihood

The employment composition in the region reflects the Corridor's present economic structure. Almost 52 percent of the employed labor force in Northern Mindanao are in agriculture, fishery and forestry sectors, while 16 percent each are engaged in wholesale and retail trade and community, social, and personal services. The average annual family income was ₱ 27,083 in Misamis Oriental and ₱ 37,431 in Lanao del Sur as of 1988.

The employment and income situation in the Corridor is:

- The underemployment rate in the Corridor is high. In Misamis Oriental, the rate of underemployment was 36.5 percent in the last quarter of 1989.

- In Misamis Oriental, the average family income reported for 1988 was ₱ 2,200 per month. Based on these reports, about 66.5 percent of families in the province were below the poverty threshold, which is estimated at ₱ 2,436.

  In Lanao del Norte, 72 percent of the total 84,211 households in the province were earning below ₱ 4,000 per month in 1983 with the average family earning ₱ 2,449.

- A total of 184 barangays in 14 municipalities within the metropolitan area of Cagayan de Oro are presently considered poor or economically depressed. Thirty-two of the 40 barangays comprising the city of Cagayan de Oro are similarly classified.

As of 1980, 173,043 people in the provinces of Misamis Oriental and Lanao del Norte were reportedly dependent on agriculture, animal husbandry, forestry and fishing for their livelihood.

Dependency on traditional forms of livelihood continues to date:

- Among the reported industry groups in Misamis Oriental, agriculture, fishing and forestry provided work to 101,314 persons, or 51 percent of the total gainfully employed workers, 15 years and over in 1990. The majority (88 percent) of agriculture workers depend on agricultural crop production, rather than salaries, for their income.

- As of 1990, there were 3,899 full-time and 2,058 part- time fishermen (about 4,067 families altogether) in the Misamis Oriental portion of the Corridor. In Lanao del Norte in 1980, 55 percent (71,729) of recorded employment was in agriculture, animal husbandry, forestry and fishery.

2.3.2 Laguindingan

2.3.2.1 Area

Laguindingan is one of 24 municipalities in the province of Misamis Oriental. It has a land area of 3,393.5 ha and is located some 29 kilometers from Cagayan de Oro, the provincial capital. It is bounded by the Mindanao Sea on the north, and the neighboring municipalities of Alubijid and Gitagum on the east and west, respectively (Figure 2-3). It consists of 11 barangays, with Mauswagon, Moog, San Isidro, and the poblacion, or town proper, being the most populated (Table 2-8).

58

Table 2-8
TOTAL POPULATION OF LAGUINDINGAN
BY BARANGAY (1970, 1980, 1990)

	TOTAL POPULATION		
BARANGAYS	1970[1]	1980[2]	1990[3]
Laguindingan	10,292	12,059	15,503
1. Aromahon	506	626	-
2. Gasi	693	707	-
3. San Isiuro	1,396	1,576	-
4. Lapad	799	698	-
5. Liberty	734	955	1,750
6. Mauswagon	1,350	1,733	-
7. Moog	1,402	1,677	2,339
8. Poblacion	1,333	1,572	-
9. Sambuwalan	550	524	-
10. Sinai	969	1,257	-
11. Tubajon	560	734	870

Source:

1) 1970 Census of Population and Housing
2) 1980 Census of Population and Housing
3) Recent field survey

2.3.2.2 Population

As of 1990, Laguindingan's population had increased to 15,503, up from 12,059 in 1980, indicating an annual growth rate of 2.8 percent. The crude birth rate increased, from 19.44 per thousand in 1982, to 29.45 in 1987, as did the crude death rate for the same periods (6.04 and 7.03, respectively). The present population density is 4.32 persons/ha.

Laguindingan's population is relatively young, the median age being 18 years old. Forty-three percent are below 15 years old, 55 percent are in the 15-64 age category, and four percent are 65 years old or over. There are about 87 dependents for every 100 individuals of working age. Males slightly outnumber females (51 percent male, or 96 females for every 100 males). Fifty-one percent of the population class 10 years in age and over are married.

59

2.3.2.3 Housing and Public Services/Utilities

- Housing conditions in Laguindingan are relatively modest, even poor by common standards.

  In 1980, Laguindingan had 2,157 dwelling units for its 2,709 households, indicating that some houses were being shared by two or more households. On the average, each household of about six members lives in and owns (90 percent) a single unit structure (99 percent) measuring less than 30 sqm. (54 percent; 1980 Census of Population and Housing). Among the more common household possessions is the radio, found in 74 percent of the households; only seven percent have a refrigerator and two percent have a television set.

  Twenty-four percent of households have a water- sealed toilet, 44 percent have a closed-pit or antipolo toilet, 26 percent use an open pit, while five percent reported having no household sanitation facilities.

- Public utilities need to be upgraded and made more accessible.

  As of 1988, Laguindingan had only seven Level II (improved wells with hand pump and limited distribution) and one Level III (piped distribution to households) water systems, concentrated in four barangays and in the poblacion, respectively. Fifty percent of the municipal water system pumps and wells were reportedly out of service due to high costs of repairs and limited municipal budgets. In 1980, 72 percent of households obtained their drinking water from a communal water system, 20 percent from a piped deep well, and seven percent from a dug well or spring. Surface water supply within this municipality is limited to only three springs which are considered inadequate to supply even present needs. Existing artesian wells in the vicinity of the proposed project site are included in Table 2-9.

  Sixty-three percent of households use electricity, supplied through the Misamis Oriental Rural Electric Service Cooperative (MORESCO I), for lighting; the rest use kerosene (37 percent). The power supply of MORESCO I, like most of the Mindanao Grid, is dependent on hydroelectric power generation which has been inadequate in recent years due to drought conditions and watershed degradation (deforestation).

  Postal and telegraph services as well as public market facilities are concentrated in the poblacion. Market days are limited to Wednesdays, Thursdays, and Fridays. Each barangay has either a basketball or volleyball court for recreation.

Table 2-9

LIST OF ARTESIAN WELLS IN THE VICINITY OF THE LAGUINDINGAN AIRPORT SITE

LOCATION	NO. OF UNITS	DESCRIPTION	REMARKS
Barangay Moog			
1. Sitio Mabalus	1	Deep Well	Under Repair
2. Sitio Mangga	1	Deep Well	Level I Water System
3. Centro Purok I	1	Deep Well	Level II Water System
4. San Juan	1	Deep Well	Level II Water System
5. Centro	1	Deep Well	Level II Water System
Barangay Tubajon			
1. Purok-2	1	Deep Well	Abandoned
2. Palanhay	1	Deep Well	Salty taste
Barangay San Isidro (Kibaghot)			
1. Centro School Site	1	Deep Well	Unoperational
2. Sitio Dalondonan	1	Deep Well	Under rehabilitation
3. Sitio Legason	1	Deep Well	Operational
4. Sitio Kalanawan	1	Deep Well	Under rehabilitation
5. Sitio Baclayon	2	Deep Well	One abandoned One operational
6. Sitio Danao	1	Deep Well	Operational
Barangay Liberty			
1. Purok I	1	Deep Well	Level II Water System
2. Purok II	1	Deep Well	Operational
Purok II	1	Deep Well	Under repair
3. Purok III	1	Deep Well	Under repair
4. Sitio Anosa	1	Deep Well	Abandoned
5. Purok IV	1	Deep Well	Operational

Source: Municipality of Laguindingan, 1991

Notes: Level I Water System includes enclosed well with hand pump

Level II Water System includes enclosed well, hand pump and limited distribution system.

2.3.2.4 Education, Health, and Social Services

- Educational facilities especially at the elementary level are widely available, services are generally adequate, and the people are mostly literate.

  As of 1987, Laguindingan had 11 public elementary and two public high schools, 74 elementary school teachers, and 72 classrooms. Given its enrollment of 2,382 elementary pupils, the municipality had one teacher for every 32 pupils, and one classroom for every 33 pupils, which is considered adequate compared to the standard 1:40 national average.

  Majority (80 percent) of Laguindingan's population 10 years and over are literate, 63 percent of the school-age population having had some elementary, 22 percent some high school, and five percent some college education; eight percent have had no formal schooling.

- Health infrastructure and personnel need to be expanded; communicable diseases are prevalent in the municipality, owing partly to poor sanitation and nutrition.

  As of 1988, Laguindingan had a Rural Health Center in the poblacion, and a Barangay Health Station in only three barangays, each serving neighboring communities as their so-called catchment area. The municipal government's health personnel includes one doctor, one nurse, four midwives, one sanitary inspector, one dental technician, and one medical technologist.

  In 1987, the five leading causes of sickness (along with their morbidity rate per 10,000 population) were bronchitis (173); diarrhea (132); pulmonary tuberculosis (52); pneumonia (50); and influenza (40). The five major causes of mortality (and rate per 10,000), on the other hand, were bronchopneumonia (19); congestive heart failure (15); hematoma (4); pulmonary tuberculosis (1.6) and hypertension (1.6).

  Of 1,748 pre-school children weighed in 1988, 64 percent were found to be malnourished, including 10.35 percent who were moderately-to-severely malnourished. A higher percentage (19.38 percent) of moderately-to-severely malnourished cases was observed among 1,321 schoolchildren weighed.

- Through the Department of Social Welfare and Development (DSWD), the municipal government provides basic welfare services.

  Among its services are programs in the areas of population and family life orientation, responsible parenthood, physical fitness and sports development, socio-civic and recreational activities, day care centers and centralized neighborhood feeding programs.

2.3.2.5 Income and Livelihood

- The residents of Laguindingan depend primarily on agriculture for their income and livelihood, with about 80 percent of the total land area devoted to crop production, primarily coconut (1,930 ha. or 69 percent), and corn and tobacco (850 ha. or 31 percent).

  Backyard livestock and poultry production is also common in the area, while small-scale fishing is an additional source of income in the coastal barangays of Tubajon, Moog, and Mauswagon.

- Yields and income from agricultural production are limited, and farmers are faced with the lack of credit facilities and the high cost of fertilizer.

2.3.3 Barangays Moog, Liberty, and Tubajon

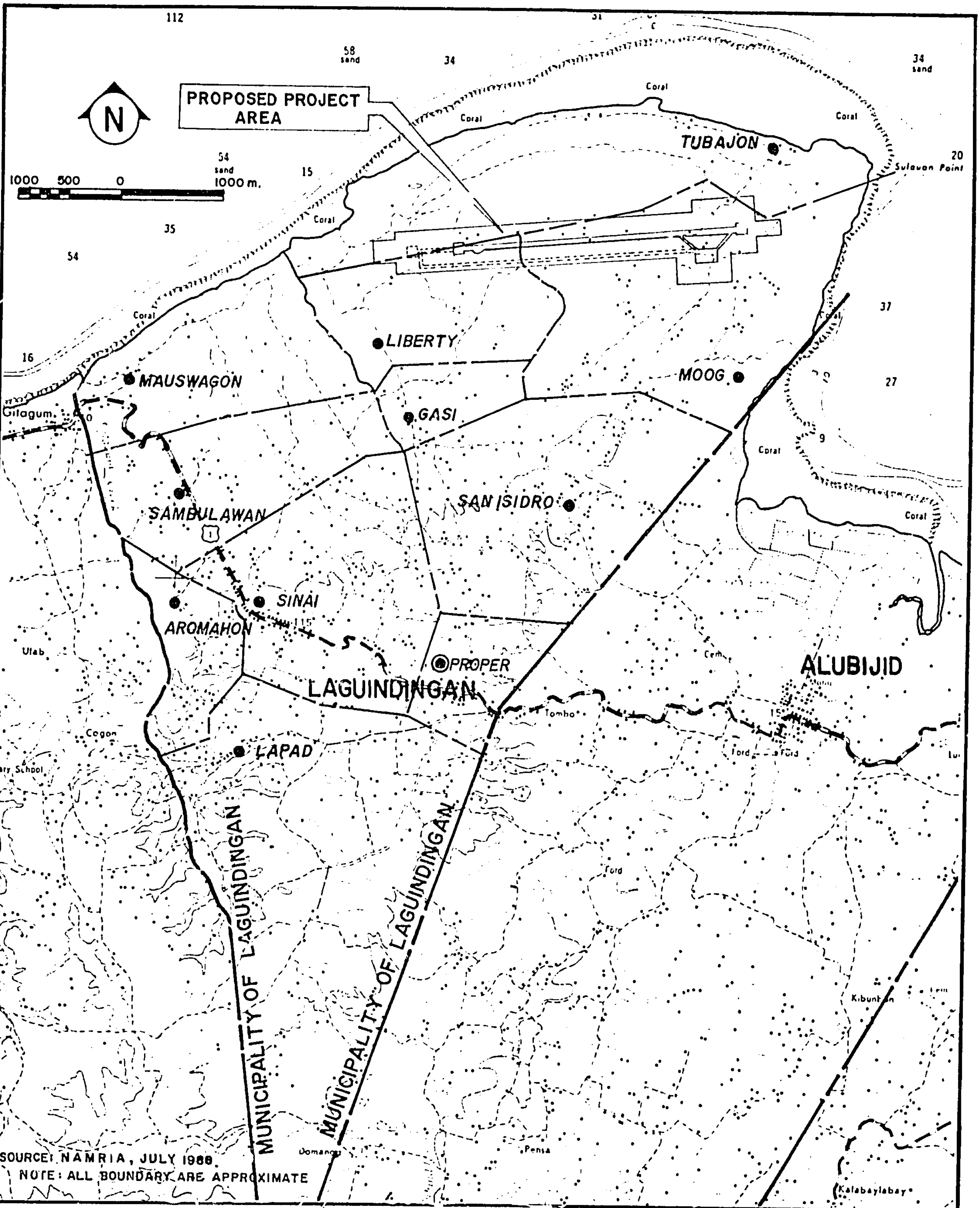
2.3.3.1 Area

The proposed 167 ha project site includes portions of barangays Moog, Liberty, and Tubajon which form a contiguous area on the peninsula near Sulauan Point (Figure 2-4). The area may currently be reached through barangay San Isidro (formerly Kibaghot) by way of a five kilometer long barangay dirt road from Laguindingan's poblacion and the national highway. At San Isidro, the road divides, with one road leading one kilometer eastward to Moog, and the other leading one kilometer westward to Liberty, linking up with an existing provincial road that leads farther northeast toward Tubajon, along the coast north of Moog.

The three barangays comprise a total land area of about 1,534 ha. In 1988, Moog's estimated land area was 567.40 ha, and Liberty about 204.29 ha. However, more recent data (1991) from the barangays' leaders place Moog's area at 533.80 ha. and Liberty at 400 ha (Table 2-10).

A large area, totaling some 604 ha, spread out over barangays Tubajon, Moog, and San Isidro in Laguindingan, and barangay Molocboloc in the adjacent municipality of Alubijid, were reportedly acquired by Diamond Cement and Industrial Corporation (DCIC) of Ayala Land, Inc. in the early 1960's. Based on Figure 2-5, it is estimated that about 40 to 50 percent of the proposed airport site is currently owned by DCIC.

The results of the perception survey conducted for 62 households residing within the proposed airport site is included in Appendix D-2. A summary of these survey findings is provided in the following sections. Available information derived from the Laguindingan Town Plan, 1990 - 2000, is also included.



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

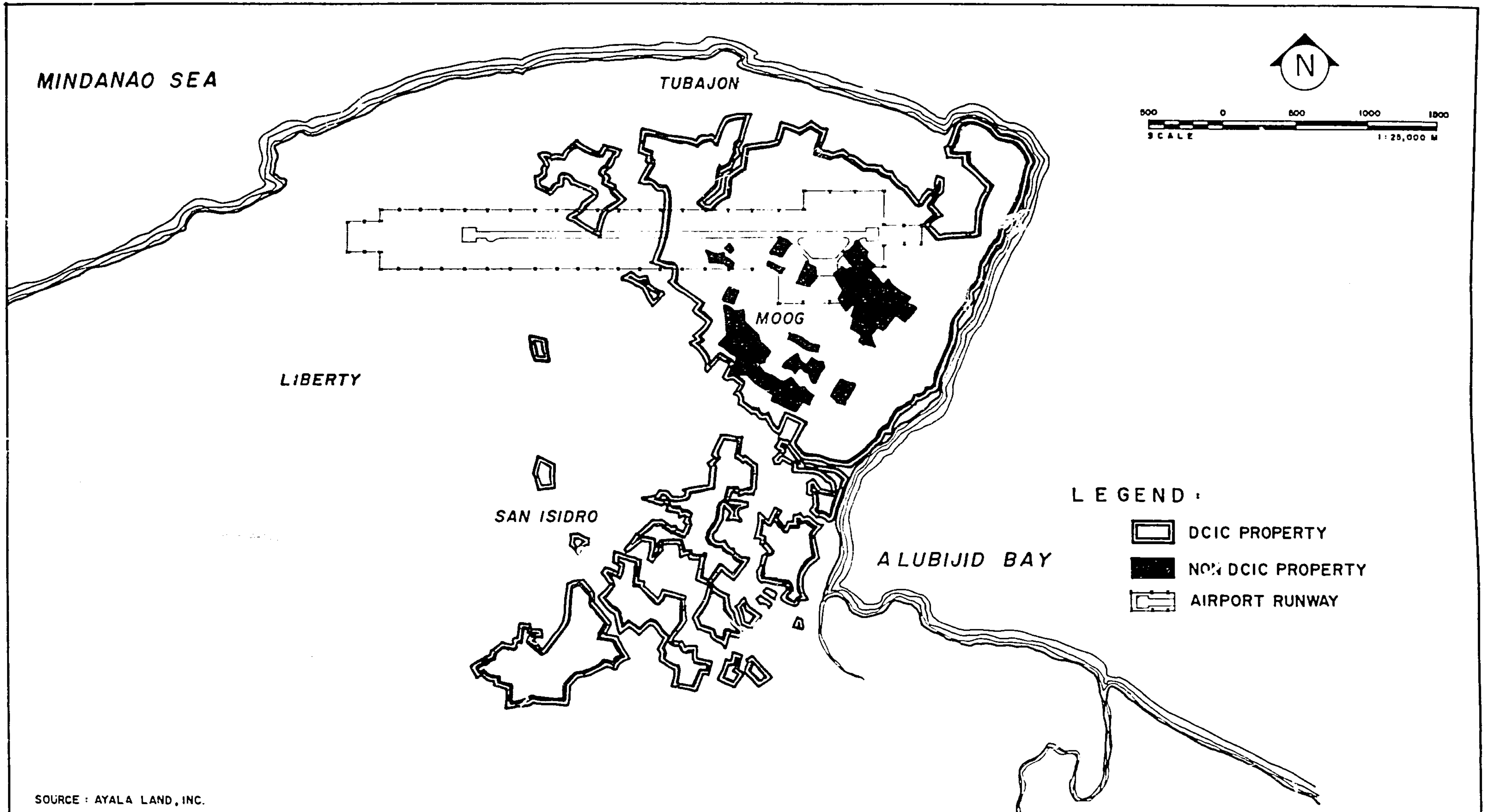
LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

POLITICAL BOUNDARY MAP
MUNICIPALITY OF LAGUINDINGAN

FIGURE 2-4

64



SOURCE : AYALA LAND, INC.

PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

LOUIS BERGER INTERNATIONAL, INC.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT

APPROXIMATE PROPERTY LINES DIAMOND CEMENT AND INDUSTRIAL CORP. (DCIC

FIGURE 2-5

Table 2-10
SELECTED SOCIO-ECONOMIC INDICATORS FOR
LAGUINDINGAN AND AFFECTED BARANGAYS

INDICATORS		MOOG	LIBERTY	TUBAJON	TOTAL	LAGUINDINGAN
1. Land Area	(ha)	533.8	400	600	1533.8	3,393.52
2. Population	(1980)	1,677	955	734	3,366	12,059
	(1990)	3,339	1750	870	5,959	15,925
3. No. of Households	(1991)	488	350	182	1,020	2,864
4. Education	(1991)					
4.1 Grade levels		1-6	1-6	1-4	-	-
4.2 Enrollment		342	320	87		2,669
4.3 Teacher-enrollment ratio		1:33	1:37	1:47	1:35	1:32
4.4 Classroom-enrollment ratio		1:58	1:37	1:47	1:39	1:33
5. Health	(1988)					
Moderately to severly malnourished (% of pop. weighed)		10.26	3.5	14.6	9.77	10.35
6. Housing	(1991)					
% Strong materials		1	50	10	-	-
% Mixed materials		2	25	25	-	-
%Light materials		96	25	65	-	-
7. Electric power distribution (1988)						
Households served (%)		34	46	44	39	50
8. Water	(1988)	3 Level II	n.i.	1 deep well	-	29 Level I; 4 Level II; 1 Level III
9. Household toilet facilities (1991)						
None (%)		59	0	26		5
Water-sealed (%)		16	20	25		24
Other types (%)		25	80	48		70

Sources: 1) 1980 Census of Population and Housing
2) 1990 Census of Population and Housing
3) Laguindingan Town Plan, 1990-2000
4) 1991 key informant interviews, perception survey

Notes: Water Systems
Level I-Enclosed well with hand pump
Level II-Enclosed well, handpump and limited distribution system
Level III-Well pump and household distribution system

2.3.3.2 Population

- The combined population of the three barangays has almost doubled in the last decade, from 3,366 in 1980 to 5,959 in 1990.

  Among the three communities, Moog presently has the largest population (3,339), followed by Liberty (1,750), and by Tubajon (870). The average household size is about six persons.

- Estimates provided by barangay informants indicate that the population aged 18 years and over ranges roughly from 75 percent (Moog) to 81 percent (Tubajon). Thus, in terms of age, Tubajon appears to have a slightly older population. As for the total number of eligible voters, Moog has 1,400, Liberty has 600, and Tubajon has 415.

- In terms of religious affiliation, Roman Catholics account for at least 75 percent of the population in each barangay, followed by Aglipayan Church adherents in Liberty and Iglesia ni Kristo and Seventh Day Adventist Church followers in Tubajon.

2.3.3.3 Housing, Utilities, and Community Infrastructure

- Housing conditions in the area indicate that the people are generally poor.

  In Moog, about 96 percent of the houses are built of light weight materials (Plate 2-1) such as wood, nipa, cogon, and coconut leaves, primarily because the families have been allowed to settle only temporarily on the land owned by the DCIC. In Liberty, 50 percent of the houses are permanent structures built of cement, galvanized iron sheets, and wood, 25 percent are made of mixed materials, while 25 percent are made of light materials. In Tubajon, only 10 percent of the dwelling units are built of strong materials, 25 percent mixed, and 65 percent light materials.

- Access to electricity and water continues to improve.

  As of 1988, only 39 percent of the households had electric power connections (Moog, 34 percent; Liberty, 46 percent; and Tubajon, 44 percent), while only Moog had three Level II water systems (Tubajon had one deep well only - Plate 2-2). Recent surveys indicate that at least 75 percent of households in Moog, 95 percent in Liberty, and 73 percent in Tubajon, already have access to electricity. In addition, Moog's three electric water pumps (two in the central barangay residential area and one in sitio San Juan) are now connected to 15 communal faucets distributed throughout the barangay, which provide scheduled water

Plate 2 - 1 Typical Housing Built of Light Weight Materials in Barangay Moog

Plate 2 - 2 Typical Landscape, Western Portion of Barangay Moog

BEST AVAILABLE DOCUMENT

service from 4:30 pm to 7:00 pm, daily.
In terms of sanitation, almost all households in Liberty are reported to have a toilet, compared to 73 percent in Tubajon, and only 41 percent in Moog.

2.3.3.4 Education, Health and Social Services

- Elementary education is available in all three barangays, although the teacher-enrollment and classroom-enrollment ratios are more favorable in Moog than in Liberty and Tubajon.

  Moog has a complete elementary school (Grades 1 to 6), 12 classrooms, and 16 teachers, and an enrollment of 342 pupils. Liberty has one elementary school, six classrooms, six teachers, and 320 pupils. Slightly disadvantaged is Tubajon which only has a primary school, three classrooms, two teachers, and 87 pupils.
- Limited health services are also accessible in the area, but the level of malnutrition remains high.

  Each of the barangays has a health station, a midwife, and a nutrition scholar. In addition, Moog has 15, Liberty has eight, while Tubajon has seven volunteer health workers. The barangay health stations each have a program funded by CARE and the Department of Social Welfare and Development (DSWD), which provides cooked food of either beans, corn, wheat, or peas to children.

  About ten percent of pre-school children weighed in 1988 were found to be moderately-to-severely malnourished (Moog, 10.26 percent; Liberty, 3.5 percent; and Tubajon, 14.6 percent).

  Available data from Moog show the following ailments (and the number of cases) reported by the barangay health station for 1990: colds and cough (213), dizziness (190), headache (130), toothache (114), abdominal pain (112), and fever (101). The reported causes of death, on the other hand, were bronchitis (3), congestive heart failure (2), pulmonary tuberculosis and bronchopneumonia (1 each). In Tubajon, the following health complaints were reported: cough (90), dizziness (60), headache (48), fever (35), and worms (35). No comparable data for Liberty were available.

2.3.3.5 Income and Livelihood

- The people in the area depend primarily on agriculture and fishing for their income and livelihood.

Results from a survey conducted among a sample of 62 households located in the proposed airport site indicate that all the households depend upon farming as their main source of income (Table 2-11). Sixty nine percent also derive additional incomes from other sources, primarily fishing (72 percent), backyard livestock raising (14 percent), small- scale buy and sell operations such as a sari-sari store (seven percent), and regular office jobs (five percent).

- Almost all surveyed households (95 percent) are engaged in tobacco cultivation. Of this number, more than half (56 percent) plant corn as a second crop. Additional income is also derived from quarterly harvests of coconuts for copra (dried coconut) production.

Tobacco is usually planted around May and harvested after about five months, in September or October. Tobacco leaves are priced differently, depending upon their quality and length. The upper most leaves of the tobacco plant, called "palaki" are generally considered as first class quality. As of August 1991, the market price of one "mano", or 100 leaves, of palaki was ₱ 100. Tobacco is usually sold by the "paldo", or bundle, one bundle consisting of 50 manos. The lower leaves of the tobacco plant or "sapod", on the other hand, are usually sold by the weight, the price as of August 1991 being ₱ 14 per kilo.

Tobacco farmers in the area cultivate about 1.54 hectares on the average, with 81 percent farming two hectares or less. The average yield in 1991 was in the range of five paldo per hectare of mixed quality tobacco, and the average income reported was ₱7,500 per hectare.

Corn which locally matures in about 90 days, is planted as a second crop (timbuklas) from September to December and, if the December rain is good, a third crop (pangulahaw) is planted from December to March. In 1991, farmers in the area were able to plant two crops, and harvested an average yield of about 12 cavans, or 600 kilos, per hectare.

- On the whole, farm households in the area reported an average monthly income of ₱ 2,500, still below the poverty line estimated at ₱ 3,000 a month. Some 39 percent of the households had reported incomes less than ₱ 2,000 per month.

- In addition to their limited income, surveyed farmers are also confronted with the often associated problem of landlessness.

Close to 70 percent of the households in the proposed airport site no longer own their farms, having sold them previously to the Diamond Cement and Industrial Corporation (DCIC). Their occupancy and use rights, therefore, are only temporary and, as per agreement, may be revoked after a three-months notice to vacate. In the meantime, the tenant farmers are allowed to plant and harvest their own crops. Although the tenant farmers harvest the existing coconut production, they do so not as the legal owners but as paid contractual laborers of DCIC.

Table 2-11
SELECTED ECONOMIC DATA DERIVED FROM PERCEPTION SURVEY

ITEM/CATEGORY	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
1. No. of household members contributing to household income		
1	35	56
2 - 3	19	31
4 - 5	3	5
6 - 7	3	5
2. Household's main source of income		
Farming	62	100
3. Household's other sources of income		
Fishing	31	50
Backyard livestock	6	10
Buy-and-sell	4	6
Employment	2	3
4. Estimated household monthly income		
Less than ₱ 1,000	3	5
1,000 - 1,999	21	34
2,000 - 3,999	32	52
4,000 +	6	10
5. Farm area (ha)		
.50 and less	8	13
.51 - 1.00	23	37
1.01 - 1.50	11	18
1.51 - 2.00	10	16
2.01 - 3.00	6	10
3.01 +	4	7
6. Main Crop		
Tobacco only	26	42
Tobacco and corn	33	53
Corn only	1	2
Others	2	3
7. Respondents tenancy status		
Owner-operator	15	24
Share tenant/lessee	5	8
Free lease	42	68
8. Yield per hectare (Tobacco)		
Mean	4.87 paldo	
Standard deviation	3.07	
9. Yield per hectare (Corn)		
Mean	12.29 cavans	
Standard deviation	10.35	
10. Income per hectare from tobacco		
Mean	₱7,490.28	
Standard deviation	5,037.69	

71

Based on a report of the Municipal Agrarian Reform Office (MARO) of the Department of Agrarian Reform (DAR, Appendix D-3), the previous landowners of the proposed project site and adjoining areas may have sold their properties to DCIC in anticipation of assured employment if and when a cement plant was constructed.

2.4 PHYSICAL ENVIRONMENT

2.4.1 Climate

The climate of the Philippines results from the interaction of various climatic controls, such as geography and topography, the relative position of semi-permanent large-scale cyclones and anticyclones, the prevailing wind streams, and the occurrence of transient weather disturbances. The locations and relative intensities of large-scale cyclones and anticyclones are mainly responsible for the prevailing wind streams that dominate the different parts of the country at various times of the year. On a regional scale, the prevailing winds together with topography are the main determinants of the climate.

The regional climate of the proposed airport site at Laguindingan was characterized using secondary data obtained from the records of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) synoptic weather station located in Cagayan de Oro. Since the weather station is only about 25 km (by air) from the project site, observations made at this station were deemed appropriate for the climatic characterization of the project site. The data set covered observations recorded from 1951 to 1985, the period of time for which the most complete weather records were available.

The climate of the Cagayan de Oro - Iligan Corridor is described as Type III of the modified Corona's classification[1] of Philippine climate (Figure 2-6). It has no pronounced maximum rainy period with a short dry season lasting only from one to three months.

2.4.1.1 <u>The Major Wind Streams</u>

The principal air streams which affect the project site are the Northeast Monsoon (amihan), the Southwest Monsoon (habagat) and the North Pacific Trades.

The Northeast Monsoon prevails during the months of November to March but exhibits maximum intensity during January to February. This air stream originates from the intensely

---

[1]The Corona climate classifications originated in 1920 and are based on rainfall patterns. The original distribution of climate types have been periodically revised, or modified, to reflect more recent rainfall patterns.

cold anticyclone that develops over the Asiatic continental land mass during the northern hemispheric winter. The Northeast Monsoon is a relatively cold and less humid air stream that reaches the project site from the northeast direction after undergoing significant temperature modification.

The Southwest Monsoon dominates the area during summer, or from June to September. This warm and extremely humid air stream originates from the northern portion of the great Indian Ocean anticyclone during the southern hemispheric winter. It crosses the equator and moves in the general direction of the thermally-induced low pressure area over continental Asia and reaches the Philippines from a southwesterly direction.

The North Pacific Trades are generally dominant over the entire country during April and early May. These air masses are extremely warm and humid and come to the site from variable directions ranging from northeast to southeast.

The geographic location of the Corridor shields it from the direct effects of both the Northeast and Southwest Monsoons.

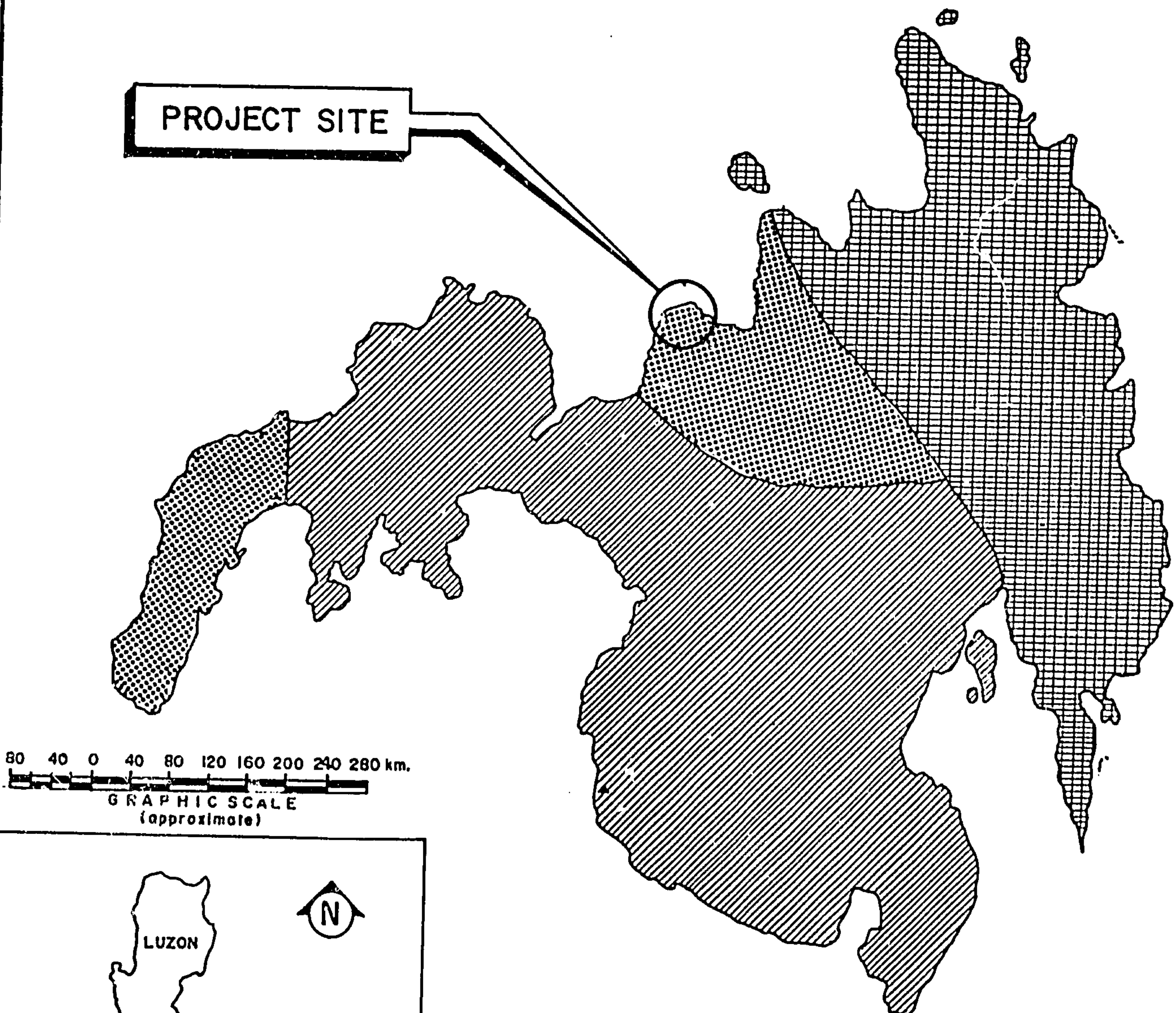
2.4.1.2 Prevailing Winds

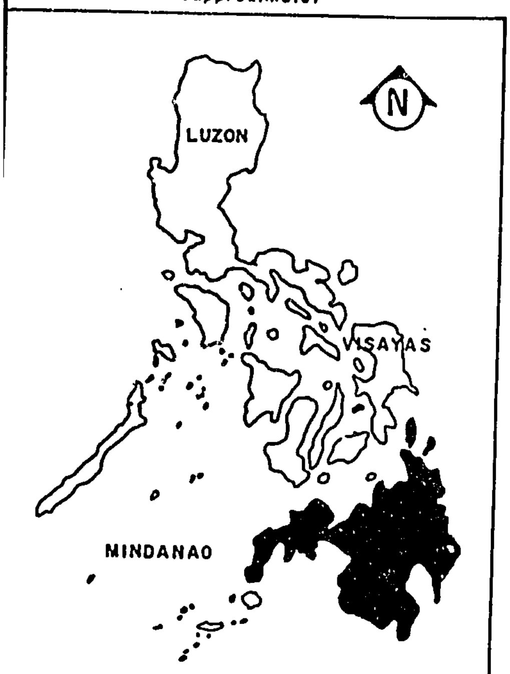
The prevailing winds recorded in Cagayan de Oro from 1951 to 1985 are presented in the form of average monthly wind rose diagrams shown in Figures 2-7 to 2-13. The average annual wind rose diagram (Figure 2-7) indicates persistently light wind conditions in the area with typical wind speeds the range of 1.0 to 3.4 m/sec[2]. These figures also illustrate the prevalent northerly and southerly winds which are presumably due to the localized land and sea breezes. More than 50% of the observations recorded calm winds with speeds less than 1.0 m/sec. Comparative wind observations from the Iligan area (National Steel Corporation, EIS, 1991) report similarly light winds with more than 40% of the wind observations (1986 - 1989) recorded as calm.

2.4.1.3 Rainfall

Rainfall in the project area is brought about by various phenomena such as the intertropical convergence zone, local convective systems (such as thunderstorms) and to a limited extent, tropical cyclones. The monthly average rainfall of Cagayan de Oro is shown in Table 2-12 together with other relevant climatic parameters. Although the climate of the area has no pronounced maximum rainy period, the months of July and September exhibit the highest rainfall with monthly rainfall averages of 214.0 mm and 216.7 mm, respectively. The area has a short, relatively dry period from February to April with monthly mean rainfalls less than 100 mm. The average annual total precipitation is 1,618.0 mm, which is less than the annual regional average for Region X of 2,300 mm.

[2]For comparison with units commonly used for aviation, 0.502 m/sec = 1 knot.





MODIFIED CORONA'S CLASSIFICATION

TYPE II - No dry season with a very pronounced maximum rain period in winter

TYPE III - No very pronounced maximum rain period, with a short dry season lasting only from one to three months

TYPE IV - Rainfall is more or less evenly distributed throughout the year.

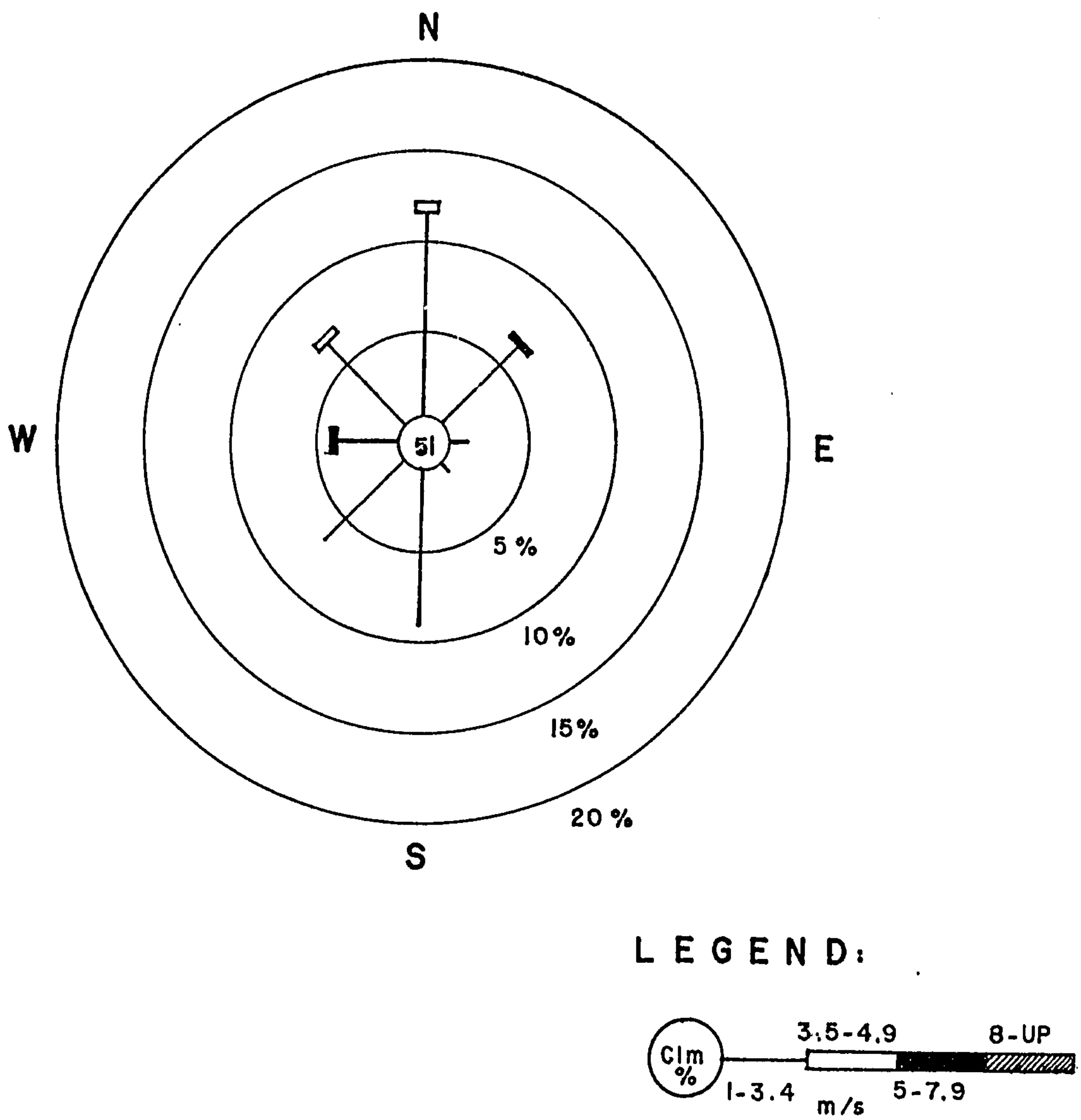
PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

LOCAL CLIMATE ACCORDING TO CORONA'S CLASSIFICATION

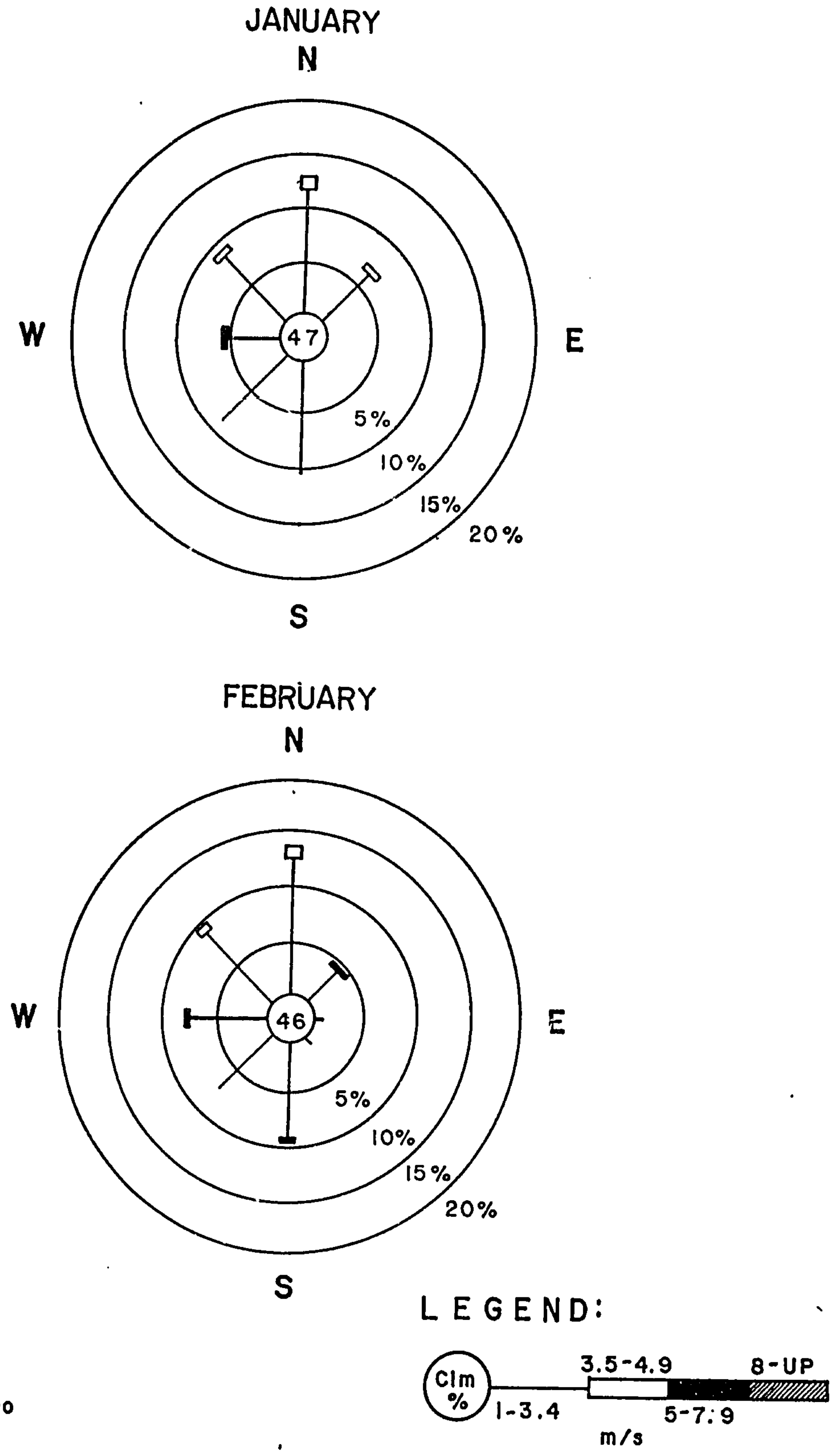
FIGURE 2-6



SOURCE — PAGASA CAGAYAN DE ORO
1951 - 1985

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0089-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 2-7
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT • GLOBETROTTERS ENG'G. CORP. SERVICES INC.	WIND ROSE FOR CAGAYAN de ORO ANNUAL AVERAGE	

75



SOURCE - PAGASA CAGAYAN DE ORO
1951 - 1966

PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

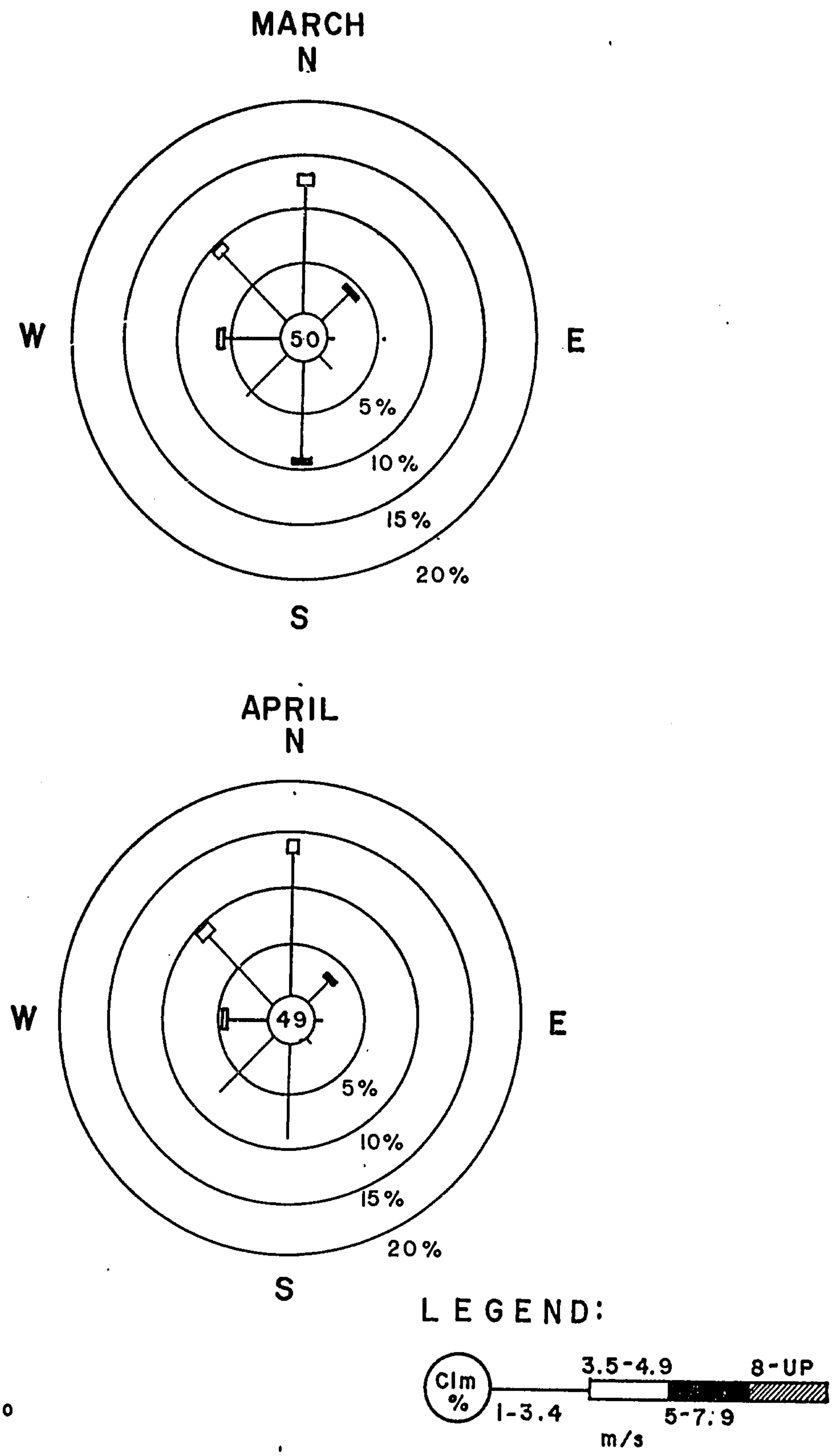
LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

WIND ROSE FOR CAGAYAN de ORO
JANUARY/FEBRUARY

FIGURE 2-8

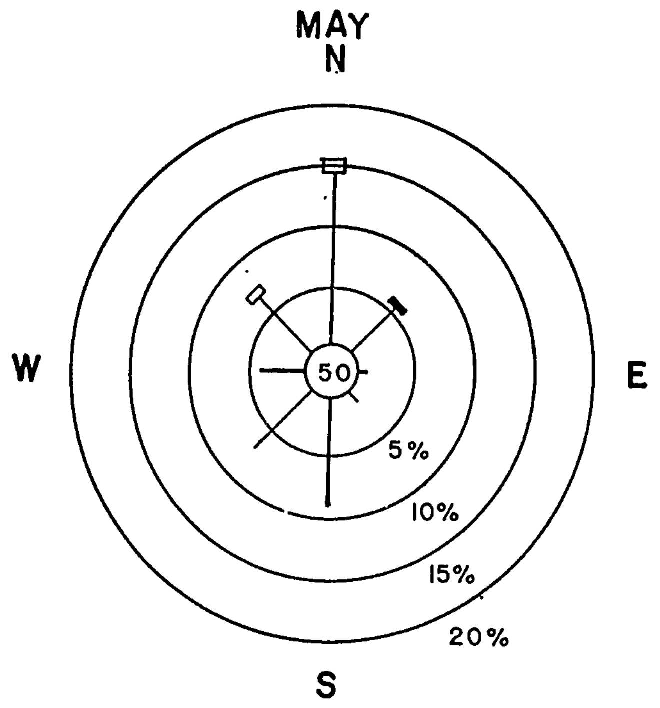
76

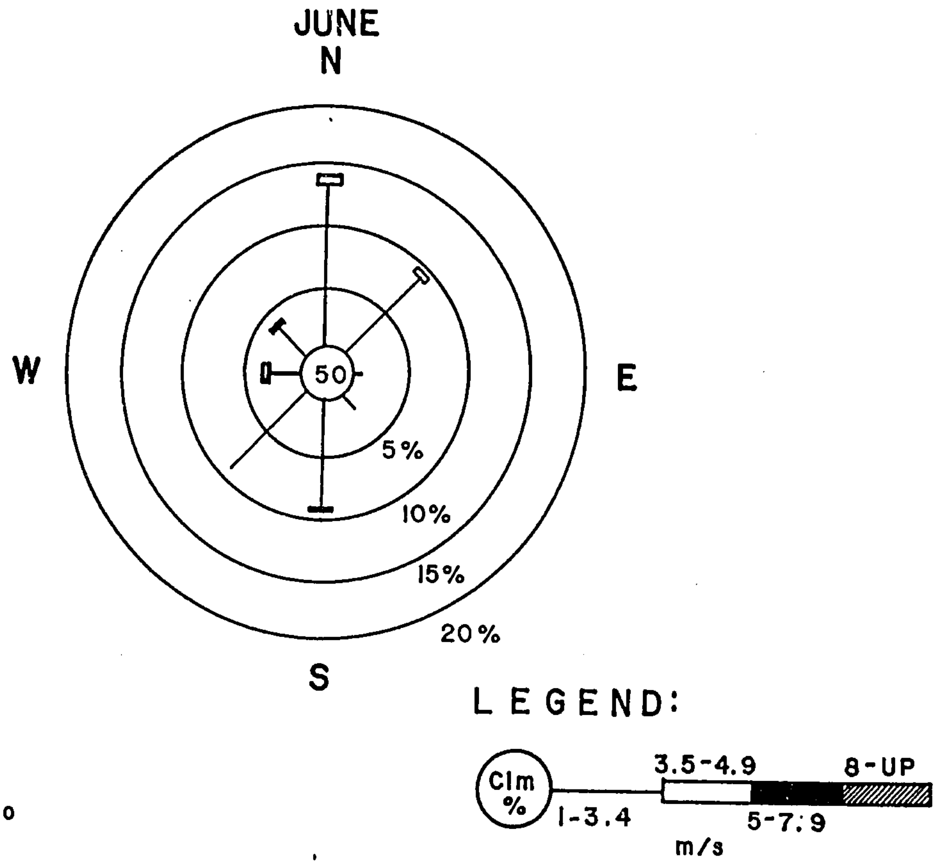


SOURCE - PAGASA CAGAYAN DE ORO
1951 - 1965

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 2-9
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	WIND ROSE FOR CAGAYAN de ORO MARCH / APRIL	

77

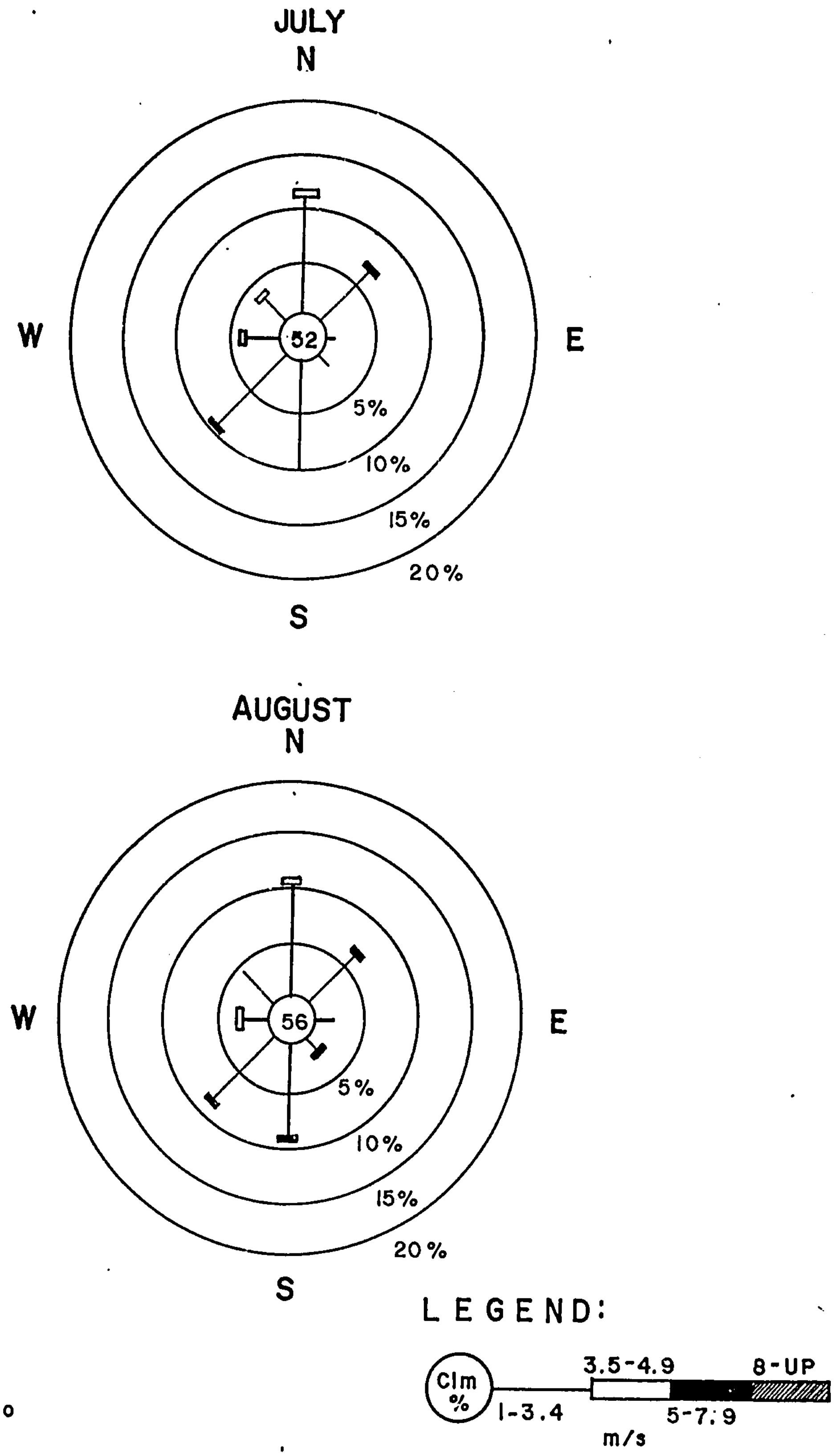




SOURCE - PAGASA CAGAYAN DE ORO
1951 - 1965

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-C099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 2-10
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	WIND ROSE FOR CAGAYAN de ORO MAY / JUNE	

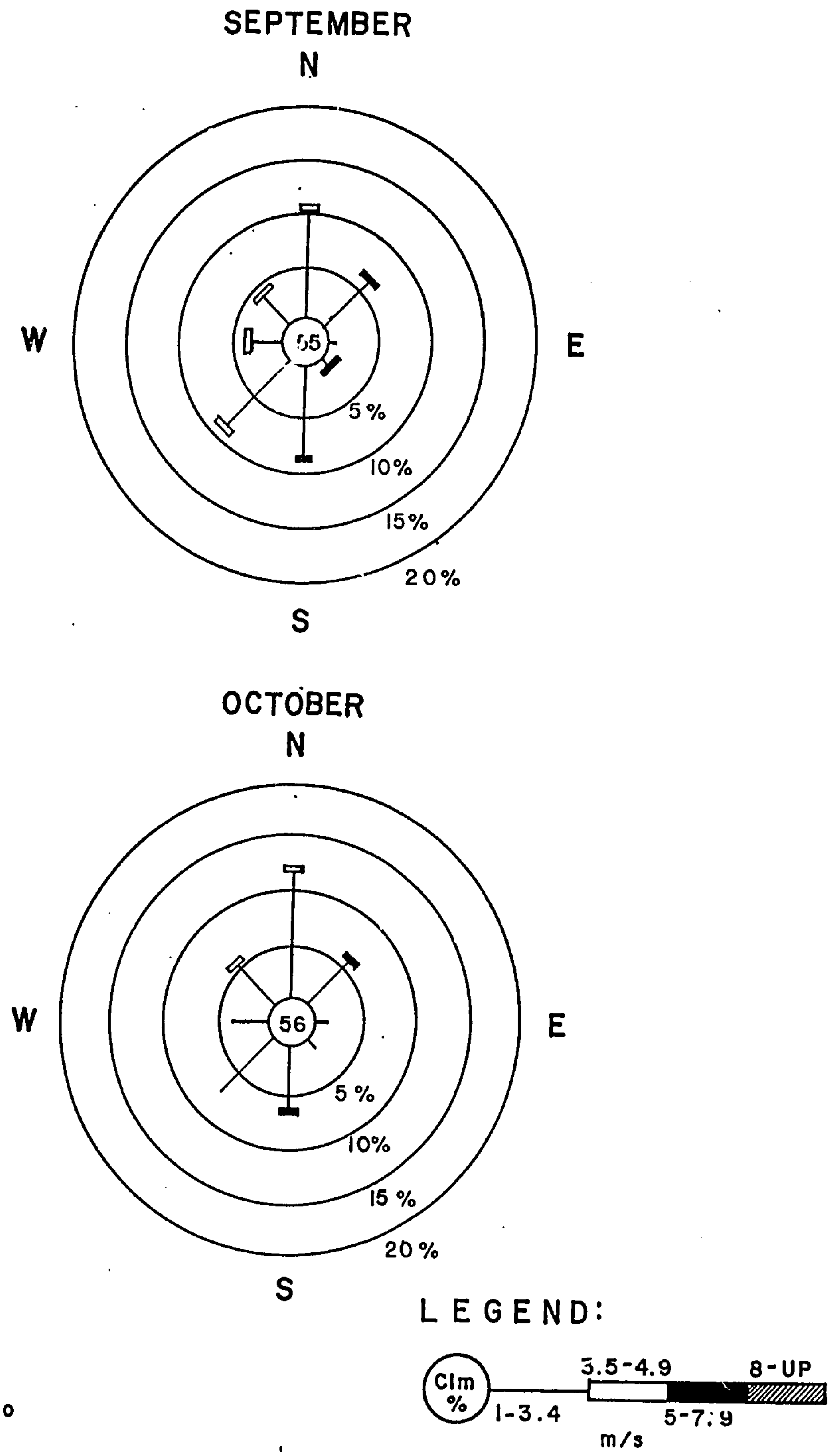
78



SOURCE - PAGASA CAGAYAN DE ORO
1951 - 1985

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492 - 0452 - C - 00 - 0099 - 00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 2-11
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	WIND ROSE FOR CAGAYAN de ORO JULY/AUGUST	

79



OURCE - PAGASA CAGAYAN DE ORO
1951 - 1985

ILIPPINE ASSISTANCE PROGRAM SUPPORT
ITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492 - 0452 - C - 00 - 0099 - 00

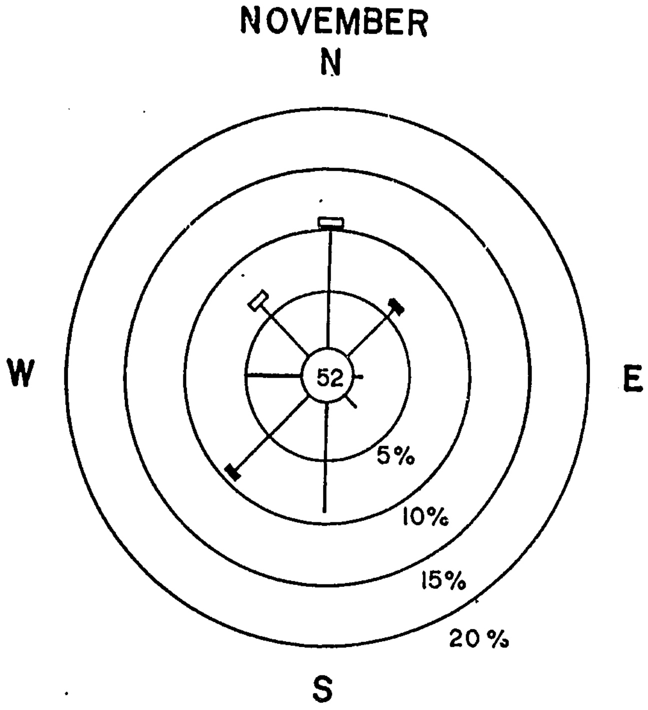
LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT
• GLOBETROTTERS ENG'G. CORP. SERVICES INC.

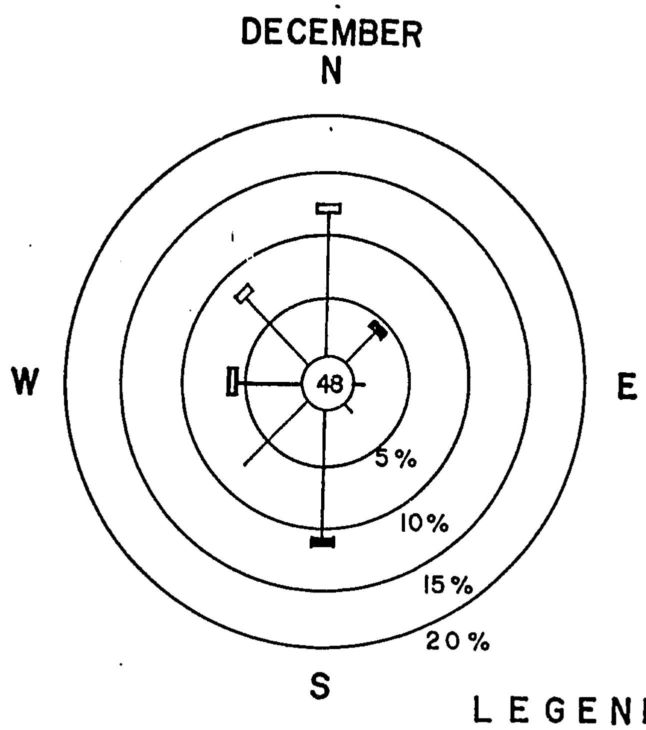
ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

WIND ROSE FOR CAGAYAN de ORO
SEPTEMBER/OCTOBER

FIGURE 2-12

80





LEGEND:

Clm % — 1-3.4 — 3.5-4.9 — 5-7.9 — 8-UP m/s

SOURCE - PAGASA CAGAYAN DE ORO
1951 - 1965

PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492 - 0452 - C - 00 - 0099 - 00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

WIND ROSE FOR CAGAYAN de ORO
NOVEMBER / DECEMBER

FIGURE 2-13

81

Table 2-12
CLIMATOLOGICAL NORMALS FOR CAGAYAN DE ORO CITY
(1951 - 1985)

MONTH	RAINFALL (mm)	RAINY DAYS	TEMPERATURE (deg C)			RH (%)	THUNDER-STORM DAYS
			MAXIMUM	MINIMUM	MEAN		
Jan	107.4	10	30.6	21.5	26.0	82	1
Feb	64.7	8	30.8	21.6	26.2	80	2
Mar	56.7	7	31.7	21.7	26.7	78	2
Apr	38.4	6	32.7	22.7	27.7	76	4
May	102.7	11	33.2	23.4	28.3	77	11
Jun	198.8	18	32.7	23.0	27.8	81	13
Jul	214.0	18	32.5	22.6	27.5	81	11
Aug	199.1	17	32.7	22.6	27.6	80	10
Sep	216.7	17	32.5	22.7	27.6	81	13
Oct	178.2	16	32.3	22.6	27.4	83	10
Nov	125.0	13	32.1	22.4	27.2	81	7
Dec	116.3	12	31.1	22.1	26.6	83	3
ANNUAL	1,618.0	153	32.1	22.4	27.2	80	87

Source: PAGASA
Note: RH-Relative Humidity

2.4.1.4 Extreme Values of Rainfall

The computed extreme values of rainfall intensity and duration together with the expected return periods for Cagayan de Oro are shown in Table 2-13. Some extreme rainfall events recorded in Cagayan de Oro from 1922 - 1985 are shown in Table 2-14.

Table 2-13
COMPUTED EXTREME RAINFALL INTENSITY AND DURATION
(Millimeters/Hour)

RETURN PERIODS	STORM DURATION						
	5 MINS.	10 MINS.	15 MINS.	30 MINS.	60 MINS.	2 HOURS	6 HOURS
2	142.8	124.2	115.2	88.8	57.3	34.6	13.4
5	190.8	159.6	146.4	113.6	74.5	46.8	18
10	222	183	167.2	130.2	85.9	54.8	21
15	240	196.2	178.8	139.4	92.3	59.3	22.8
20	253.2	205.8	186.8	146	96.8	62.5	24
25	262.8	213	193.2	151	110.3	64.8	24.9
50	292.8	234.6	212.8	166.4	110.9	72.4	27.7
100	322.8	256.8	232	181.8	121.5	79.8	30.6

Source: Computations based on PAGASA records for Cagayan de Oro, 1951-1985.

Table 2-14
CLIMATOLOGICAL EXTREMES FOR CAGAYAN DE ORO CITY
(1922 - 1985)

MONTH	TEMPERATURE				GREATEST DAILY RAINFALL		HIGHEST WIND (m/sec)	
	HIGH	YEAR	LOW	YEAR	AMOUNT	YEAR	SPD/DIR	YEAR
Jan	36.2	1958	16.1	1969	203.2	1965	14/NNW	1982
Feb	35.6	1961	16.2	1959	114.3	1968	12/E	1977
Mar	36.0	1979	16.9	1970	95.8	1954	30/NNE	1982
Apr	35.3	1975	16.3	1963	90.8	1985	30/NW	1983
May	36.2	1977	18.3	1970	168.9	1954	37/N	1959
Jun	36.8	1968	19.4	Var	163.1	1954	12/N	1986
Jul	37.6	1968	18.7	1970	132.9	1977	22/WSW	1986
Aug	38.2	1979	19.4	1970	117.1	1967	18/WSW	1986
Sep	37.4	1976	19.8	1969	119.4	1947	26/N	1982
Oct	36.5	1984	19.6	1969	104.1	1922	12/NW	1971
Nov	36.1	1959	17.5	1969	227.3	1958	12/NNW	1985
Dec	35.2	1977	17.2	1960	175.3	1954	12/WSW	1986
Overall	38.2	1979	16.1	1969	227.3	1958	37/n	1959

Source: Climatological Extremes in the Philippines (Up to 1986)
PAGASA

2.4.1.5 Temperature

The mean annual temperature recorded in Cagayan de Oro is 27.2° C. The warmest month is May with a mean temperature of 28.3°C while the coldest is January at 26.0°C. The mean annual maximum temperature is 32.1°C while the mean annual minimum is 22.4°C. The average diurnal temperature range is 9.7°C. The highest temperature ever recorded in the area as of 1986 was 38.2°C, on August 16, 1979, while the lowest was 16.1°C, recorded on January 29, 1969.

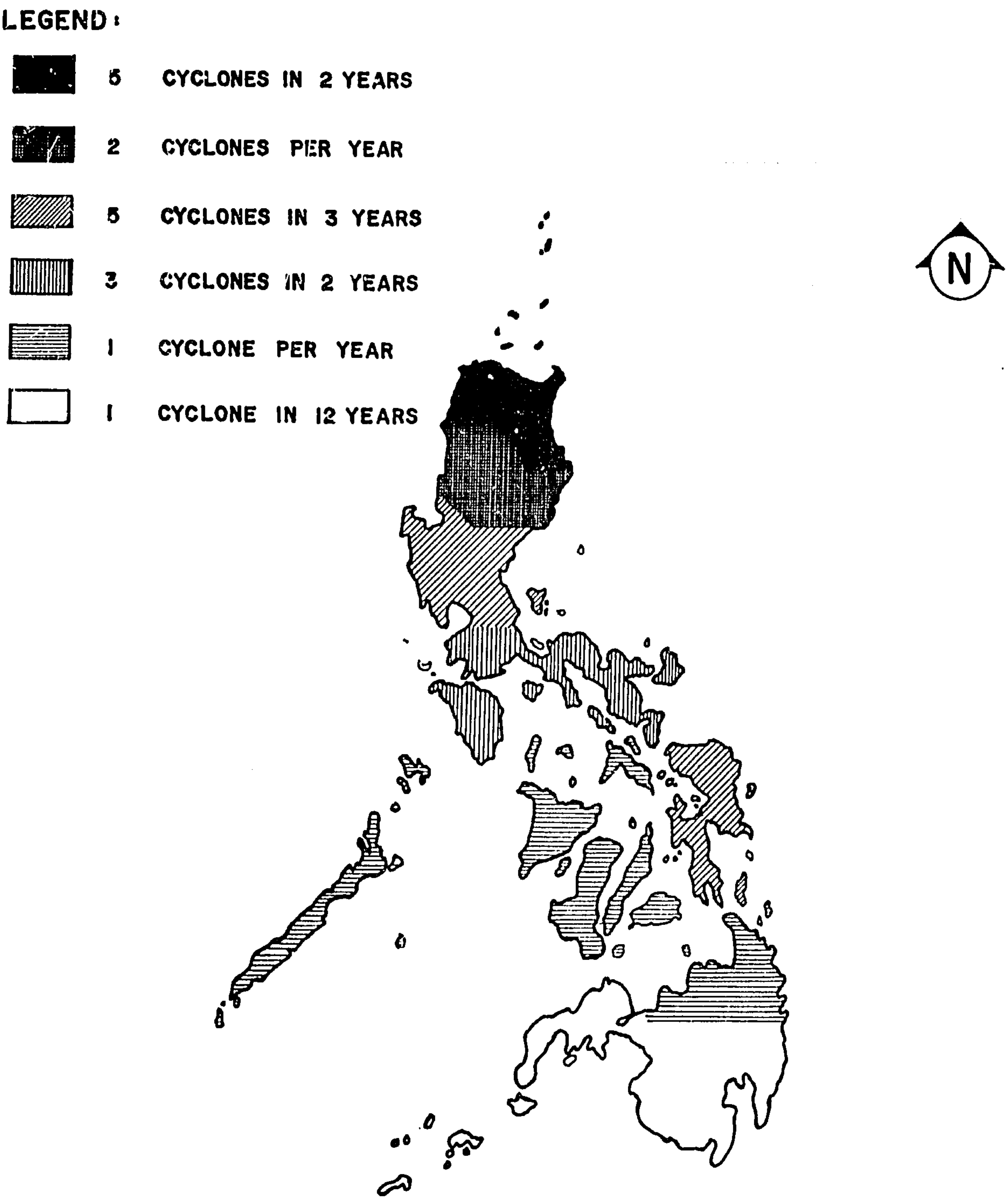
2.4.1.6 Relative Humidity

The mean annual relative humidity is 80%, which is a typical maritime tropical value. The lowest mean monthly value of 76% occurs in April, the driest month, while the highest is 83%, during the months of October and December.

2.4.1.7 Frequency of Thunderstorms

Table 2-12 also shows the average monthly frequency of thunderstorm occurrence for Cagayan de Oro. The period from May to October is characterized by relatively high incidence of

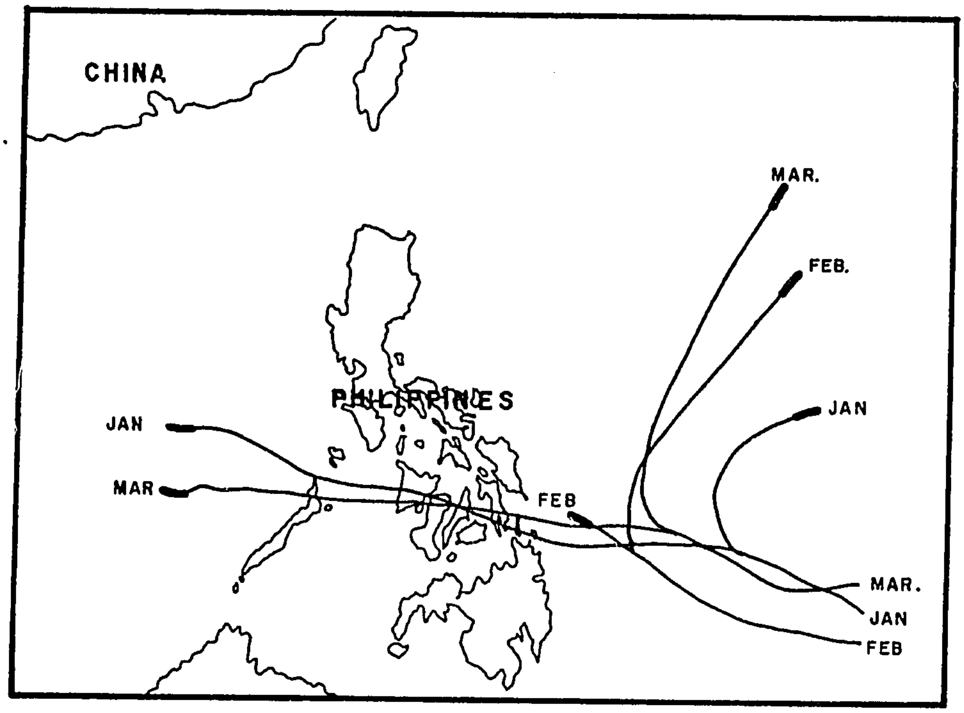
83



SOURCE: PAGASA
KINTANAR, 1984. CLIMATE OF THE PHILIPPINES

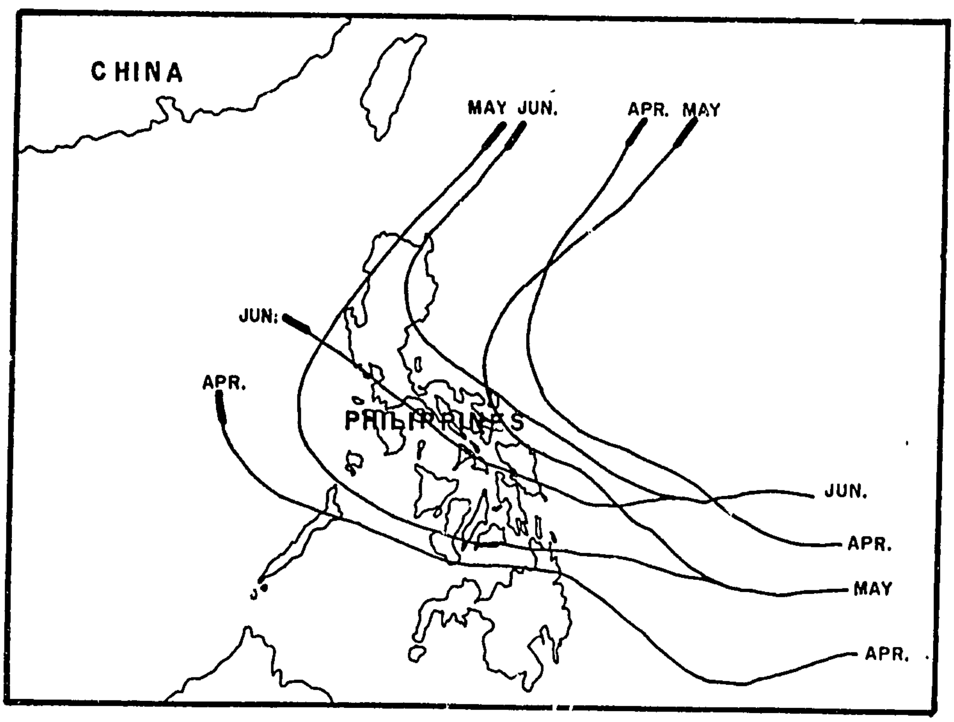
PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 2-14
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	FREQUENCY OF TROPICAL CYCLONE PASSAGE	

84



FIRST QUARTER (JAN, FEB, MAR.)

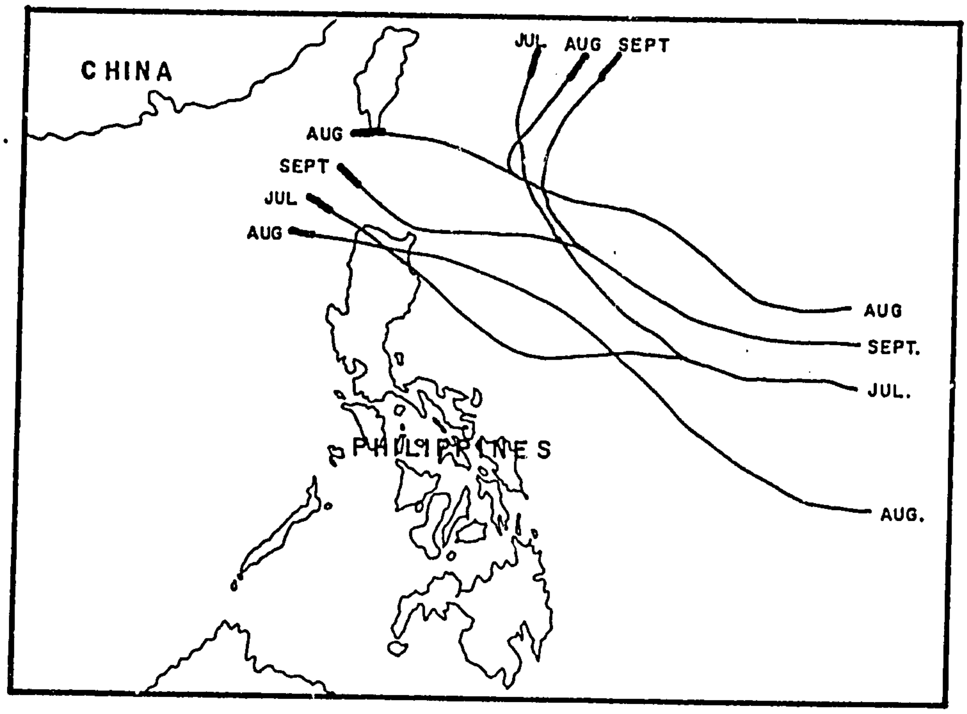
SECOND QUARTER (APR, MAY, JUN.)



SOURCE : PAGASA

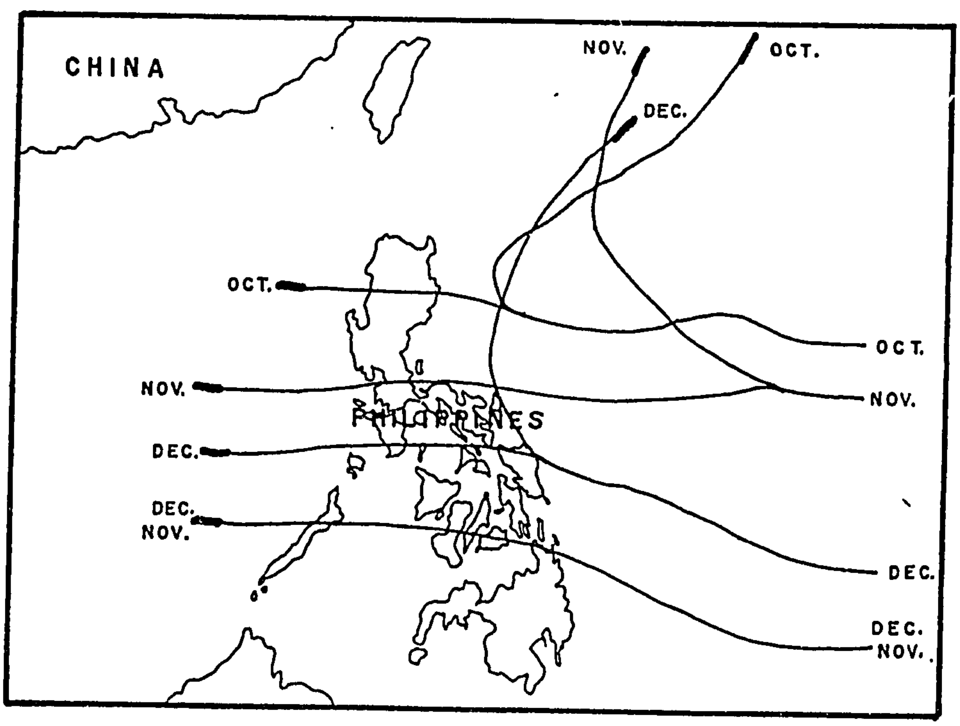
PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO. : 492 - 0452 - C - 00 - C099 - 00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 2-15
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	AVERAGED PATH OF TYPHOONS WITHIN THE PHILIPPINE AREA OF INFLUENCE, 1951-1980	

85



THIRD QUARTER (JUL, AUG, SEPT)

FOURTH QUARTER (OCT, NOV, DEC)



SOURCE: PAGASA

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 2-16
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT • GLOBETROTTERS ENG'G. CORP. SERVICES INC.	AVERAGED PATH OF TYPHOONS WITHIN THE PHILIPPINE AREA OF INFLUENCE, 1951-1980	

86

thunderstorms. This is probably associated with the passage of the intertropical convergence zone over the area.

2.4.1.8 Frequency of Tropical Cyclones

While the Corridor is not considered a typhoon prone area (Figures 2-14 to 2-16), its weather, particularly rainfall, may be affected by typhoons passing close to the northeastern tip of Mindanao during the later part of the tropical cyclone season (November-December). At least one typhoon a year may affect the area's rainfall (Figure 2-14).

2.4.2 Air Quality

The air quality of the Laguindingan airport site is considered typical of a rural agricultural environment. There are no significant sources of industrial air contaminants in proximity to the site. There are no long-term records of air quality measurements conducted within the site. The nearest place where sulfur dioxide (SO_2) and total suspended particulate measurements were conducted is at the regional office of the DENR located near the port area of Cagayan de Oro. Ambient sulfur dioxide concentration was monitored using a sequential SO_2 sampler while the total suspended particulate concentrations were determined with a high volume sampler. Ambient sulfur dioxide and total suspended particulate concentrations at the airport site is expected to be substantially lower than those in Cagayan de Oro which is about 25 km from the site. Nevertheless, the observations in Cagayan de Oro were used to characterize ambient air quality in the vicinity.

Baseline noise sampling was conducted at the proposed site on July 30-31, 1991 using a MSA-brand (Type 1) noise meter.

2.4.2.1 Sulfur Dioxide

A total of 150 hourly observations of SO_2 concentrations were undertaken by the DENR Regional Office in Cagayan de Oro, between October 1990, and April, 1991. The maximum recorded hourly value was 39.68 $\mu g/m^3$ while the minimum recorded was zero. The average hourly concentration during the period was 13.85 $\mu g/m^3$ with a standard deviation of 8.92 $\mu g/m^3$.

The observed values are much lower than the national ambient standard of 850 $\mu g/m^3$ for one hour exposure. The average hourly daytime concentrations for each month during the seven month observation period is shown in Table 2-15.

87

Table 2-15
EXISTING AIR QUALITY DATA FOR
CAGAYAN DE ORO CITY

MONTH/YEAR	AVERAGE HOURLY DAYTIME CONCENTRATION (micrograms/cubic meter)			
	SULFUR DIOXIDE		TOTAL SUSPENDED PARTICLES	
	μg/cu. m.	NO. OF CASES	μg/cu. m.	NO. OF CASES
October 1990	3.36	(8)	191.2	(65)
November 1990	2.83	(7)	169.1	(46)
December 1990	8.32	(33)	180.6	(12)
January 1991	16.42	(36)	167.4	(29)
February 1991	16.21	(24)	165.0	(16)
March 1991	22.42	(29)	114.3	(16)
April 1991	10.56	(13)	118.2	(15
Average hourly concentration	13.85		168.2	
Standard deviation	8.92		7.5	
Maximum recorded value	39.68		447.6	
Minimum recorded value	0.00		16.1	
National ambient standard	850.00		250.0	
No. of times standard is exceeded	0.00		21	
Total numbers of observations		150		199

Source: DENR, Region X

2.4.2.2 Total Suspended Particulates

A total of 199 hourly observations of total suspended particulates were also conducted in Cagayan de Oro by DENR, during the seven month sampling period. The average hourly concentration recorded during the period was 168.2 $\mu g/m^3$ with a standard deviation of 77.5 $\mu g/m^3$. The maximum observed value was 447.6 $\mu g/m^3$ while the minimum was 16.1 $\mu g/m^3$. The national ambient standard for total suspended particulates of 250 $\mu g/m^3$ was exceeded in 21 out of 199 observations. The relatively high concentration of dust in the area is primarily attributed to the proximity of the sampler to the access road leading to the busy port area. The monthly average particulate concentrations are included in Table 2-5.

2.4.2.3 Noise Levels

A baseline sample of exiting noise was made at the proposed site of the airport. Sound pressure levels measured at the site during daytime (around 2 pm) ranged from a low of 38 dB(A) to a high of 48 dB(A). The measured values satisfy the national ambient noise standard for residential areas which is 55 dB(A) during daytime hours.

VV

2.4.3 Water Resources and Water Quality

2.4.3.1 Groundwater Sources

The estimated depth and capacity of groundwater wells in the project site vicinity was obtained from the interviews made with the barangay captain of Moog and local residents in addition to available published studies (Table 2-16). The information compiled from these sources indicates that groundwater in the Laguindingan areas situated in the more highly settled upper limestone terraces are mostly obtained at depths greater than 50 meters.

Table 2-16
GROUNDWATER AVAILABILITY AT SELECTED WELLS IN THE PROJECT SITE VICINITY

LOCATION	DRILLING DEPTH (m)	ACTUAL CAPACITY (lps)	SPECIFIC CAPACITY (lps/m)	STATIC WATER (mbgs)
Moog	82.32	0.44	0.07	59.45
Laguindingan (high school site)	71.63	0.51	0.16	22.80
Upper Laguindingan	59.45	0.95	0.07	28.04
Tubajon	42.99	NA	NA	2.40
Liberty	82.32	0.63	0.41	73.78
Centro Liberty	78.96	0.63	0.17	71.65
San Isidro	91.16	0.51	0.83	31.70

Note: lps - liter per second
lps/m - liter per second/meter
mbgs - meter below ground surface

Source: National Water Resources Council (1982)

The existing well opposite the Moog Elementary School has been in service since 1961. Equipped with a 1.5 hp electric pump, this well reportedly supplies 40 households in the vicinity with high quality drinking water.

In contrast, communal wells on the lower terrace platform near Tubajon are shallow wells with recorded static water levels at 2.4 m below ground surface, and water quality locally described as brackish.

A free flowing spring, as reported by local informants, is located in a tidal area near the existing DCIC wharf. This spring is utilized at low tides for laundry and bathing purposes, in addition to supply potable water to nearby households.

89

2.4.3.2 Water Quality, Groundwater

In coordination with the ongoing study of the water supply and distribution system for Metro Cagayan de Oro (LBII, 1991), the study area of which extends to the municipality of Alubijid, two existing wells and the shoreline spring were sampled for water quality (Figure 2-17). The results of the laboratory analysis of these water samples, conducted by Xavier University and the Region X DENR water testing laboratory, are included in Table 2-17, while the methodologies are included in Appendix A-2. In addition to the listed parameters tested, a heavy metal analysis is ongoing and presence of the pesticides DDT, Heptachlor, Dieldrin, Endrin, Malathion and Parathion, as well as PCB's, was tested for but not detached.

Corresponding quality standards established by DENR and the Department of Health (DOH) for drinking water are included in Table 2-17 for comparative evaluation. Of the tested parameters of two wells currently utilized for the domestic water needs of local residents, elevated levels of total dissolved solids, oil and grease, phenols[3], phosphates and the pesticide Aldrin were indicated to be in exceedence of established national standards. Similar elevated values were reported for the sampled shoreline spring.

Based on the results of the single sampling program, additional studies are recommended to verify the suggested poor water quality of sampled groundwater sources.

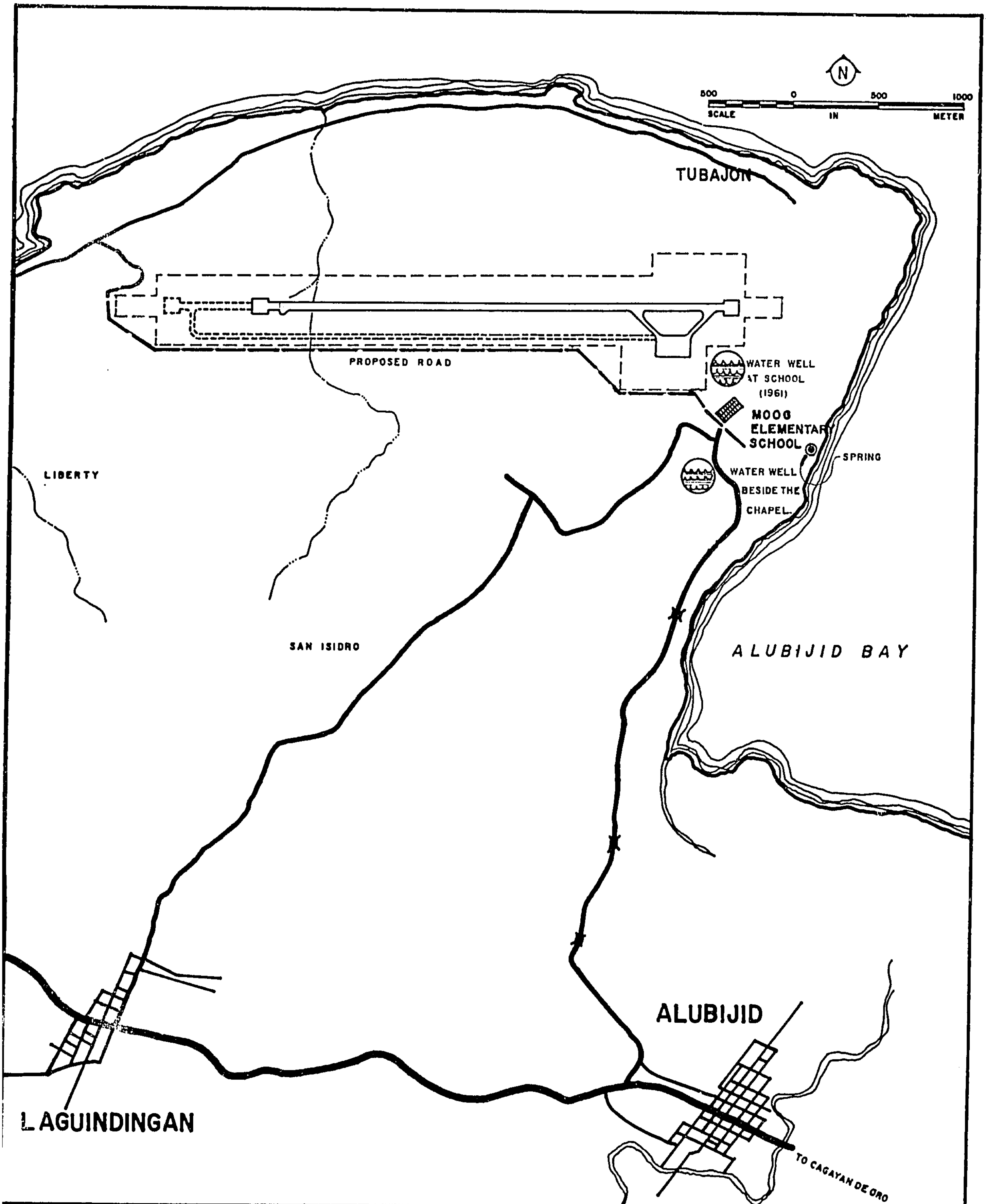
2.4.3.3 Coastal Water Quality

Previous research studies were conducted to evaluate coastal water quality in response to concerns of increased levels of pollution corresponding to growth and industrial development of the Corridor. McKeough et al (1980), for example, described Macajalar Bay as not being seriously polluted at that time but noted the presence of oil slicks, solid wastes and concentrations of the pesticides heptachlor and aldrin exceeding the 0.01 mg/l national limit for seawater in coastal sampling stations near Cagayan de Oro.

Recent research studies conducted near the relatively isolated Sulauan Point (Ato, 1990; Atrigenio, 1988; Diaz; 1990; Mallorca, 1990; Montebon, 1989; Quiaoit, 1989; Roa, 1989; Sabanal, 1988) reported high coastal water quality, including the following averages for November to January (1988 - 89), sampling periods:

- vertical (secci) visibility - 10 - 13 m
- temperature - 28 - 32°C
- salinity - 30 - 350/00
- pH - 7 - 8

[3]Phenols are a group of substances, including carbolic acid, that are derived from organic matter as may be common in marine derived (reef) limestone, petroleum products or decaying vegetation. Phenolic compounds effect water taste, particularly chlorinated water.



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0089-00

LOUIS BERGER INTERNATIONAL, INC.
- LOCKWOOD GREENE INT'L.
- TRANS-ASIA (PHIL.) INC.
- ERNST & YOUNG INT'L.
- CONSULTANT MANAGEMENT SERVICES INC.
- GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

GROUND WATER SAMPLING SITES

FIGURE 2-17

91

Table 2-17
RESULTS OF WATER QUALITY ANALYSIS OF GROUNDWATER OF SAMPLING SITES WITHIN BARANGAY MOOG

PARAMETERS TESTED	MOOG SPRING	WELL NEAR THE CHURCH	WELL NEAR ELEMENTARY SCHOOL	DENR QUALITY STANDARD[1]	NSDW QUALITY STANDARD[2]
Color (PCU)	10	10	10	15	6
pH	7.20	7.02	7.01	6.5-8.5	6.5-8.5
DO (mg/l) Meter Reading	5.5-6.0	3.0-3.5	3.5-4.5		
Azide Method	9.0	9.2	9.0	5	*
Total SS (mg/l)	4.0	2.0	7.3	25	*
TDS (mg/l)	3620	562	530		
TDS (mg/l)	3336.7	614.4	522.3	500	*
Salinity (0/00)	13.9	0.2	0.2	*	*
Coliform (CFU/100 ml)	700	440	390	1000	*
BOD (mg/l)	0.9	0.2	1.0	1.0	*
Oil/Grease (mg/l)	1.9	2.6	0.0	nil	nil
Phenol (mg/l)	275.0	717.5	15.0	nil	0.001
Phosphates (mg/l)	21.5	7.0	18.5	nil	*
Pesticides					
Aldrin (mg/l)	1.08×10^{-3}	1.08×10^{-3}	1.08×10^{-3}	*	1×10^{-3}

[1] Water quality criteria base on Revised Water Usage and Classification Water Quality Criteria, DENR Administrative Order No. 34, Series of 1990.

[2] National Standard for Drinking Water Quality, Bureau of Research and Laboratories Department of Health, Manila

* No Water Quality Standard Recommended

Notes: DO - Dissolved Oxygen
SS - Suspended Solids
TDS - Total Dissolved Solids
BOD-Biological Oxygen Demand

92

During the marine surveys conducted in September/October, 1991 for this EA/EIS, water quality as measured by underwater visibility was judged as excellent at the drop off edge of the coral reef directly opposite the main community of Tubajon, with vertical visibility estimated at more than 20m. In contrast, at a second reef site surveyed opposite Sulauan Point, approximately two km east of the Tubajon site, underwater visibility was notably cloudy, and vertical visibility was estimated at 10 to 15 m. Reduced underwater visibility at the Sulauan Point site was attributed to the prevailing westerly winds and reef flat-derived silt.

2.4.4 Oceanography

The proposed project site is located on the peninsula near Sulauan Point that serves to delineate the coastal water bodies of Iligan and Macajalar Bavs, and the Mindanao Sea[4]. In addition to the physical characteristics of these three bodies of water, the oceanography of the site is influenced by the hydrographic profile of the adjoining coastline, which includes:

- A shallow reef flat that extends as a muddy platform up to one kilometer seaward along the northern coastline of the peninsula. Shoreward portions of the reef flat are exposed at low tide;

- A steep, often vertical coralline reef slope (drop off) to approximately 20 m depth;

- A sandy fore reef slope extending beyond the reef platform and drop off to offshore depths of over 1000 m.

2.4.4.1 Coastal Circulation Patterns

Coastal currents and circulation patterns can be described as a composite of tidally-generated, wind-induced and density-driven water movements. Wind-driven currents are usually confined to the surface layer while the deep layer, relatively undisturbed by wind stress, is dominated by density currents. Tidal currents affect both surface and deep layers of the sea.

The prevailing surface wind speed in the project vicinity is normally weak, with over 50 percent of recorded wind observations less than 1.0 m/sec. As a result, weak wind-driven currents are also expected. A surface layer barotropic model was applied to characterize the movement of waters within the surface layer, which extends to approximately 100 m depth in response to the surface stress exerted by the wind. Northerly, northeasterly and southwesterly prevailing wind conditions were imposed in the model, corresponding to typical wind directions recorded in the area (Figures 2-7 to 2-13). The results are shown in Figures 2-18 to 2-20 for these three different surface wind directions.

---

[4]The Mindanao Sea is also commonly refereed to as the Bohol Sea.

Due to light prevailing winds in the region, the predicted wind-driven surface currents in the area are generally weak with magnitudes less than 0.1 m/sec. As expected, the simulated surface currents tend to follow the general direction of the prevailing wind. In shallow coastal areas, surface currents are predicted to generally flow parallel to the shoreline.

Available data from past research studies in the coastal waters of Macajalar Bay (J.A. McKrough et al. 1973, 1980; P.S. Quiaoit, 1989; C.I. Cezar, 1991; I.P. Lonsing, 1991) reported surface and sub-surface currents in the range from 0.025 to 0.05 m/sec., including sites sampled at Sulauan Point. Within the context of the Philippines, these predicted and recorded currents are relatively weak, as supported by observations made during the marine surveys.

Comparative anecdotal information (EIS, National Steel Corp., Iligan City, 1991; and local informants) suggests that tidal currents flow alternately north during low tide and south during high tide within Iligan and Macajalar Bays.

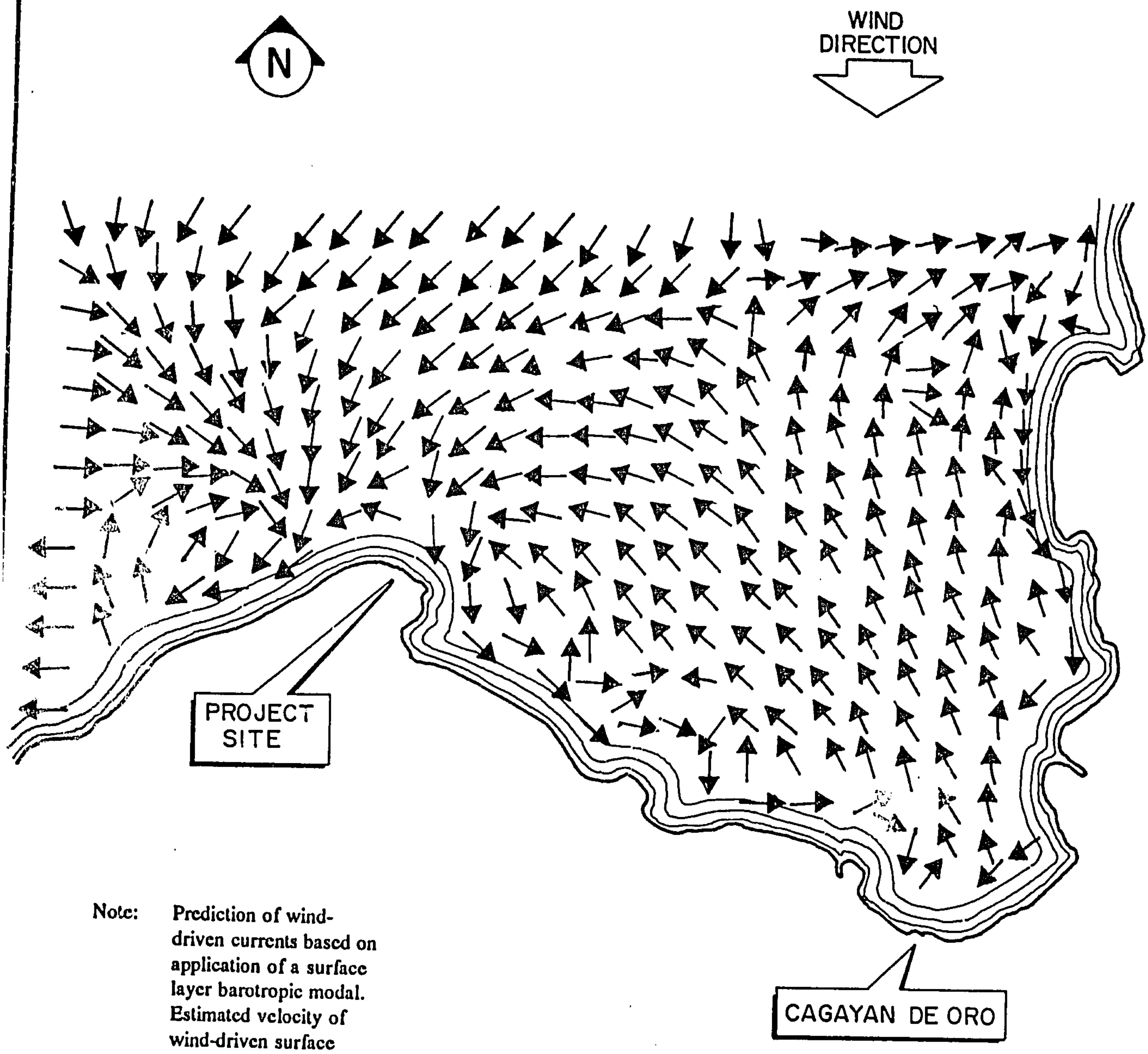
2.4.4.2 Tides

The predicted tides for the project vicinity of Sulauan Point are based on the tidal data for the port of Cagayan de Oro published in the 1991 Predicted Tide and Current Tables by the National Mapping and Resources Information Authority (NAMRIA). The predicted tides are semi-diurnal in character with a mean tidal range of about 0.76 m and a diurnal range of 1.13 m.

2.4.4.3 Sediment Transport

The vicinity of the project site does not include any permanent sources of sediment load such as rivers or existing factories. The proposed alignment of the runway will cross a ravine which according to local informants contains an intermittent creek which only flows during periods of heavy rainfall. Oblique aerial photographs taken during the field studies indicate a coastal plume of sand and sediment offshore of the outlet of this ravine. The sediment plume extended westward over the reef platform following predicted surface currents and wind-induced wave patterns corresponding to the prevailing north to northeasterly winds.

Major river systems, including the Cagayan, Iponan and Agus Rivers, contribute to substantial coastal sedimentation of the Iligan and Macajalar Bays. The sediment transport systems associated with these major rivers do not visually appear to influence the coastal areas of the project site on account of the relative distance, weak and alternating current patterns and the steep hydrographic profiles of the bays.



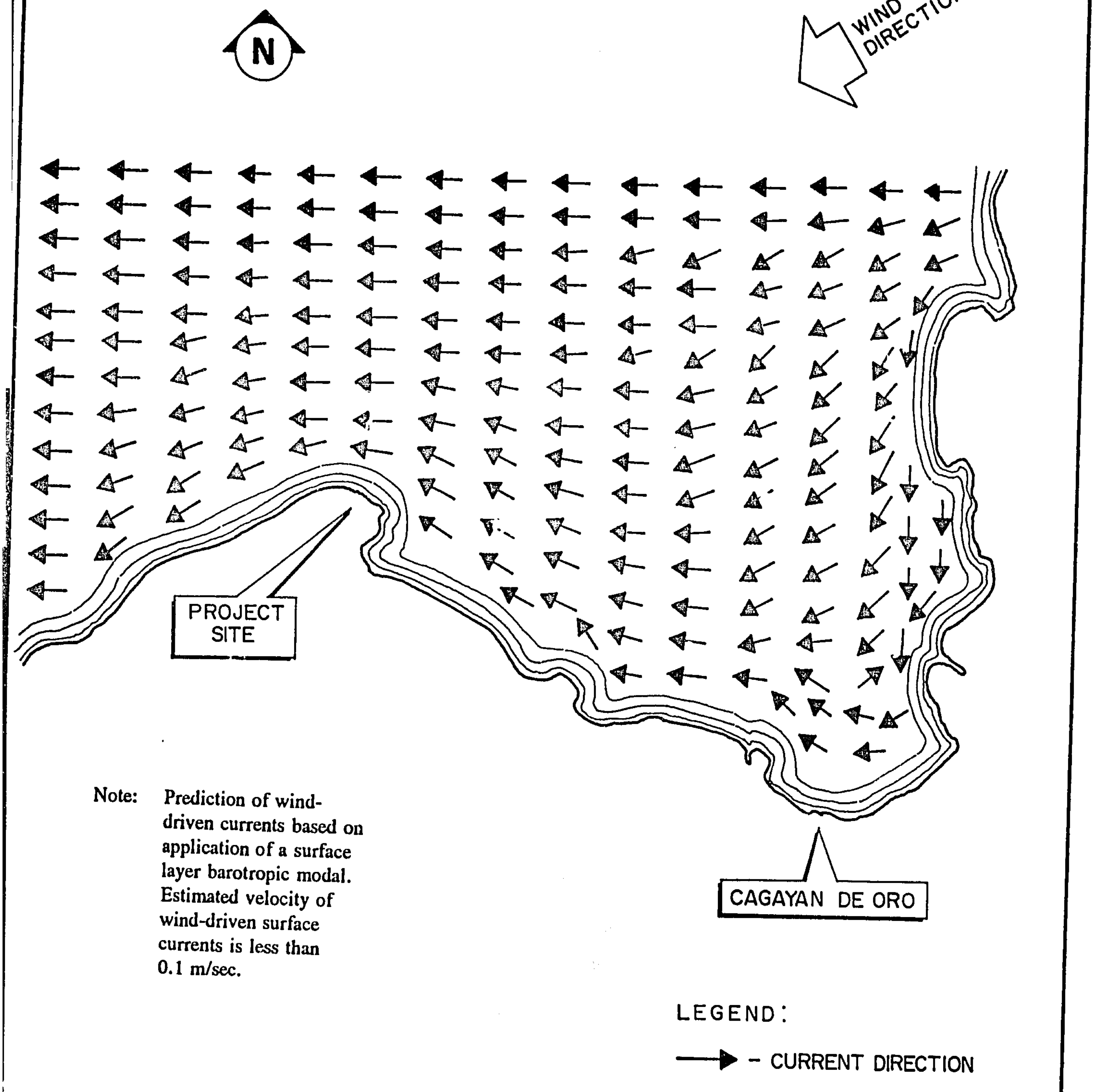
Note: Prediction of wind-driven currents based on application of a surface layer barotropic modal. Estimated velocity of wind-driven surface currents is less than 0.1 m/sec.

LEGEND:

→ - CURRENT DIRECTION

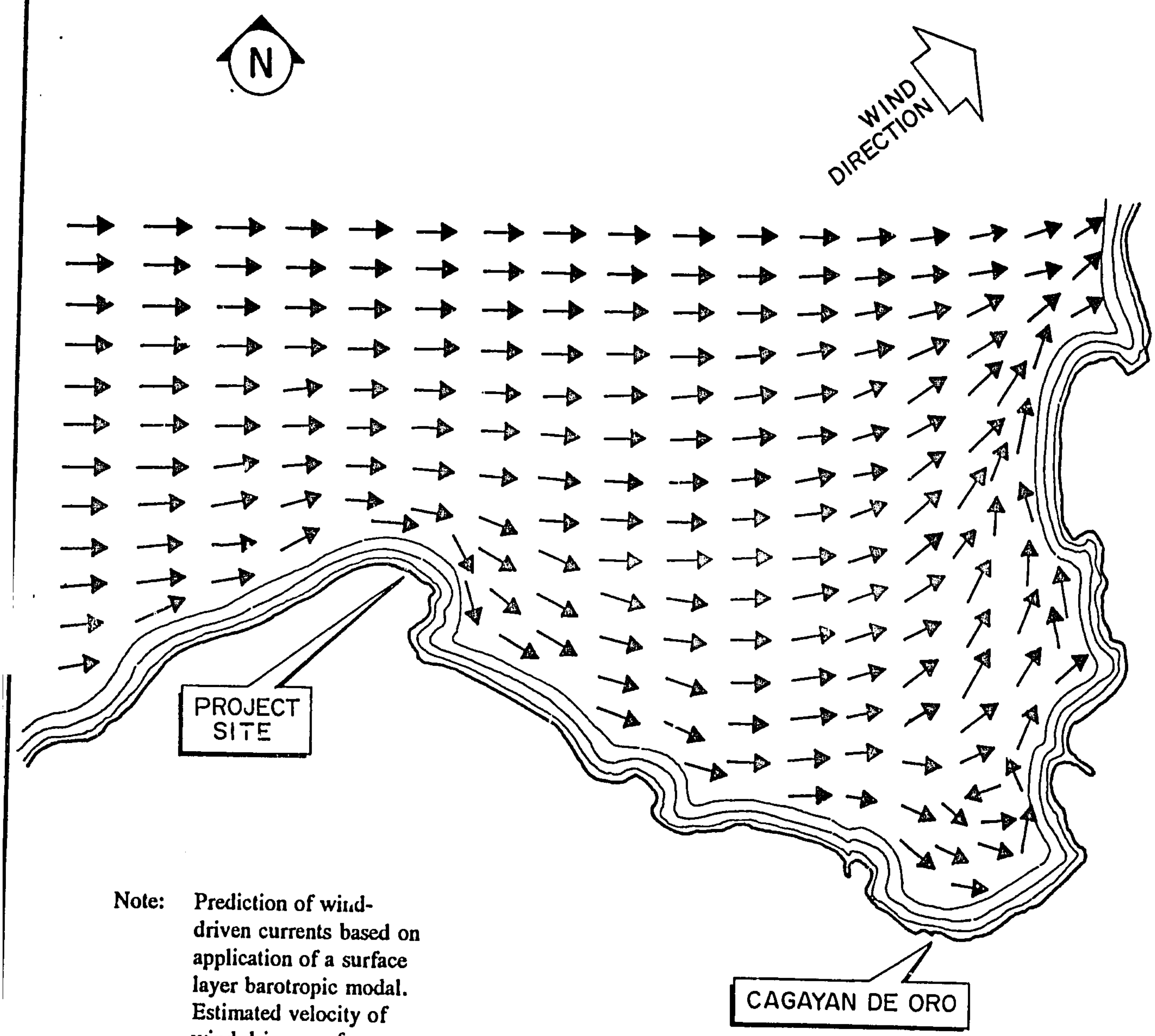
PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492 - 0482 - C - 00 - 0089 - 00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 2-18
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT • GLOBETROTTERS ENG'G. CORP. SERVICES INC.	PREDICTED CIRCULATION PATTERN FOR NORTHERLY WIND AT MACAJALAR BAY	

95



Note: Prediction of wind-driven currents based on application of a surface layer barotropic modal. Estimated velocity of wind-driven surface currents is less than 0.1 m/sec.

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 2-19
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT • GLOBETROTTERS ENG'G. CORP. SERVICES INC.	PREDICTED CIRCULATION PATTERN FOR NORTHEAST WIND AT MACAJALAR BAY	



Note: Prediction of wind-driven currents based on application of a surface layer barotropic modal. Estimated velocity of wind-driven surface currents is less than 0.1 m/sec.

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0482-C-00-0099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT	FIGURE 2-20
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT • GLOBETROTTERS ENG'G. CORP. SERVICES INC.	PREDICTED CIRCULATION PATTERN FOR SOUTHWEST WIND AT MACAJALAR BAY	

97

2.4.5 Geology, Soils and Topography

In addition to an overview of the proposed project site vicinity within the context of the Corridor, a specific study area was defined and described in detail. The specific study area, totalling 3672 ha, includes most of the municipality of Laguindingan, as well as adjoining portions of the municipalities of Alubijid and Gitagum.

2.4.5.1 Geology

The proposed airport site is located on uplifted coralline limestone which is a characteristic of the coastline of the region. These strata are composed of Pliocene to Pleistocene sediments of both marine and terrestrial deposition including reef derived limestone, pyroclastics and gravel deposits. The dominant strata is referred to as the Indahag Limestone Formation (Figures 2-21 and 2-22).

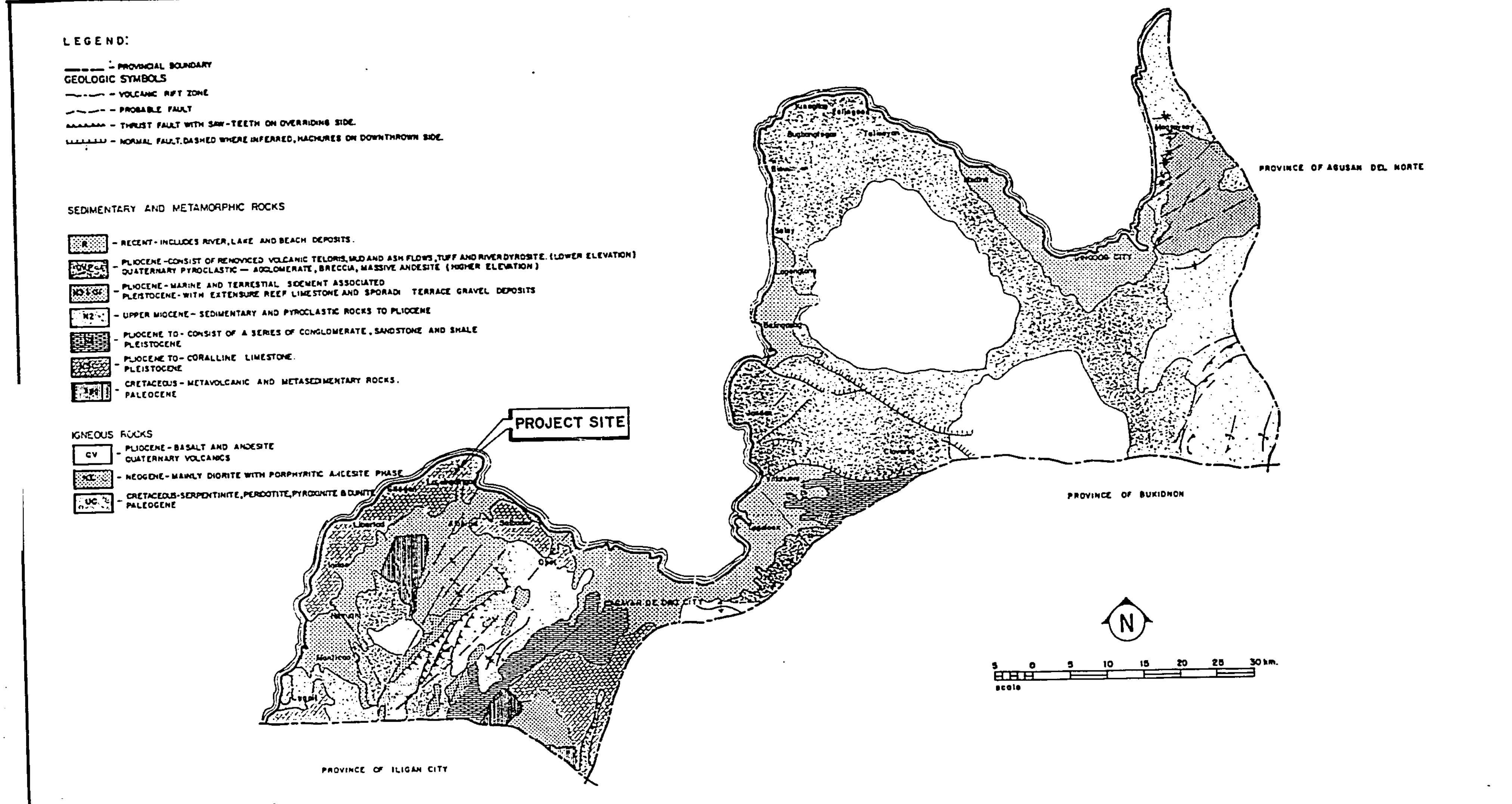
The project area also includes a geological formation, referred to as the Opol Formation, which is of the Upper Miocene - Pliocene period and consists of agglomerate, tuffaceous sandstone, tuff, conglomerate and pebbly limestone. Fine to medium grained, unsorted and poorly compacted pebbly sandstones occur as interbeds with tuffaceous sandstone and tuff, as identified near Alubijid. Recent deposits of heterogeneous and unconsolidated detrital materials, including silt, fine to coarse sand, pebbles, gravels, and boulders are found along the rivers and watercourses near the coastline.

2.4.5.2 Geomorphology and Soils

The proposed airport site is located on the upper terrace of a limestone plain, the most extensive geomorphic landscape that occupies 2, 259 ha, or about 61.5 percent of the specific project area studied (Figure 2-23). In general, this geomorphic landscape has a well drained, non-acid, highly permeable shallow soils (<50 cms.) underlain by soft coralline limestone. A significant portion of this landscape is characterized by eroded limestone outcrops and soil surfaces strewn with stone-sized limestone fragments. Some areas of the uplifted terraces have evidence of sinkholes and solutional cavities which often result from the chemical reaction of rainfall-generated carbonic acid and limestone. A Bureau of Mines and Geo-Sciences publication (Ugalde, 1980) listed 21 caves in the Tubajon area and is indicative of solutional cavity formation within the local geological structure.

Portions of the eastern and western extensions of the proposed airport perimeter include sections of the lower coralline limestone terrace which has soil and drainage properties similar to those described for the upper terrace. About 2.5 km south of the proposed site, near the eastern portion of the Laguindingan town proper, are low relief limestone hills with shallow soils (432 ha). Lowland areas are mainly found near the town of Alubijid and include alluvial plains (222 ha) and active tidal flats (304 ha). A smaller active tidal flat, estimated at four hectares in area,

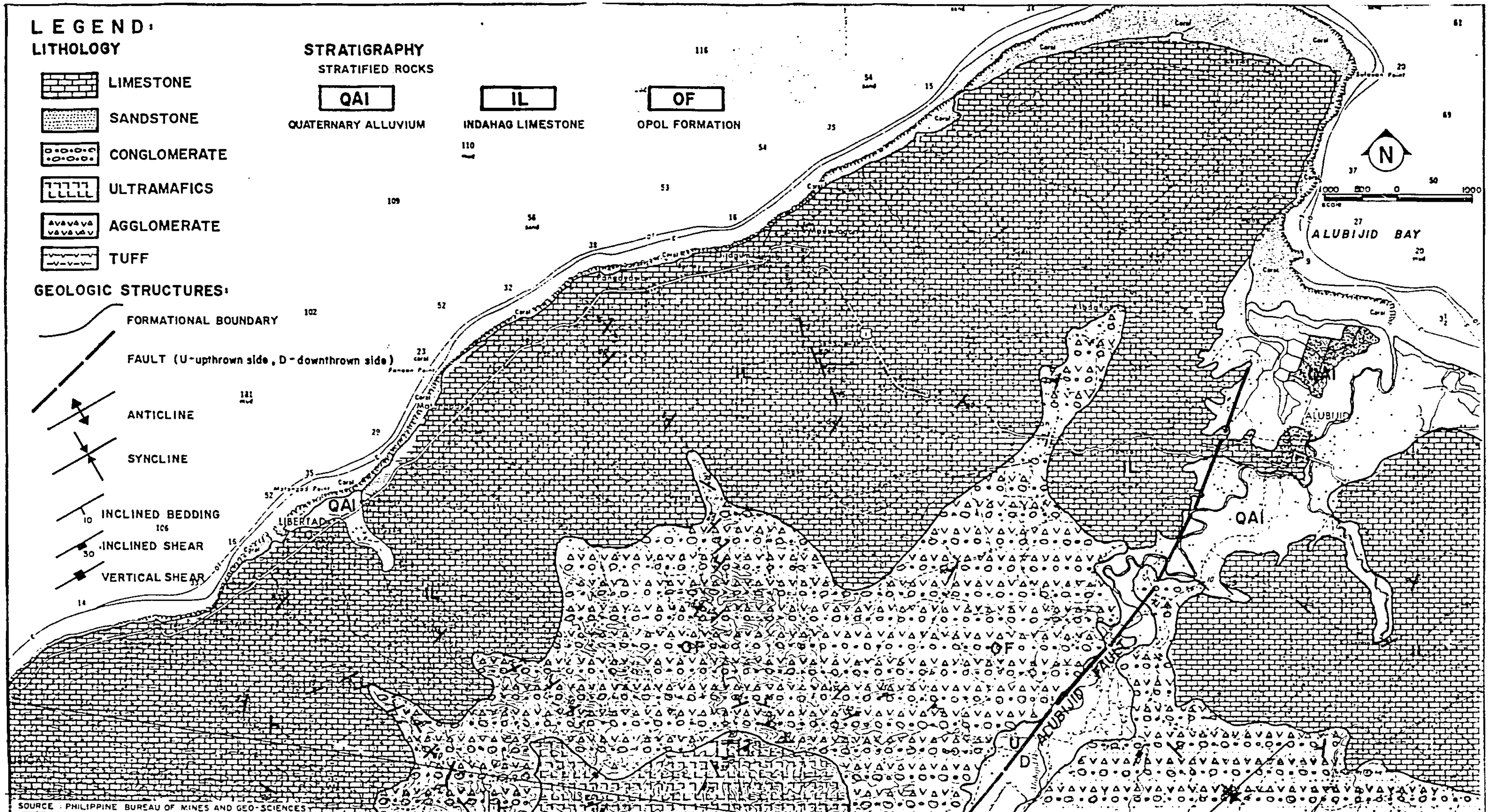
98



SOURCE : NATIONAL WATER RESOURCES COUNCIL

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0482-C-00-00?? -00	ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT	FIGURE 2 - 21
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT • GLOBETROTTERS ENG'G. CORP. SERVICES INC.	**GEOLOGIC MAP** PROVINCE OF MISAMIS ORIENTAL	

96



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

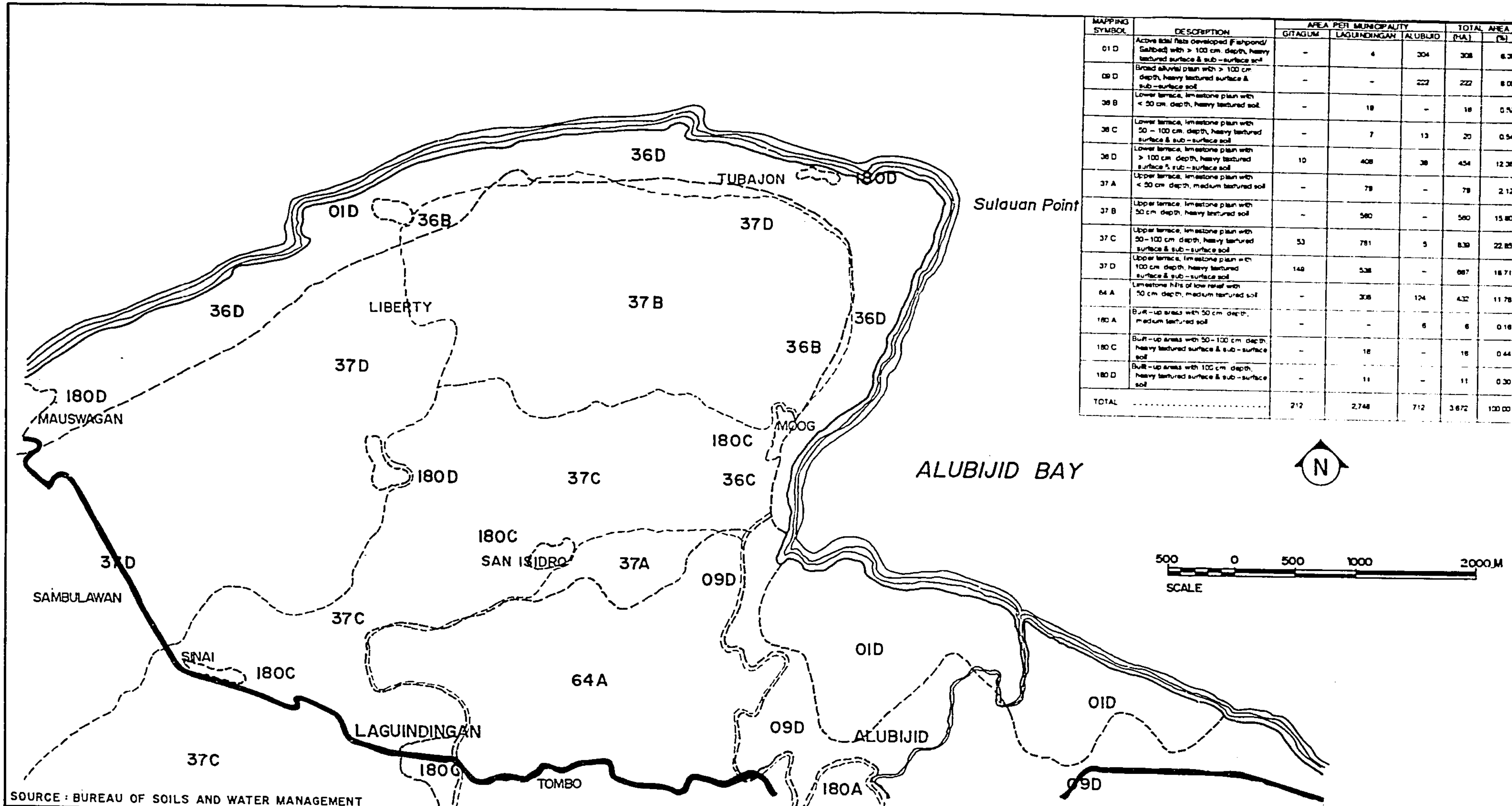
LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA(PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT

GEOLOGICAL MAP

FIGURE 2-22

100



MAPPING SYMBOL	DESCRIPTION	AREA PER MUNICIPALITY			TOTAL AREA	
		GITAGUM	LAGUINDINGAN	ALUBIJID	(HA)	(%)
01 D	Active tidal flats developed (Fishpond/ Saltbed) with > 100 cm. depth, heavy textured surface & sub-surface soil	-	4	304	308	8.39
09 D	Broad alluvial plain with > 100 cm depth, heavy textured surface & sub-surface soil	-	-	222	222	6.05
36 B	Lower terrace, limestone plain with < 50 cm. depth, heavy textured soil	-	18	-	18	0.49
36 C	Lower terrace, limestone plain with 50 - 100 cm. depth, heavy textured surface & sub-surface soil	-	7	13	20	0.54
36 D	Lower terrace, limestone plain with > 100 cm depth, heavy textured surface & sub-surface soil	10	408	36	454	12.36
37 A	Upper terrace, limestone plain with < 50 cm depth, medium textured soil	-	78	-	78	2.12
37 B	Upper terrace, limestone plain with 50 cm depth, heavy textured soil	-	580	-	580	15.80
37 C	Upper terrace, limestone plain with 50-100 cm depth, heavy textured surface & sub-surface soil	53	781	5	839	22.85
37 D	Upper terrace, limestone plain with 100 cm depth, heavy textured surface & sub-surface soil	149	538	-	687	18.71
64 A	Limestone hills of low relief with 50 cm depth, medium textured soil	-	308	124	432	11.76
180 A	Built-up areas with 50 cm depth, medium textured soil	-	-	6	6	0.16
180 C	Built-up areas with 50-100 cm depth, heavy textured surface & sub-surface soil	-	16	-	16	0.44
180 D	Built-up areas with 100 cm depth, heavy textured surface & sub-surface soil	-	11	-	11	0.30
TOTAL	....	212	2,748	712	3,672	100.00

SOURCE : BUREAU OF SOILS AND WATER MANAGEMENT

PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT
• GLOBETROTTERS ENG'G. CORP. SERVICES INC.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

LAND MANAGEMENT UNITS MAP

FIGURE 2 - 23

101

is located on the lower terrace approximately 500 m northwest of the western terminus of the proposed airport perimeter.

2.4.5.3 Topography and Slope

The proposed airport site is located on a relatively flat terrain with slopes of zero to three percent (Figure 2-24). This particular slope class represents an area of 1,660 ha, or about 45 percent of the total area. The areas south of the airport are slightly undulating with slopes generally from three to eight percent (1,507 ha, or 41 percent of the area). The rest of the area, such as near the Laguindingan town proper, consists of limestone hills of low relief with 285 ha of rolling topography (8-10 percent slopes) and 220 ha of steeply sloping hills (18-30 percent slopes).

2.4.5.4 Soil Erosion

The proposed airport site is generally located on less eroded soils with some portions in the southern section located on moderately eroded soils (Figure 2-25). The combined area for the non-eroded and slightly eroded soil is 2,500 ha, (68 percent) of the study area. Moderately eroded soil areas are located mostly in the rolling, low relief hills near the Laguindingan town proper and are estimated to occupy about 1,172 ha (32 percent) of the study area.

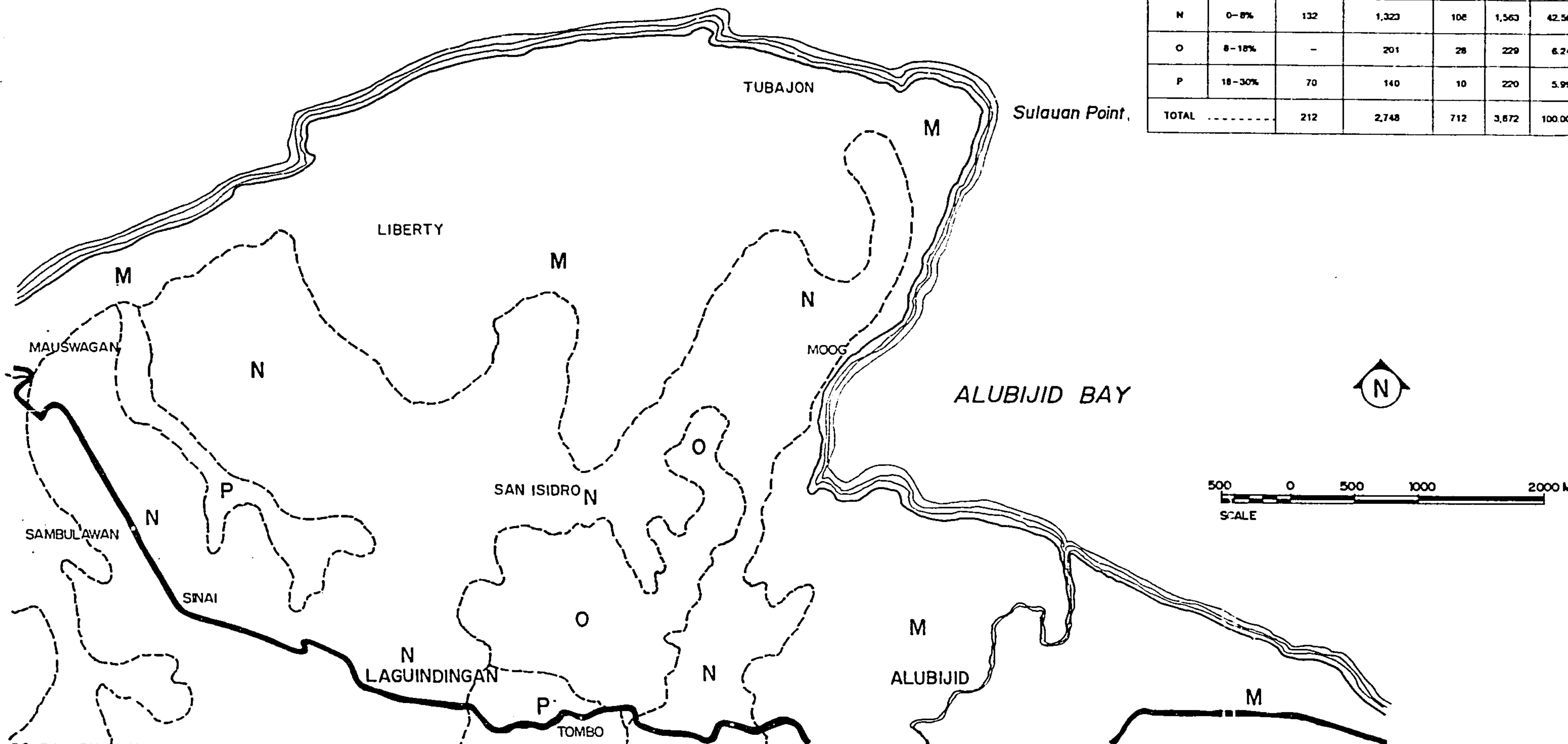
2.4.5.5 Geologic Hazards

Located along the Pacific "rim of fire", the Philippines is considered seismically and volcanically active. Historically, the proposed project area has been relatively free from serious geologic disturbances. Records and maps available from the Bureau of Mines and Geo-Sciences (BMG) indicated that none of the epicenters of 9,763 earthquakes that occurred in the country from 1960 to 1988 were recorded at or near the project site. The same is true for the location of epicenters of destructive earthquakes recorded to date (1619 to present, Figure 2-26) in the Philippines. Northern Mindanao is included within Zone 7 of the seismogenic, or seismic source, zones for the Philippines, and accounts for approximately 14 percent of seismicity within the country.

The distribution of major earthquake generators in the Philippines is presented in Figure 2-27. A potential branch of the Philippine Fault has been initially identified by the BMG as the Alubijid Fault. During a recent BMG survey, the north-northeast trending section of the Alubijid Fault was found to have affected recent sediments overlying the fault area which indicates that the geological structure is relatively active. A January 17, 1969 tremor, having a magnitude of 5.1 and an epicenter located east of Naawan, could be related to a trace fracture of the Alubijid Fault. The location of the Alubijid Fault, however, is inferred to traverse along the northeast to southwest direction and generally parallel the entire stretch of the Alubijid River (Figure 2-22). Local geologists considered it important to map the area in more detail to

AREA DISTRIBUTION PER SLOPE CLASS

MAPPING SYMBOL	PERCENT SLOPE	MUNICIPALITY			TOTAL AREA	
		GITAGUM	LAGUINDINGAN	ALUBIJID	(HA.)	(%)
M	0–3%	10	1,084	566	1,660	45.21
N	0–8%	132	1,323	108	1,563	42.56
O	8–18%	–	201	28	229	6.24
P	18–30%	70	140	10	220	5.99
TOTAL	....	212	2,748	712	3,672	100.00



SOURCE: BUREAU OF SOILS AND WATER MANAGEMENT

PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492 – 0452 – C – 00 – 0099 – 00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

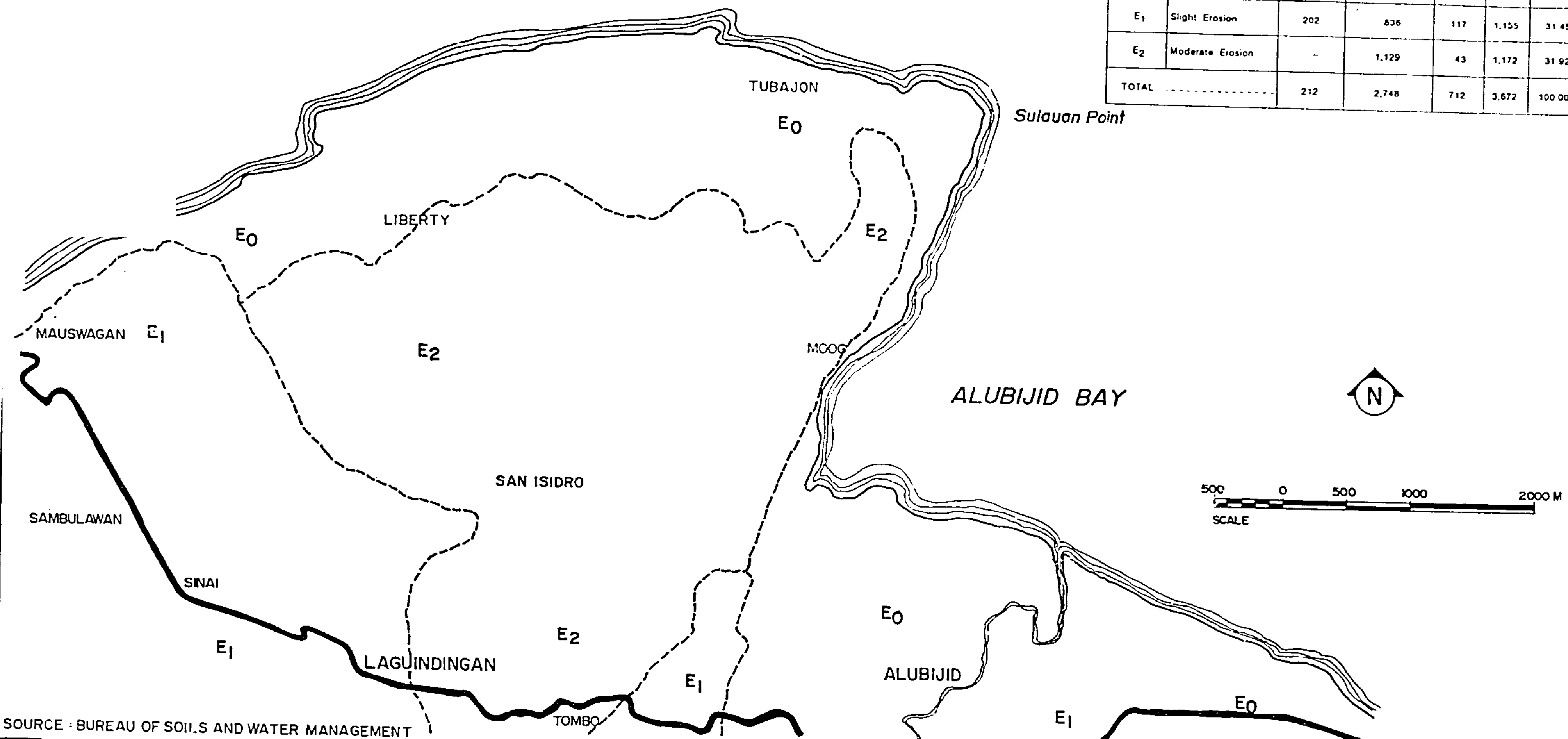
ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT

SLOPE MAP

FIGURE 2 - 24

AREA DISTRIBUTION PER EROSION CLASS

MAPPING SYMBOL	LAND USE	AREA PER MUNICIPALITY			TOTAL AREA	
		GITAGUM	LAGUINDINGAN	ALUBIJID	(HA.)	(%)
E_0	No Apparent Erosion	10	783	552	1,345	36.63
E_1	Slight Erosion	202	836	117	1,155	31.45
E_2	Moderate Erosion	–	1,129	43	1,172	31.92
TOTAL	----------------	212	2,748	712	3,672	100 00



SOURCE : BUREAU OF SOILS AND WATER MANAGEMENT

PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492 - 0452 - C - 00 - 0099 - 00

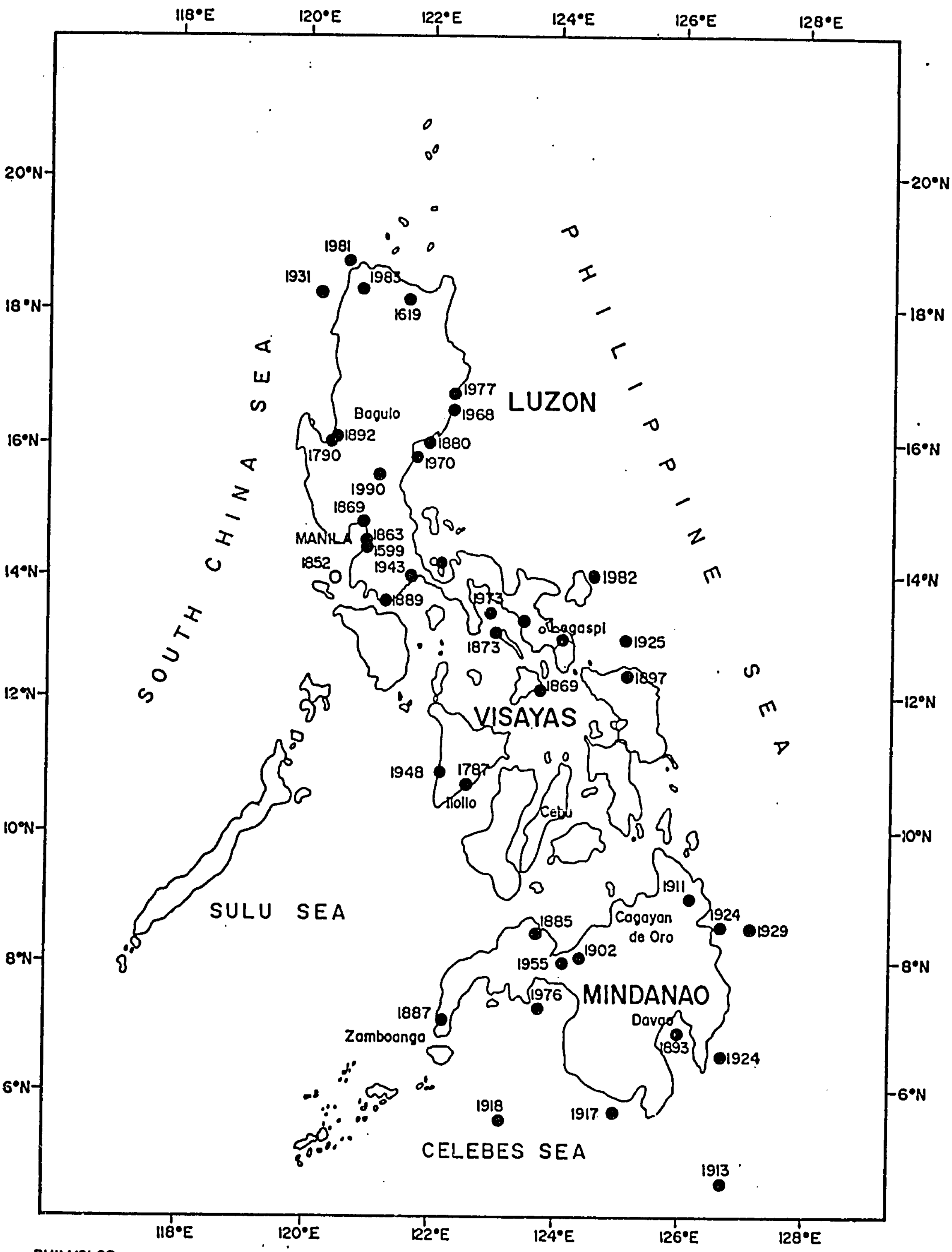
LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT
• GLOBETROTTERS ENG'G. CORP. SERVICES INC.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT

SOIL EROSION MAP

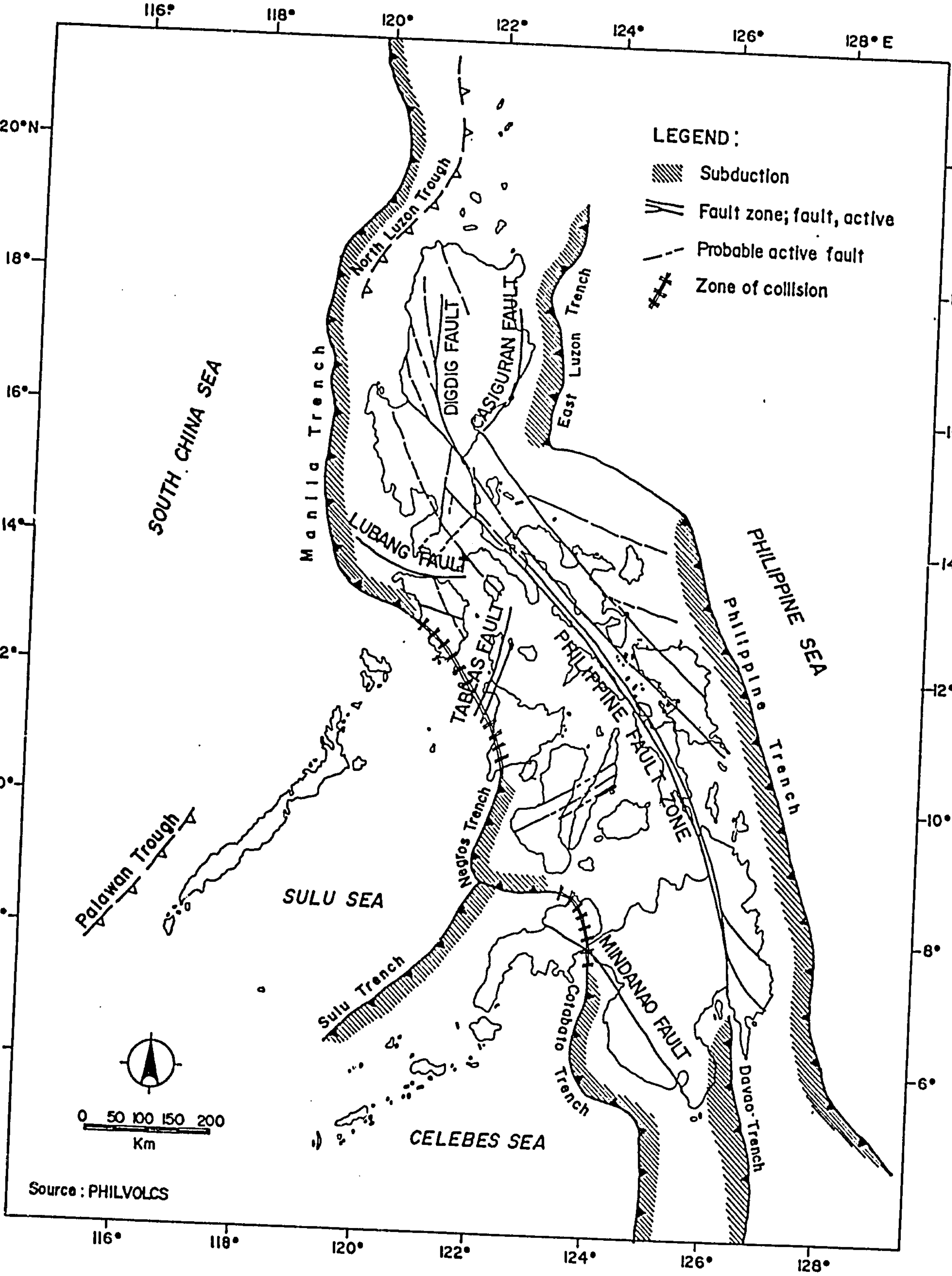
FIGURE 2 - 25

104



Source - PHILVOLCS

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492 - 0452 - C - 00 - 0099 - 00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 2-26
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	EPICENTERS OF DESTRUCTIVE PHILIPPINE EARTHQUAKES	



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492 - 0452 - C - 00 - 0099 - 00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

DISTRIBUTION OF EARTHQUAKE GENERATORS IN THE PHILIPPINES

FIGURE 2-27

106

determine the specific location and movement of the geological faults in the Corridor area (Appendix D-4 and D-5).

The areas south of the project site are mainly composed of the Opol Formation where siliceous volcanic tuff is recorded. The BMG staff of Region X related this soil formation with active volcanism in the area (possibly that of Mt. Hibok-Hibok on Camiguin Island) which suggests that the area is potentially within the affected, or ash deposit influence areas, of volcanic eruptions.

The Philippine Institute of Volcanology and Seismology (PHILVOCS) has also reportedly listed the 2,435 m high Malindang Range, which straddles Zamboanga del Norte, Zamboanga del Sur and Misamis Occidental as one of the country's 23 active volcanos. Mt. Hibok-Hibok and Mt. Malindang are approximately 60 and 90 km, respectively, from the Laguindingan site.

The proposed site and project elevation of more than 50 m above sea level, is outside the identified tsunami (tidal wave) prone areas of Mindanao. Tsunamis are a significant concern in low laying, seismicly active coastal zones. As recent as 1976, a tsunami, on the coast of Cotabato, reportedly accounted for most of the 8,000 deaths resulting from a major earthquake in the Sulu Gulf.

2.5 BIOLOGICAL ENVIRONMENT

Based on a review of existing literature, SPOT satellite imagery[5], aerial photography[6] and site reconnaissances (Plate ES-2), the Corridor can best be described as generally agriculturally developed with inroads of urban and industrial use (Figure 2-1). Recent surveys indicate significant reduction of the previously indicated forested areas.

Most remaining forest stands within the Corridor are situated in the mountains, comprising parts of Claveria and Jasaan in the east, and the foothills along the boundary shared by Misamis Oriental, Bukidnon and Lanao del Norte to the west. The present pattern of land use in the watersheds of these regions reflect the adverse effects of deforestation and soil erosion. Grass and shrub areas, followed by agricultural areas predominate most areas included in Table 2-1. The forest of Regions X and XII are described as the most denuded in Mindanao. Logging reportedly accounted for more than 50 percent of forest displacement in both regions, though shifting cultivation (kaingin) is also prevalent in upland areas.

[5]SPOT Image Corp., March 1988. Multi Spatial Images.

[6]NAMRIA, 1980.

The removal of vegetation in the watershed of Lake Lanao has apparently contributed to extreme fluctuations in water flow and water elevation of the lake. In 1990, an average inflow of 73 cu. m/sec was reported as compared to the 100 year average of about 100 cu. m/sec. Lake Lanao is the major source of hydroelectric power which provides some 80 percent of the Mindanao power grid.

Recent assessments[7] of the coastal areas of Macajalar Bay, Iligan Bay, and Panguil Bay revealed a deteriorating state of coastal resources and environment within the Misamis Oriental - Lanao del Norte region. Among the coastal resources and environmental management issues/problems identified were:

- the overexploitation of fishery resources in coastal areas due in part to the use of illegal fishing gear, including cyanide and dynamite fishing;

- the deterioration in water quality due to pollution from industrial wastes, agricultural and urban runoff, domestic sewage and massive siltation as a result of deforestation and hydraulic mining.

- the destruction of coastal ecosystems including seagrass beds, mangrove forests and coral reefs; and the modification of estuaries, beaches and shoreline land due to conflicting use for industrial, agricultural, and commercial activities;

- the reduction in aquaculture productivity due to dwindling natural sources of spawners and try resulting from the destruction of natural breeding and rearing grounds; and,

- the decline in economic status of municipal families in the coastal areas due to the deteriorating resource base coupled with increasing population growth.

2.5.1 Terrestrial Habitats, the Laguindingan Site

2.5.1.1 Vegetation

The setting of the airport site is described as rural agricultural (Plates 2-3 to 2-6). Tobacco (Nicotiana tabacum) is the principal cash crop. Some income is derived from coconut (Cocos nucifera), but the more productive coconut groves are found farther inland and south of the project site. The coconut groves found in the vicinity of the airport site yield products for direct use by the farmers and their families, in addition to dried coconut (copra) products which are marketed.

---

[7]LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro - Iligan Industrial Master Plan.

Plate 2 - 3 Representative View of the Proposed Project Site Vicinity along the Existing Access Road from Tubajon to Liberty

Plate 2 - 4 Representative View of the Proposed Project Site Vicinity along Existing Access Road near Moog Elementary School

Plate 2 - 5 Representative View along the Existing Access Road from Tubajon to Upper Limestone Terrace near Liberty

Plate 2 - 6 Representative View along Existing Provincial Road from Mauswagon to Tubajon

110

Additional crops grown in the area include:

- corn, mais (Zea mays)
- mung bean, mongos (Phaseolus radiata) - often intercropped with corn.
- cassava, kamoteng-kahoy (Manihot utilissima) - planted as a living fence between fields and along roadsides.

Numerous additional local plant species form the basis for traditional food and medicinal products. A few are planted in residential areas but do not rank as crop plants. Also of interest are the many species of ornamental plants which provide shade and beauty.

The only undisturbed terrestrial habitats found near the project site are limited to small sections of the roughed ravines and slopes too steep to cultivate. These small uncultivated tracts are comprised solely of successional species. No natural stands of forests remain in the immediate project site vicinity (Figure 2-28). Anecdotal information included in the socio-economic profile of Laguindingan suggests that forest cover historically characterized the area prior to existing settlement and cultivation. A 50 ha patch of forest within the Initao National Park is located approximately 15 km southwest of the project site and may be representative of vegetative cover prior to conversion to agriculture.

In addition to agricultural crops, four relatively distinct plant communities were identified within the proposed project site:

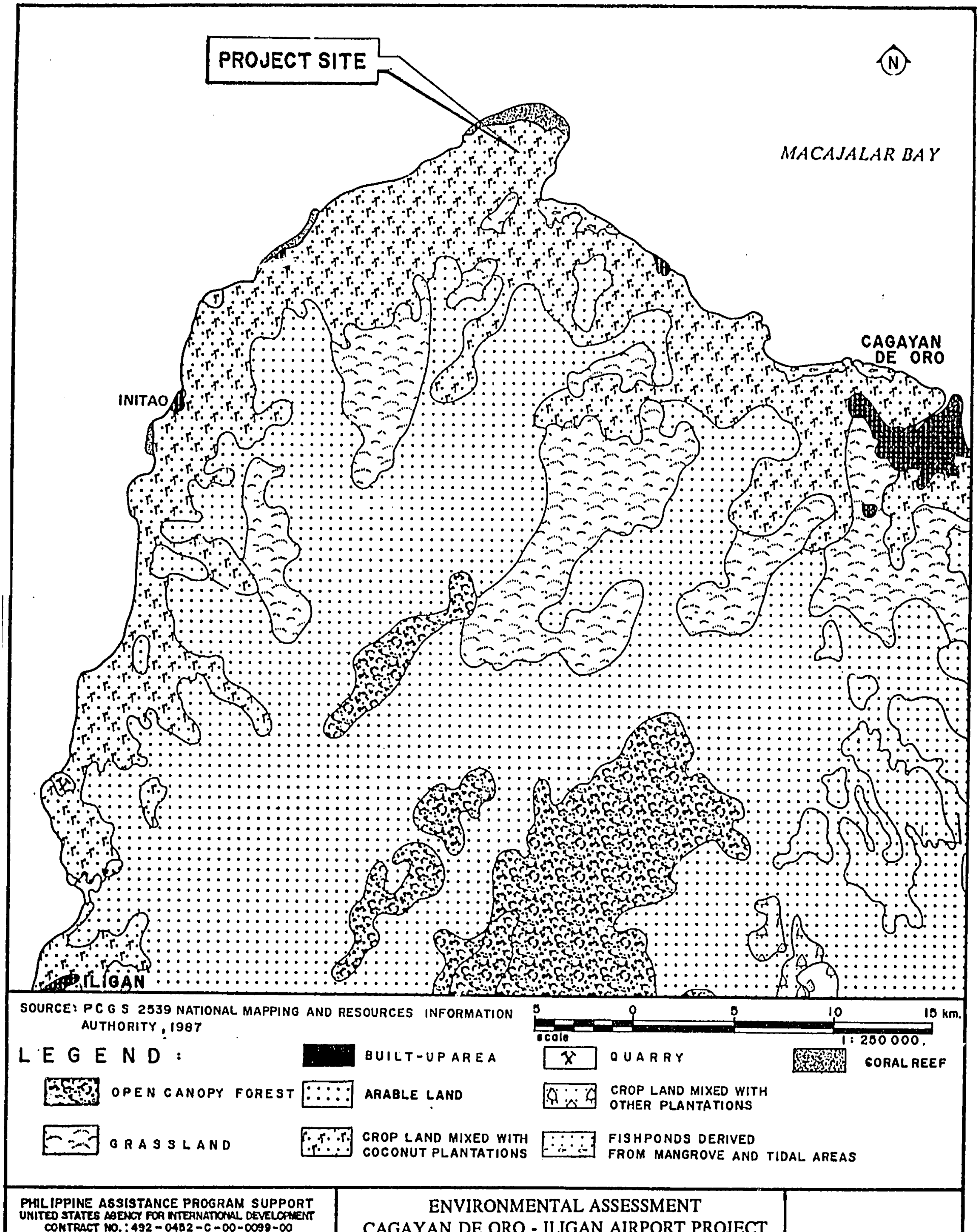
- Grassland Community

  This is a successional community type in which grasses have become dominant. The succession beyond the grass stage may be prevented by the effects of grazing animals, such as goats and cows, or regular burning. Typical dominants are Kawat-kawat (Paspalum conjugatum), Dinochloa, Mahjong Grass (Setaria), and Ischaemum. These same pioneer grasses also show up in other open habitats as, for example, the less maintained cultivated fields.

- Shrubby Thickets

  Thickets, comprised of an assortment of life-forms but dominated by woody plants, occur throughout the study area near coralline boulders, in between cultivated properties, and in pasture areas. These shrubby thickets are also successional. Between survey stakes T-13 and T-14 is a good example of such a thicket dominated by Tungao tuwad (Tabernaemontana pandacaqui), Utot-utot (Lantana camara), and Ipil-ipil (Leucaena glauca). Elsewhere, for example between stakes T-30 and T-31, the dominant species are Cireguelas (Spondias purpurea) and Ipil-ipil.

///



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

LAND COVER MAP

FIGURE 2-28

112

- Weed Communities

  Owing to the constant disturbances in the area brought about by the effects of grazing and crop cultivation, the weed-infested areas constitute the most abundant kind of plant community present. All life-forms are represented except mature trees. Typical weed species, often occurring in great abundance, are Gabon-gabon (Synedrella nodiflora), Wild-daisy (Tridax procumbens), Mote-mote (Ipomaea spp.), Panyo-panyo (Cyperus iria), Gatas-gatas (Euphorbia), and Blumea (Blumea laciniata).

- The Ravine Community

  Crossing the runway alignment at right angles is a steep-sided ravine with a depth of 16 m below the existing grade (Figure 1-14, Plate ES-2). On its slopes was found a successional community consisting of more mature individuals of the species characterizing the shrubby thickets: Ipil-ipil, tungao, tuwad and scattered clumps of banana (Musa spp). In the more open sections of the ravine, profuse stands of tall grasses are present while cireguelas dominated sections of the open slopes.

2.5.1.2 Wildlife and Avifauna

The presence or absence of wildlife was also recorded during biological surveys of the proposed project site. With the exception of domesticated livestock, no mammals, or reptiles, were observed during these surveys, and only a single species of amphibian was seen: the common toad or bak-bak (Bufo marinus).

Very few birds were observed along the transects, and none were seen nesting. Yellow-vented Bulbuls, White-collared Kingfishers, crows, and sunbirds are commonly seen in lowlands and along fields near the shore of Macajalar Bay, but in this particular area these species were unexpectedly very few in number. A list of the avifauna observed and identified during the transect surveys is also included in Appendix D-6.

During a subsequent archaeological survey, a cave site and several rock shelters were investigated near Tubajon. This cave and some twenty others in the adjoining area were listed in 1980 by the Bureau of Mines and Geo-Services as sources of guano and rock phosphate, indicative of substantial avifauna and/or bat populations. The archaeological survey team attributed the highly disturbed existing condition of the site and absence of any present avifaunal or bat populations within the cave to past guano and rock phosphate mining. Local informants reported that other cave and rock shelter habitats in the area were similarly disturbed by mining in the past.

2.5.2 Coastal Marine Habitats

The coastal areas adjacent to the project vicinity include significant marine habitats (Plate ES-1). Recent studies conducted by researchers of Xavier University, in addition to marine surveys conducted for this EA/EIS, identified several marine habitats in the local vicinity (Figure 2-29) which include:

- Seagrass-dominated intertidal reef flat

  An estimated 250 ha of Enhalus acoroides (eel grass) dominated reef flat exists within the identified marine habitat of project site vicinity (Plates 2-7 and 2-8). Associated with E. acoroides are the seagrasses Halophila minor, H. ovalis, Halodula pinifolia, H. uninervis, Cymodocea rotundata, C. serrulata and Thalassia hemprichii. The jellyfish, Cassiopea, as well as the sea urchin Diadema are common within the reef flat.

  As noted during the scoping sessions, in the unpublished report of Montebon (1989) and the recent marine survey, this seagrass-dominated reef flat is a significant source of shellfish, namely the clam Phacoides argentea, or silvery lucine (imbao or alibuho). The harvest of this clam requires digging beneath the turf-like layer of seagrass, resulting in substantial disturbance to this habitat.

- Coral-dominated back reef

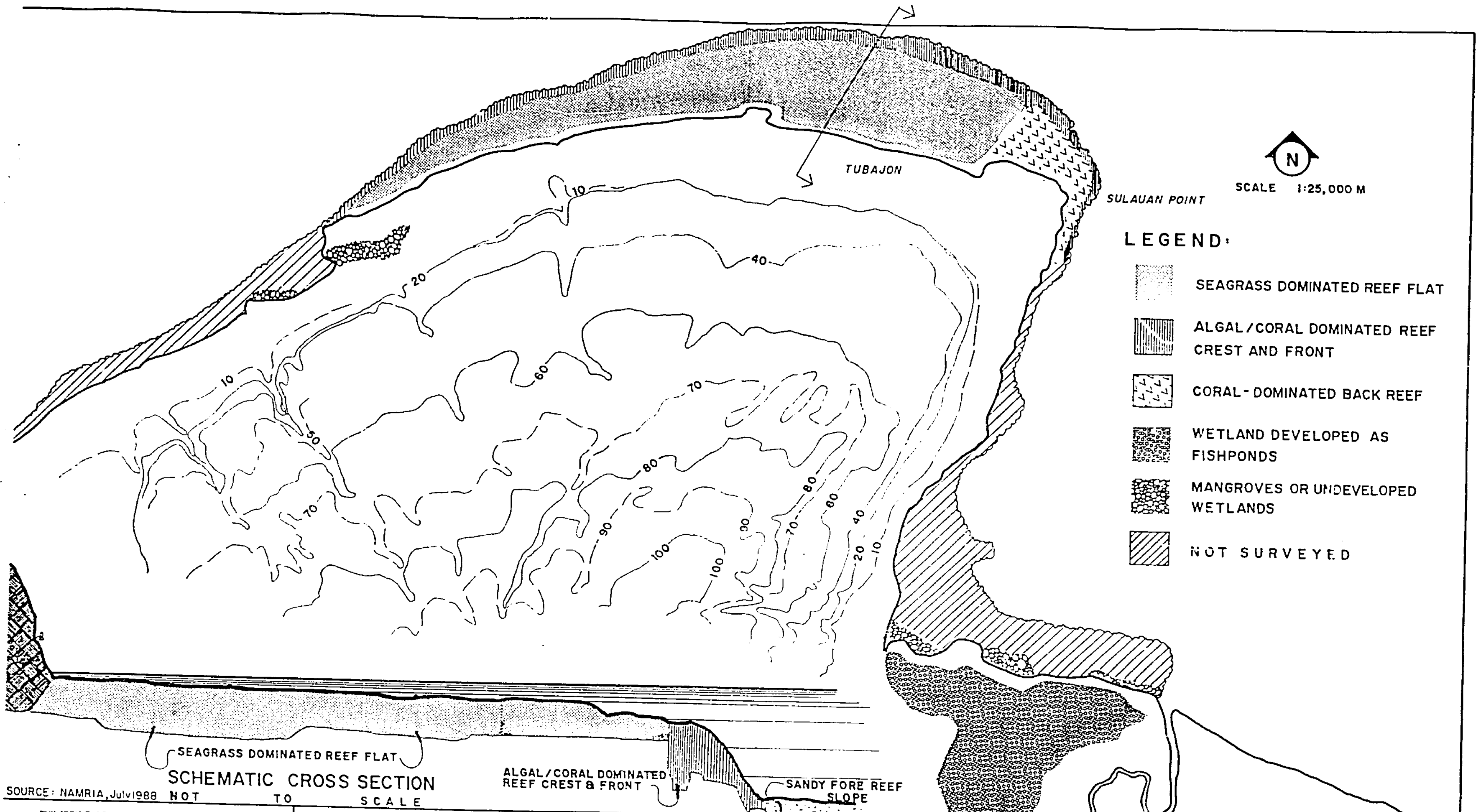
  Near Sulauan Point, the intertidal seagrass reef flat grades into a slightly deeper shoreline (0.5 to 1.0 m deep at low tide) described as a coral-dominated back reef. Principal hard corals include members of the genera Pavona and Galaxea, with unattaced massive "micro-atoll" growth forms. This area, which extends in places from the reef front to the undercut karst limestone shoreline, includes roughly 10 to 20 ha of the surveyed marine habitat.

- Algal-dominated reef crest

  Seaward of the intertidal reef flat, an algal-dominated, wave scour zone was distinguished which includes representatives of the seaweeds Turbinaria, Sargassum, Codium, Hormophysa, Caulerpa, Padina and Enteromorpha. Soft corals, including Lobophytum, Sinularia and Sarcophytun are also present. The estimated area of this approximately five meter wide seaward zone is 3.3 ha.

- Coral-dominated reef front

  Below the intertidal and wave scour zones, at a depth of approximately three to four meters, hard corals (scleractinia) are increasing prevalent, as are the soft corals reported for the shallower reef crest. Ramose (branching) species of the



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492 - 0452 - C - 00 - 6099 - 00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT

SCHEMATIC DISTRIBUTION MAP OF COASTAL MARINE HABITATS

FIGURE 2-29

Plate 2 - 7 Representative View of the Tubajon Shoreline, including Low Tide Exposure of Eel Grass-Dominated Reef Flat

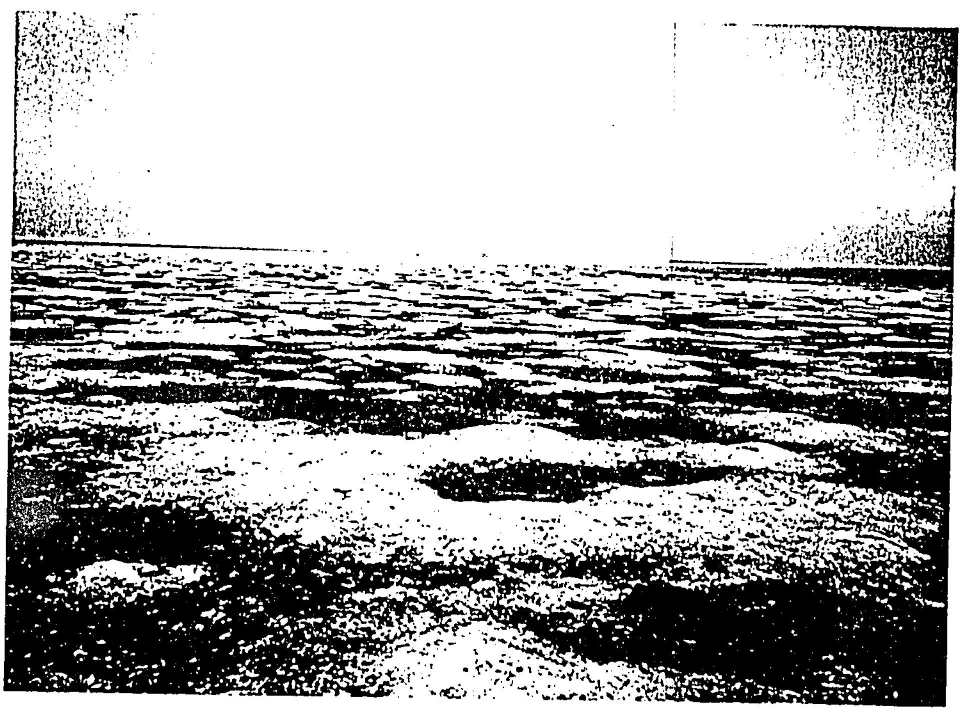


Plate 2 - 8 View Northward from Tubajon Coastline including Low Tide Exposure of Eel Grass-Dominated Reef Flat

hard coral genus Porites dominate the reef edge opposite the community of Tubajon, and were visually estimated to cover nearly 50 percent of the substrate, followed by the soft Sinularia (10 - 20 percent coverage). Secondary hard coral community members include Hydnophora, Millepora, Fungia, Galaxea and Lobophyllia, while associated reef organisms include anemones, crinoids, basket sponges, starfish and feather plume hydroids. Fish life within this deeper section of the marine habitat was qualitatively rated as rich and diverse, as was the reef habitat in general. The area of the narrow band of coral-dominated reef front is estimated to 2.0 ha.

Notably absent within the surveyed areas offshore of the Tubajon and Sulauan Point survey sites were evidence of coral destruction (coral rubble), members of the common hard coral genera Acropora and Montipora, and silt. A predator of hard corals, the crown-of-thorns starfish (Acanthaster), was relatively abundant off Sulauan Point.

- Active tidal wetlands

The Land Management Units Map (Figure 2-23) identifies two wetland areas in the vicinity of the project site. The principal area, covering a reported 304 ha, is located in the adjacent municipality of Alubijid and is largely developed as fishponds with a fringing seaward border of Avicennia and Sonneratia mangroves.

A smaller wetland area, of approximately four hectares, is located shoreward of the western link access road, within the barangay of Tubajon (Plates 2-9 and 2-10). This wetland area is relatively undeveloped, though dryer, landward sections are apparently used as pasture for livestock grazing, while the coastal section includes the privately-owned, inactive BTH Prawn Hatchery. Dominant species identified within this wetland area include the mangroves Rhizophora and Avicennia, and the mangrove fern Acrostichum. Avifauna was subjectively described as abundant and diverse, including numerous nightjars, of the genus Caprimulgus.

The 1991 Asian waterfowl census included mid-winter bird counts within the wetland areas of Alubijid and Opol, located approximately five and 15 km southeast of the proposed airport site, respectively (Appendix D-9). A total of 24 bird species were observed within these two sites during the limited, one day surveys, including migratory species.

Such as the Mongolian Plover (Charadrius mongolus), the Red-necked stint (Calidris ruficollis) and the Chinese Pond Heron (Ardeola bacchus). The Philippines is considered as an important wintering area of shorebirds and egrets following the Asian migratory flyway.

Plate 2 - 9 Rhizophora Mangroves within Wetland Area located along Western Link Access Road from Gitagum to Tubajon

Plate 2 - 10 Landward Portion of Wetland Area located along Western Link Access Road from Gitagum to Tubajon, including the Mangrove Fern Acrostichum

118

The condition of the surveyed wetland areas was noted as disturbed, due to human activities including fishpond construction, the cutting of remaining mangrove vegetation and hunting.

2.5.2.1 Coastal Fisheries

As identified during the perception survey of the project-affected barangays of Moog, Liberty and Tubajon, 50 percent of respondents reported fishing as a secondary source of income. The traditional harvest of the clam Phacoides argentea was described by Montebon (1989) while the local collection of Sargassum sp. (samo), a brown algae, was included in Roa (1989) and Mallorca (1990).

Fishery practices noted during the marine surveys include, in addition to the seagrass beds disturbed by clamming, the use of fish corrals (bunsod). Based on local interviews fishing is primarily by handline, offshore and at night, using kerosine lanterns. The principal catch is reportedly the big-eyed scad (Selar crumenophthalmus, gulog), which is generally caught a few kilometers offshore with the surplus catch marketed locally in Laguindingan. Local fishermen described rough sea conditions during the northeast monsoon (amihan), which generally occurs from November to March.

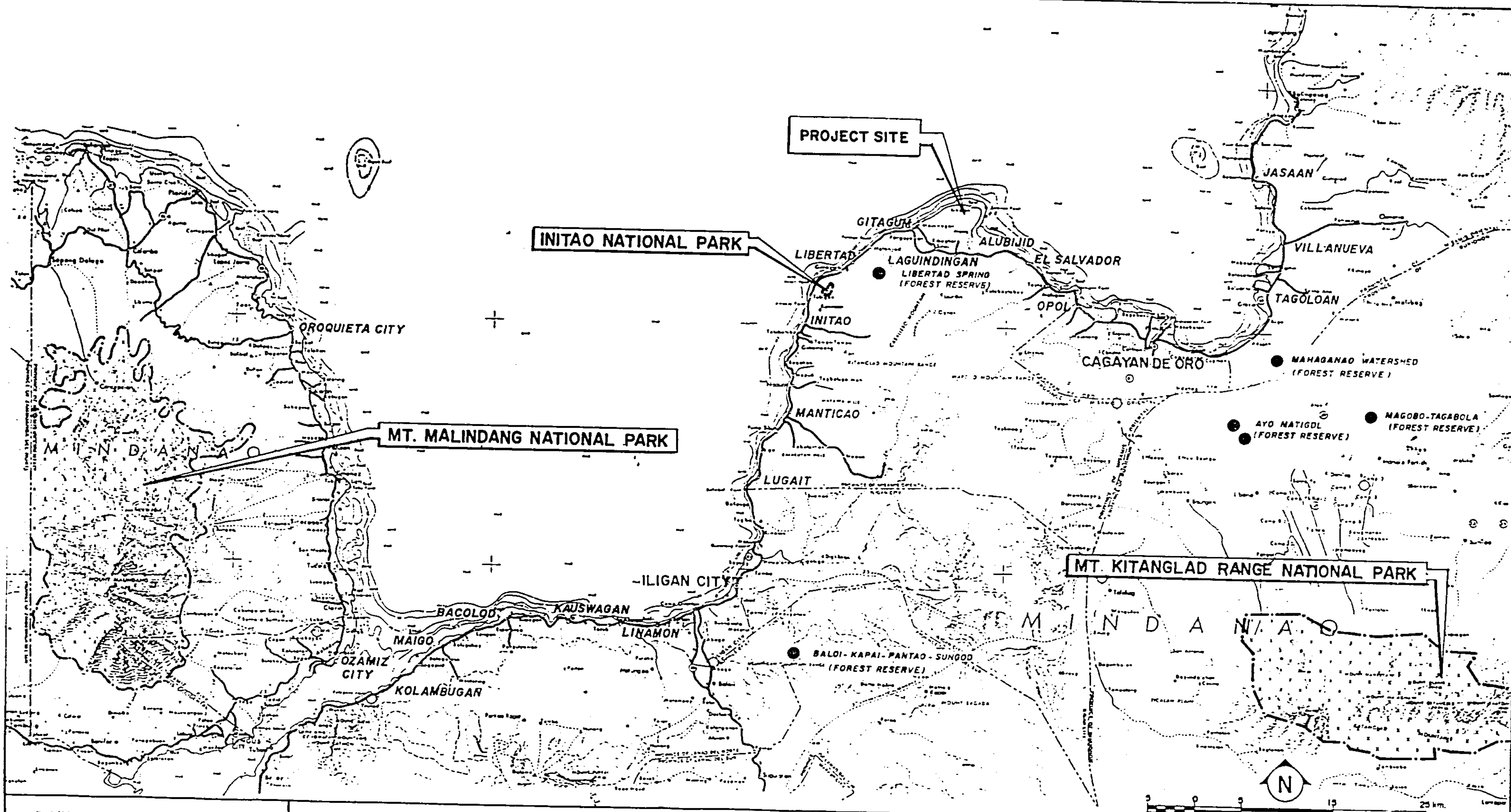
Problems identified in previous studies conducted by researchers of Xavier University include the prevalence of illegal fishing practices such as the use of dynamite and cyanide, and the over-harvesting of the seaweed Sargassum in the past. A 1985 barangay ordinance apparently bans the current harvest of this seaweed.

2.5.3 **Protected Areas, Critical Habitats and Endangered Species**

Existing protected areas in the vicinity of the proposed site are included in Figure 2-30. Within a 15 km vicinity of the proposed airport are located two reserves: the Libertad Spring Forest Reserve (52 ha) and the Initao National Park (57 ha).

In addition to these sites, the Asian Wetlands Bureau (AWB) recognizes as critical habitats the wetlands adjoining Lake Lanao, Lake Dapao and Lake Mainit. All of these sites are more than 100 km away. Based on personal communications with the AWB, no migratory flyways were identified in the predicted flight paths of the proposed airport project.

The Philippine Tarsier, the smallest monkey in the world, was been reported in the upper portion of the Initao National Park. Undisturbed areas of Misamis Oriental are also the reported habitat of the endangered Philippine Eagle, the Philippine Flying Lemur, the Blue-naped Parrot, Rufous Hornbill and Bleeding-heart Pigeon.



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0482-C-00-0089-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT
• GLOBETROTTERS ENG'G. CORP. SERVICES INC.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

PROTECTED AREAS REFERENCE MAP

FIGURE 2-30

120

The terrestrial floral and faunal surveys of the proposed project site did not identify any critical habitats and/or endangered species. Due to the relative paucity of undisturbed wetlands and coral reef/seagrass habitats within the Corridor (Figures 2-1 and 2-28), the described marine habitats, including the small Tubajon wetland area are considered critical. Local resident and fishermen did not report the local presence of any endangered marine species, such as sea turtles, or the use of nearby beaches as turtle nesting grounds.

2.6 CULTURAL ENVIRONMENT

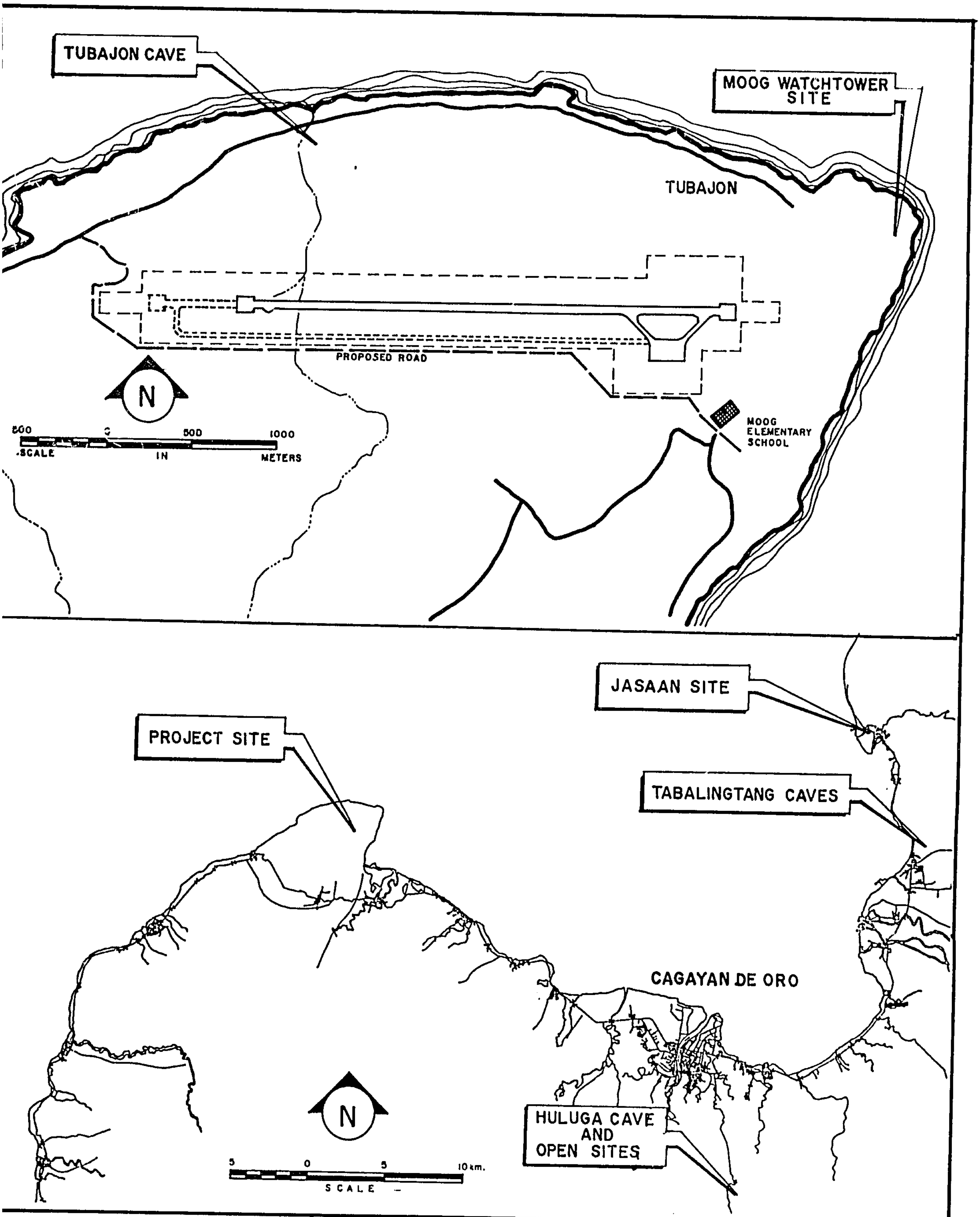
2.6.1 Literature Review

Prior to the field studies of the project area, literature survey and consultations were undertaken with faculty members of Xavier University who have been involved in past anthropological and archaeological studies in the vicinity of Cagayan de Oro City. This research supported the existing records of archaeological sites available at the National Museum.

- In May, 1968, Avelino Legaspi and Jesus Peralta found ceramic sherds from the late Ching Dynasty, in Aplaya, Jasaan, (Figure 2-31) which is located east of Cagayan de Oro (Peralta 1968).

- In November, 1970, Mr. Israel Cabanilla visited reported archaeological sites in coordination with personnel from Xavier University. He reported on the Tagbalintang Caves, where a stone bark cloth beater was found along with Metal Age pottery. However, he failed to mention the exact location of the site (Cabanilla 1970). Interviews with Dr. Linda Burton of Xavier University, indicate out that the Tagbalintang Cave is located in the municipality of Villanueva, the present site of Philippine Sinter Corporation of Kawasaki. Tagbalintang Cave reportedly contained Neolithic culture material and Iron Age type of potteries. The artifacts were recovered but not systematically recorded. The site has been completely destroyed by subsequent industrial development of the site without the benefit of archaeological investigation. The previously recovered artifacts are presently kept at the Xavier University Museum.

- Cabanilla (1970) also mentioned the Huluga Cave sites in Barrio Tagwanao, composed of caves and open sites. The Huluga area is on the eastern side of Cagayan River, about 8 kilometers south of the city near the present Cagayan de Oro airport in Lumbia. At the Huluga Open Site, tradeware ceramic sherds and local pottery sherds were found along with obsidian flake tools and a polished edge of silioified sandstone dated to the Late Neolithic-Metal Age period 3000-2000 B.C. The variety of finds here suggest a long period of occupation in the area (Cabanilla, 1970; Demetrio, 1971).



ILIPPINE ASSISTANCE PROGRAM SUPPORT
ITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

REFERENCE MAP
ARCHAEOLOGICAL SITES

FIGURE 2-31

- Demetrio (1971, 1972) noted that the Huluga Caves were probably used as a burial ground. One very interesting characteristic of these caves was that there were no traces of Chinese trade pottery found among the artifacts, only Philippine Metal Age or Iron Age wares.

- From January to May, 1975, Fr. Francisco Demetrio, S.J. invited Ms. Linda Burton, then a resident archaeologist, to conduct further archaeological activities at the Huluga sites. One of the Gisok Caves was mentioned to contain pieces of skeletal remains associated with pottery sherds (Burton, 1975).

- In March, 1991, Mr. Angel Bautista visited the Huluga Cave sites in order to reassess the sites for a thorough archaeological investigation. Mr. Bautista found more pottery sherds on a fluvial deposit on the bank of the Cagayan River (Bautista, 1991).

- Based on the literature survey, it was noted that no archaeological study has yet been made in the vicinity of the proposed Laguindingan airport site.

Cagayan de Oro has a very rich history of folklores, myths and legends about its origin, place names as well as its people (Madigan 1963; Demetrio, 1971, 1972; Magana, 1980; Lao, 1980).

The Cagayanon and Bukidnon folktales agree that the name of "Cagayan" before the coming of the Spaniards was Lumbagohon, Kalambagohan, Lambagu or Lambagowon due to the predominant growth of lambago trees (Hibiscus tileiaceus) in the area. The term Cagayha-an, on the other hand, is derived from the word kagayha, meaning shame, is a later name replacing the ancient name Kalambagohan as studied in folk etymology (Magana, 1980).

The following account is one of the most popular legends of Cagayan de Oro as recorded by Demetrio (1972):

> The old name of Cagayan de Oro was Kalambagohan, named after the luxuriant growth of lambago trees. Its original inhabitants were the Bukidnons but they were driven away to the hills by the Muslims of Lanao. The Bukidnons, however, were set on taking back their land. This plan, unfortunately, did not push through because the Bukidnon chief fell in love with the enemy chief's daughter. Greatly embarrassed by this turn of events, the Bukidnon warriors began referring to Kalambagohan as Kagayha-an, the Binukid dialect term for shame. The Spaniards later changed the named to Cagayan de Oro when they discovered large deposits of gold in the place.

There are many more versions of this legend by both the people of Cagayan, Bukidnon and Lanao.

Historically, the work of Madigan (1963) remains to be most authoritative, although Lao (1980) is a more recent publication. Sulauan Point is noted on the map of 1752 by Murillo de Vellarde

(Netzorg 1985). Nevertheless, it was Madigan who mentioned the existence of a watchtower at Sulauan Point in Moog, Laguindingan. In the 1750's, Moro raids were prevalent in the areas of Spanish settlement. According to Madigan (1963):

> In the face of new raids, the people of Cagayan and other north coast towns continued to defend themselves as best they could without expecting much aid from Manila. They set up watchtowers (still to be seen in such Misamis Oriental and Lanao del Norte coastal towns as Alubijid, Aplaya, Balingasag, and Punta Sulauan) from which the appearance of Moro praus[8] might be decried from afar and the warning quickly communicated by church bell and messenger from village to village. Breastworks of stone and wood were raised, behind which the men of the town fought for the lives of their wives and children .... (underscoring supplied).

This is the only written historical reference to the proposed Laguindingan airport site that was identified during the literature survey.

2.6.2 Archaeological Survey

Contemporary earthenware and porcelain sherds along with glass fragments from beer bottles were found in the present surface of the proposed runway area. These materials were apparently utilized and disposed of by the present settlers in the surveyed area of Moog. The absence of any significant archaeological material was notable in this area. Nevertheless, a number of fossil giant clam shells (Tridacna sp.) and corals were observed in the exposed karst and scattered farm plots, planted primarily with tobacco, corn and coconut.

A cave and several rock shelters are located on the eastern side of the terminus of the principal ravine and intermittent creek in the area, in the limestone escarpment north of the proposed runway (Figure 2-31, Plates 2-11 and 2-12). According to Mr. Domingo Estrada, the barangay captain of Moog, the cave was called Liyang Bahu ("smelly cave") by his forefathers. Guano mining was reportedly undertaken in this cave between 1960 and 1970, which might explain the descriptive place name. It is also locally referred to as the Kuweba de Agua ("water cave"). The mouth of the cave is approximately two meters wide and is oriented at 270 degrees west. Inside, the ceiling is three meters high, rising to 10 meters at the small roof opening in the innermost part of the cave. Its maximum width is 15 meters and has a length of about 50 meters. No ceiling stalactites were found which may explain the abundance of limestone debris on the floor of the cave. The ground inside this cave is reportedly always wet which explains the local name, Kuweba de Aqua. The cave was surveyed for evidence of archaeological resources such as artifacts, ecofacts, unique features and petroglyps. No archaeological remains were found in the cave which appears to have been extensively disturbed during the past mining of quano deposits. In the vicinity of the opening of the cave, contemporary materials similar

[8]Traditional outrigger sailing vessels.

Plate 2 - 11 Typical Rock Shelter located in the Limestone Escarpment between the Lower (Tubajon) and Upper (Moog, Liberty) Terraces

Plate 2 - 12 Close-up View of Typical Rock Shelter located in the Limestone Escarpment near Tubajon

to those found on the proposed runway area were noted. Based on 1980 reports of the Bureauof Mines and Geo-Sciences, there are a total of 21 recorded caves and rock shelters in the vicinity of Tubajon identified for guano and rock phosphate deposits.

The historic remains of the base and foundation of the Moog watchtower, located at Sulauan Point, are set atop sharp rocks at the tip of the headland (Figure 2-31, Plates 2-13 and 2-14). The remaining walls have average thickness of 75 centimeters, a maximum height of two meters and a perimeter area of 8.9 in x 8.4 as measured along the outer wall. The structure, built of mortared coral stones, is characteristic of the early 18th century Spanish construction work in the Philippines. Bogo (Garuga fioribunda) trees are presently growing on what remains of the walls (Plate 2-13). An excavated area inside the northern corner of the wall was reportedly made by local treasure hunters a few years ago. The site of the Moog watchtower commands an expansive view Macajalar Bay and the Mindanao Sea.

2.6.3 Tribal Filipinos or Ethnic Groups

Based on the literature review, field surveys and local interviews (Section 2.3, Appendix D-2), no Tribal Filipinos or Ethnic Groups were identified in the vicinity of the proposed project. Major cultural communities found within Region X include Manobo, Higaonon, Bukidnon, Subanon, Matigsalug and Talandig tribal groups.

Plate 2 - 13 View towards the east, of Sulauan Point including remaining Structure of Spanish-Era Watchtower

Plate 2 - 14 Remains of Spanish-Era Watchtower Structure near Sulauan Point

CHAPTER 3
PREDICTED ENVIRONMENTAL CONDITIONS WITHOUT PROJECT

CHAPTER 3

PREDICTED ENVIRONMENTAL CONDITIONS WITHOUT PROJECT

3.1 LAND USE AND PLANNING

3.1.1 Cagayan de Oro - Iligan Corridor Development

Concurrent feasibility studies[1] envision the Corridor to be an industrial/agro-industrial center of the southern Philippines, with continued high rates of population growth spurred by programmed economic development projects generally emphasizing the growth and dispersal of heavy industry within the Corridor. For example, the Metro Cagayan de Oro Special Development Project (MCDO-SDP) focuses on the Cagayan de Oro metropolitan area and identifies four major components for implementation during the period from 1990 - 2000:

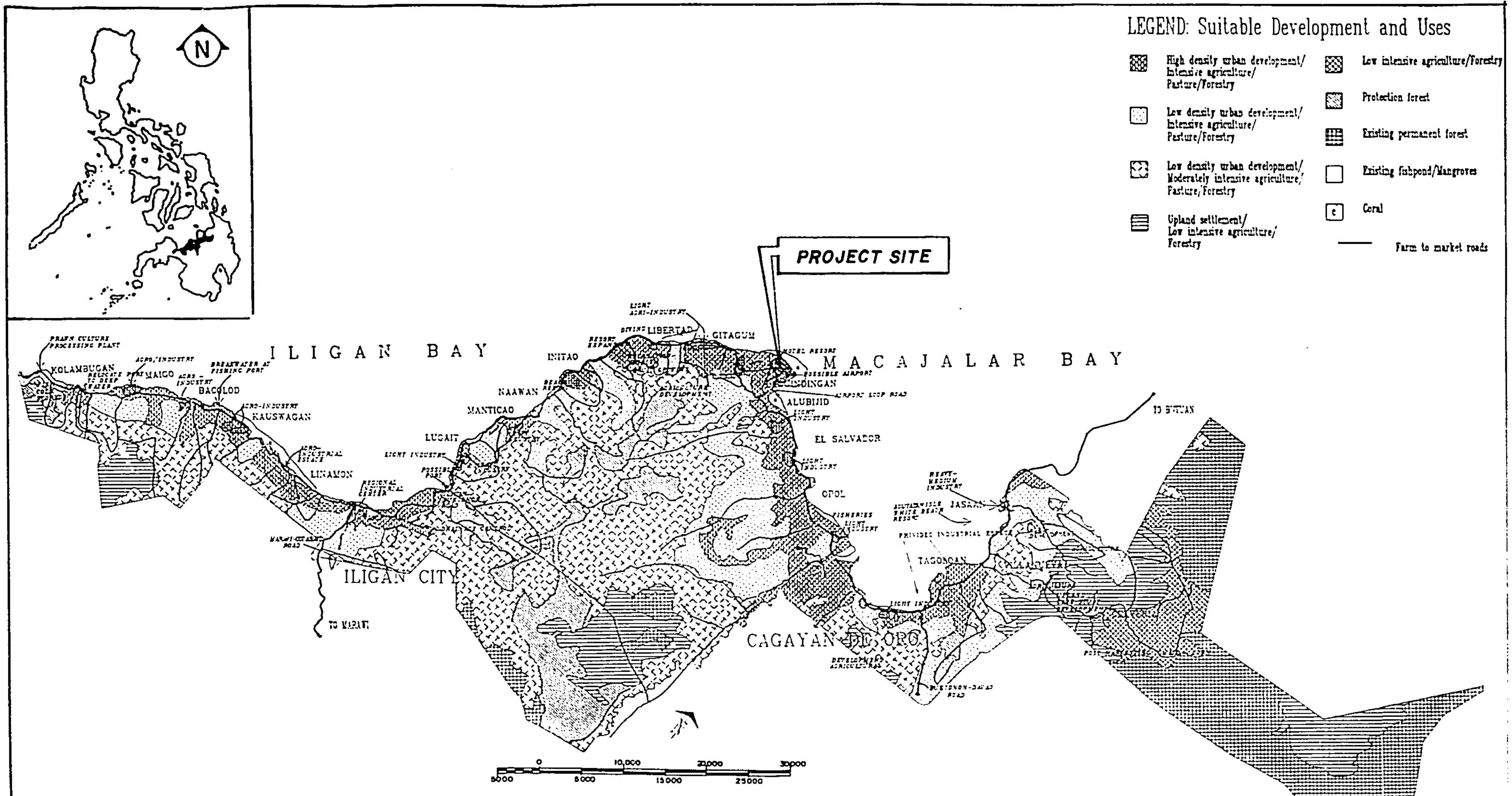
- The completion of the 3,000 ha PHIVIDEC Industrial Estate (PIE-MO) in Tagoloan-Villanueva, Misamis Oriental;
- Provision of infrastructure support, including modernization of Cagayan de Oro's telephone system;
- Social development consisting of community organization, human resource development resource utilization, augmentation of basic social services, and coordination and monitoring activities;
- Assessment of the feasibility of the Corridor resources, needs and potentials, and feasibility of integrated area planning and sector studies as part of the Cagayan de Oro-Iligan Area Development Planning Project (CIADPP).

Additional public and private sector projects are identified in these feasibility studies, the subsequent implementation of which will significantly influence land use and planning within the Corridor (Figure 3-1). These projects include:

- The National Steel Corp. (NSC) Integrated Steel Mill Project in the PHIVIDEC Industrial Estate;

---

[1] Feasibility Study and Industrial Master Planning Cagayan de Oro - Iligan Corridor, 1991. Feasibility Study of Wastewater Collection, Treatment and Disposal, and Water Supply and Distribution System for Cagayan de Oro City, 1991.



SOURCE: LBII, 1991. FEASIBILITY STUDY AND INDUSTRIAL MASTER PLANNING CAGAYAN DE ORO - ILIGAN CORRIDOR

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0482-C-00-0099-00	ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT	FIGURE 3-1
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	DEVELOPMENT AND LAND USE SUITABILITY OF THE CORRIDOR	

130

- The development of Regional Industrial Centers (RICs) both in Cagayan de Oro and Iligan;

- The development of People's Industrial Enterprises (PIE) sites, in Kauswagan and Kapatagan, Lanao del Norte.

The predicted net trend within the Corridor without implementation of the proposed airport project is the continuation of past industrial development as supported by current government strategies. The dispersal of industry within the Corridor is anticipated in accordance with site specific qualities (proximity to National Highway 1, deep coastal access, terrain) and market-based factors. For example, the siting of the new Asia Brewery facility in the basically rural municipality of El Salvador was reportedly influenced by the lower cost of real estate at this site.

The anticipated tendency for land use and planning is the gradual shift from a traditionally agricultural-based, rural population to satellite population centers supportive of the agro-industrial/industrial cores of the Cagayan de Oro and Iligan metropolitan areas. The National Economic and Development Authority (NEDA, 1989) projects that by the year 2020, the population of Region X, for example, will be distributed equally between urban and rural settings. Currently (1990), the population of Region X is described as 33 percent urban and 68 percent rural. Within the Macajalar Bay sub-region, the proportion of urban population is projected by the NEDA study to reach 63 percent by the year 2020.

3.1.2 Existing Air Transport Facilities

The present agricultural land use of the areas adjoining the existing air transport facilities have not been visibly affected to date by the presence of a commercial airport.

The predominance of agricultural use is predicted to continue near the existing airports, particularly near the Lumbia facility, where existing grassland/pastures are slated for land distribution under the Comprehensive Agrarian Reform Program (CARP).

The Department of Transportation and Communications (DOTC) has programmed improvements for the existing Cagayan de Oro (Lumbia) and Iligan (Balo-i) Airports (Section 1.3.1). While the programmed investments will improve safety and handling of traffic demands at these existing airport facilities, prevailing constraints, including aircraft capacity, topographic obstructions and weather limitations related to the higher elevation of these airports, will remain basically unchanged.

Forecasts of air transport demands without project implementation, the no action alternative, were developed by the Feasibility Study and are summarized for the existing airports, under base case scenarios, in Tables 3-1 and 3-2. The three forecast scenarios (low, base and high case) are graphically presented in Figures 3-2 to 3-4.

Table 3-1
SUMMARY OF PASSENGER, CARGO AND AIRCRAFT MOVEMENT FORECASTS, CAGAYAN DE ORO AIRPORT
(base case scenario, without project)

YEAR	NUMBER OF PASSENGERS	AVERAGE GROWTH RATE (%)	AIR CARGO (MT)	AVERAGE GROWTH RATE (%)	AIRCRAFT MOVEMENTS	AVERAGE GROWTH RATE (%)
1991	291,278		4,579		3,010	
1996	357,521	4.2	5,692	4.4	3,694	4.5
2001	424,267	3.5	6,816	3.7	4,384	3.7
2006	488,208	2.8	7,893	3.0	5,045	3.0
2011	546,722	2.3	8,879	2.4	5,650	2.4

Source: LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Corridor Airport. Draft Final Report.

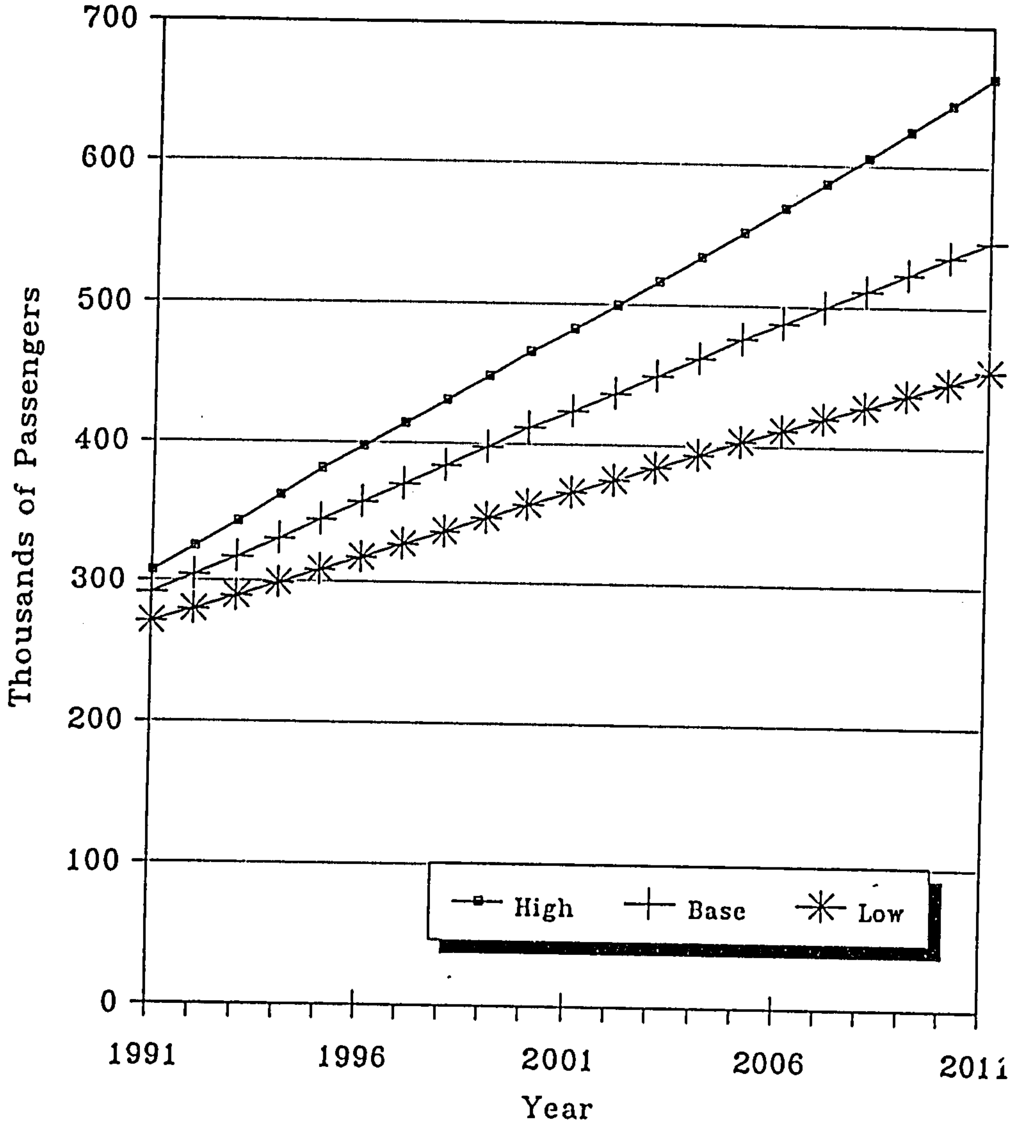
Note: Aircraft movements refer to Class 2 aircraft, such as the narrow-body B 737 jet with about 140 seats. Forecast assumes implementation of programmed DOTC airport improvements.

Table 3-2
SUMMARY OF PASSENGER, CARGO AND AIRCRAFT MOVEMENT FORECASTS, ILIGAN AIRPORT
(base case scenario, without project)

YEAR	NUMBER OF PASSENGERS	AVERAGE GROWTH RATE (%)	AIR CARGO (MT)	AVERAGE GROWTH RATE (%)	AIRCRAFT MOVEMENTS	AVERAGE GROWTH RATE (%)
1991	59,120		140		1,577	
1996	71,483	3.9	171	4.2	1,906	4.2
2001	84,141	3.3	203	3.5	2,244	3.5
2006	96,316	2.7	234	2.9	2,568	2.9
2011	107,380	3.0	262	2.3	2,863	2.3

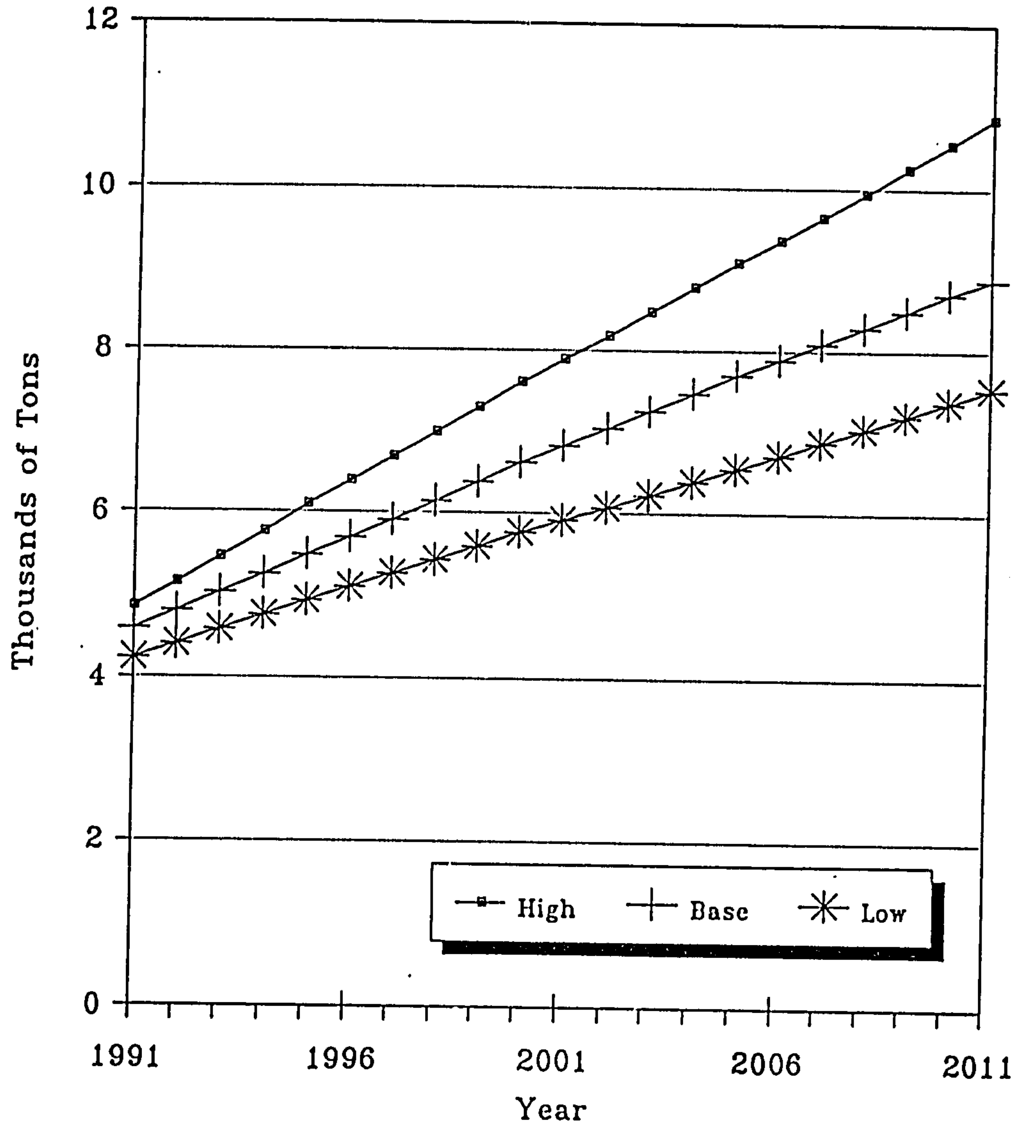
Source: LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Corridor Airport. Draft Final Report.

Note: Aircraft movements refer to Class I aircraft, such as the Fokker F50 turboprop, with approximately 50 seats Forecast assumes implementation of programmed DOTC airport improvements.



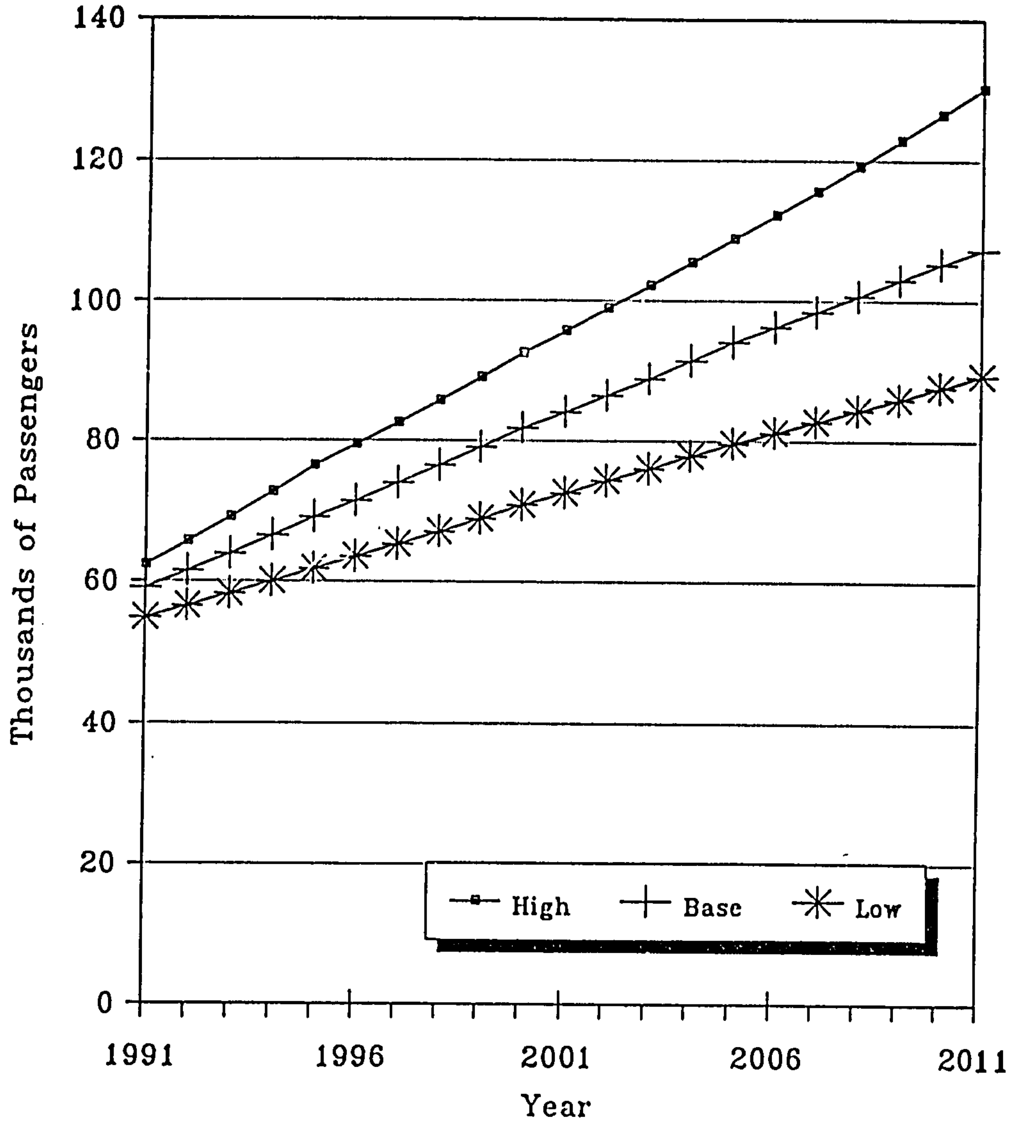
SOURCE: FEASIBILITY STUDY

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 3-2
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT • GLOBETROTTERS ENG'G. CORP. SERVICES INC.	**AIR PASSENGER FORECAST CAGAYAN DE ORO AIRPORT**	



SOURCE: FEASIBILITY STUDY

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 3-3
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	AIR CARGO FORECAST CAGAYAN DE ORO AIRPORT	



SOURCE: FEASIBILITY STUDY

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 3-4
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT • GLOBETROTTERS ENG'G. CORP. SERVICES INC.	**AIR PASSENGER FORECAST ILIGAN AIRPORT**	

The key findings of the Feasibility Study forecasts are:

- In the next 20 years, the total number of passengers in the Corridor service area will be in the range of 545,000 (low case scenario) to 793,000 (high case scenario), or approximately double the levels of present traffic. The average annual growth rate is predicted to 2.6 to 3.9 percent.

- Passenger demand in the Iligan, Marawi and their corresponding vicinity areas will be about 25% of total demand in the Corridor service area.

- Iligan Airport (IGN) passengers are forecast to be between 89,000 and 130,000 by the year 2011, or approximately 16% of total air passenger traffic in the service area.

- At the Cagayan de Oro Airport (CGY), the number of passengers is forecast to reach an annual total of between 455,000 and 663,000 in the year 2011, with annual average growth rates between 2.6% and 3.9%.

- Twenty-five percent of CGY passengers is forecast to be generated from Iligan, Marawi and their respective vicinity areas.

- Air cargo demand generated in the service area will be between 7,760 and 11,170 metric tons by the end of forecast period (the year 2011), and the average air cargo growth rates will be between 2.9 and 4.1 percent.

- The majority of air cargo (97%) will continue to be shipped through CGY due to the higher flight frequency and larger size aircraft serviceable at CGY;

- Air cargo at IGN is forecast to be in the range of 220 to 320 metric tons in 2011, while at CGY, the forecast is between 7,540 and 10,850 metric tons.

It is assumed, for the Feasibility Study, that non-commercial aircraft movements will expand at a rate equivalent to growth in the gross service area product, in other words, these aviation operations will grow in proportion to the growth of the local economy. The forecast of non-commercial aircraft movements is shown in Table 3-3.

Table 3-3
FORECASTED ANNUAL NON-COMMERCIAL AIRCRAFT MOVEMENTS
(base case scenario, without project)

YEAR	ILIGAN	CAGAYAN DE ORO
1991	363	5,294
1996	409	5,969
2001	456	6,650
2006	501	7,302
2011	542	7,899

Source: LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Corridor Airport. Draft Final Report.

3.1.3 Proposed Laguindingan Project Site

The 604 ha property of Diamond Cement and Industrial Corp. (DCIC), owned by the Ayala Corp., is currently under legal review for application of agrarian reform laws implementing land distribution as well as pending zoning conversion from agricultural to industrial use (Appendix D-3). The DCIC property includes approximately 40-50% of the 167 ha proposed airport site (Figure 2-5). Under agrarian reform, there are a reported 450 beneficiaries if the property is distributed to existing or identified tenant farmers.

Recently (July 5, 1991), the municipal government of Laguindingan filed three resolutions (Nos. 40-42, Series of 1991, Appendix D-1), endorsing the conversion from agricultural to industrial zoning for the DCIC property. The conversion to an industrial zoning designation could, in principal, pre-empt application of GOP agrarian reform regulations.

As evident from the background material included in Appendix D-10, the legal case of the DCIC property is still pending and subject to resolution. Based on personal interviews with Ayala Corp. representatives, no current or proposed plans presently exist for the DCIC property, although reviving previous plans for the construction of a cement plant within the property was mentioned. The Ayala Corp. has reportedly owned the DCIC property for nearly 30 years. For the purpose of predicting environmental conditions without the airport project, the continued agricultural use of the Laguindingan site was assumed.

3.2 SOCIO-ECONOMIC CONDITIONS

3.2.1 Socio-Economic Projections, the Service Area

3.2.1.1 Population Projection

The projected population of the service area is based on the official medium projections prepared by the National Census and Statistics Office (NCSO). The provincial projections were prepared using data obtained from the 1980 Census of Population and Housing and the 1980 Philippine Fertility Survey conducted by the NCSO, in addition to available forecasts of the University of the Philippines Population Institute and the Commission on Population (POPCOM). These final projections were endorsed to the Statistical Advisory Board by the Philippine Inter-Agency Committee on Population and Vital Statistics, which approved the figures for official use by all government agencies. Although the recent 1990 national census has been completed, no official updated projections have been prepared.

For the purpose of estimating the forecast air traffic demand, the medium population projections were used to establish the base case scenario (Table 3-4). For the low and high growth scenarios, the Feasibility Study adopted population growth rates that took into consideration the impact of various economic developments within each traffic zone of the service area by province, the service area under the base case is shown in Table 3-5.

Table 3-4
AVERAGE ANNUAL POPULATION GROWTH RATES
(1991 - 2011)

SCENARIO	AVERAGE ANNUAL POPULATION GROWTH RATE
Low Case[2]	1.55%
Base Case[1]	1.97%
High Case[2]	2.52%

Source: 1. National Economic and Development Authority
2. LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Corridor Airport Draft Final Report.

Table 3-5
PROJECTED POPULATION IN THE SERVICE AREA
(Medium Growth Assumptions)

YEAR	MISAMIS ORIENTAL	BUKIDNON	CAMIGUIN	LANAO DEL NORTE	LANAO DEL SUR	TOTAL
1995	1,061,500	938,266	65,764	676,957	547,299	3,289,786
2000	1,192,674	1,051,149	67,545	751,313	602,186	3,665,138
2005	1,319,330	1,161,959	69,545	822,974	655,546	4,029,354
2010	1,434,763	1,262,989	70,845	888,451	702,676	4,359,724
2015	1,542,186	1,361,300	72,026	950,977	746,890	4,673,379

Source: National Census and Statistics Office, (1980, 1990)

3.2.1.2 Economic Projections

Using the gross provincial product (GPP) estimates developed for the National Road Improvement Project (NRIP) for the provinces of Misamis Oriental, Bukidnon and the two Lanao provinces, the service area product (excluding Camiguin where no estimates are available) is projected to reach ₱60.607 billion by the year 2000 and ₱106.403 billion by the year 2012 (Table 3-6).

Table 3-6
GROSS PROVINCIAL PRODUCT IN THE SERVICE AREA
(Million ₱ in 1987 Prices)

PROVINCE	1987	1992	2000	2012	AVERAGE ANNUAL GROWTH RATE (%)	
					1987-2000	2000-2012
Misamis Oriental	11,137	15,281	22,678	42,014	5.62	5.27
Bukidnon	10,181	12,932	18,097	29,344	4.52	4.11
Lanao del Norte	5,510	7,577	11,255	20,792	5.65	5.25
Lanao del Sur	4,766	6,194	8,577	14,253	4.62	4.32
Total	31,594	41,984	60,607	106,403	5.14	4.80

Source: LBII, 1989. National Road Improvement Project.

A projected growth rate of 5.14% is seen for the area between 1987-2000 (Region X actually grew by an average of 6.4% in 1988 and 1989) but growth is expected to taper off to 4.80% in 2000-2012. On a long-range basis, the average annual rate of growth for the Corridor air transport service area for the next 20 years is placed at a figure of 4.76 percent. With the immense agricultural and manufacturing potentials of the area, especially in agro-based manufacturing/processing operations, the annual growth rate of 4.8% projected for the area over the 20 year study period is considered reasonable especially in light of the plans and programs of the government to accelerate infrastructure development to encourage the establishment of industries within the area.

A structural shift in the economy of the Corridor and air transport service area is anticipated with growth of the component industrial and service sectors. For Region X, NEDA projects that by the year 2010, industry and services will account for 36 and 35 percent, respectively, of the gross regional domestic products (GRDP) from current (1990) levels of 30 and 32 percent (Table 3-7). Agriculture is projected to decline, in terms of contribution to the GDRP, from 38 percent to 29 percent during this forecast period.

Table 3-7
PROJECTED GROSS REGIONAL DOMESTIC PRODUCT
REGION X, 1990 - 2020

	1990		1992		2010		2020	
GROSS VALUE ADDED	IN ₱B	%	IN ₱B	%	IN ₱B	%	IN ₱B	%
GDRP, Region X	6.415	100	14.774	100	32.282	100	57.750	100
Agriculture	2.438	38	4.875	33	9.362	29	14.438	25
Industry	1.924	30	5.171	35	11.622	36	21.496	38
Services	2.053	32	4.728	32	11.298	35	21.368	37

Source: NEDA, 1989
Note: ₱B - pesos, billion

The per capita GPP by province for the service area was estimated utilizing NRIP GPP calculations and extrapolated NCSO medium population projections. The per capita GPP projections are presented in Table 3-8.

Table 3-8
ESTIMATED PER CAPITA GROSS PROVINCIAL PRODUCT IN THE SERVICE AREA
(in pesos, 1987 prices)

PROVINCE	1987	1992	2000	2012
Misamis Oriental	13,029	15,571	19,014	28,449
Bukidnon	13,301	14,908	17,216	22,547
Lanao del Norte	9,589	12,000	14,980	22,771
Lanao del Sur	10,251	12,018	14,243	19,795
Service Area	11,950	14,015	16,536	24,121

Source: Feasibility Study calculations based on NRIP (1989) data
Note: Data on Camiguin unavailable

The NCSO medium projections assume gradually declining population growth rates within the service area over the 1985 to 2012 time period. The GPP is projected to grow at continued moderate rates over the same period. Due to these favorable population and GPP expectations, the per capita GPP in the region, estimated at ₱ 11,950 in 1987, is expected to reach ₱ 24,121 by the year 2012.

3.2.2 Laguindingan

Without the proposed airport, the following conditions are likely to occur within the project area of the barangays Moog, Liberty and Tubajon:

- The current rate of annual population growth (currently 2.8 percent in Laguindingan) will continue, and population density (4.32 persons per ha) will increase as a result.

  This is likely inasmuch as no significant population control and family planning programs are in place locally and migration into the Corridor remains an attractive alternative.

- Public utilities (water, electricity, roads) will continue to be improved and made more accessible, however, gradually.

  Some improvements may occur as early as 1992 as the prompt installation or delivery of public services and infrastructure become good political capital just prior to upcoming national elections.

The municipal development plan of Laguindingan has proposed increasing the number of households served by electricity in the three barangays of Moog, Tubajon, and Liberty and install more water systems in Liberty and Moog. A water system planned for implementation in 1990 for the Moog community has been recently completed.

- Similar levels of health, educational, and welfare infrastructure and services will be provided.

  The provision of public services will still be faced with a lack of supplies such as food, medicine, and learning materials due to limited government revenues. Additional training programs are being planned for the health personnel.

- Increased literacy rates and improved educational opportunities may be realized as enrollments increase, more classrooms are built, and the two public high schools in Laguindingan are upgraded.

- The socio-economic status of most households is likely to remain about the same.

  Households in the three barangays will continue to be largely dependent on traditional agriculture (tobacco, corn, and coconut) and fishing. Yields and incomes from agricultural production are likely to be limited due to inadequate technology, inaccessibility of credit, and high costs of inputs, especially fertilizers.

  Landlessness may prevail in Moog, where 70 percent of households live as tenant farmers in areas that are held by a private corporation. The concerned area of Moog, and adjoining sectors of Laguindingan, are under legal process for zoning conversion and as well as agrarian reform.

- Because of poverty, housing and health conditions within these communities will not significantly improve.

  Adequate housing and common amenities will not be easily affordable due to limited incomes and land tenure issues. Improved levels of nutrition and proper health care will also be constrained by insufficient incomes as well as the continual trend for the concentration of health care facilities within the urban areas of Metro Iligan and Cagayan de Oro.

For the most part, the quantity of public investments and the quality of facilities and services will depend upon the resources and priorities of the local government. To some extent, the allocation and release of public funds have been and still are conditioned on political and party ties.

Changes in these trends, however, may occur if other development efforts in the Corridor, such as the proposed projects identified in the industrial master plan (Figure 3-1), are implemented.

- Employment opportunities will increase as various projects are introduced in neighboring municipalities. Similarly, proposed projects throughout the corridor will have significant indirect effects on Laguindingan, including employment opportunities.

  Particularly relevant to Laguindingan, which presently depends heavily on coconut, corn and tobacco farming, are the proposals to integrate and improve the utilization of coconut lands, introduce grain processing and storage facilities, as well as programs for fruit and vegetable processing. Equally important are the plans to construct more farm-to-market roads.

3.3 PHYSICAL ENVIRONMENT

3.3.1 Air Quality

3.3.1.1 Noise Levels

Without the airport project, the noise levels at the site are likely to remain within the range of existing values which are generally less than 50 dB(A) during the day and typical for rural agricultural environments. However, near the Laguindingan-Alubijid portion of National Highway 1, the noise levels are expected to increase slightly due to the predicted increase in vehicular traffic even without the project.

Noise level attributed to vehicular traffic was predicted using the following equation[2], with the assumption that forecasted vehicular traffic is confined within the period of 5 a.m. to 10 p.m.

$$L_A = L_W - 8 - 20 \log_{10} \ell + 10 \log_{10} (\pi\ell/d\tanh 2\pi\, \ell/d)$$

where L_A = average traffic noise in dB(A)

L_W = average noise power level of vehicular traffic in dB(A);

$$L_W = 86 - 0.2\, V + 10 \log_{10} (a_1 + 8a_2)$$

[2]Source: Philippine Ports Authority, 1991. Batangas Port Development Project, Phase I, EIS. Pacific Consultants International, Inc.

V = average driving speed (assumed 40 kph)

a_1 = ratio of small vehicles

a_2 = ratio of large vehicles

ℓ = distance between noise origin and receptor

d = average queuing distance = $\frac{1000\ V}{N}$ (m)

N = traffic density (no. of vehicles/hr)

Based on the projections of the Feasibility Study, the predicted average daily vehicular traffic along the Laguindingan - Alubijid highway section without the project are:

Year	Small Vehicles	Large Vehicles	Total
1991	1661	293	1954
2001	2887	507	3394
2011	4988	781	5769

The predicted noise levels at various distances along the road for the forecasted traffic density and mix of vehicles are:

Year	Distances from Roadside		
	20 m	50 m	100 m
1991	51.6 dB(A)	50.7 dB(A)	48.8 dB(A)
2001	56.0	54.1	51.3
2011	59.4	56.3	53.3

The calculations show that without the project the noise levels along the Laguindingan - Alubijid section of the highway roadside will still be within the national ambient noise standards for commercial use areas, as defined in Table 3.9.

Table 3-9 ENVIRONMENTAL QUALITY STANDARDS FOR NOISE				
CLASS	AREA/ LAND USE	MAXIMUM ALLOWABLE NOISE LEVEL dB(A)		
		DAY	MORNING/EVENING	NIGHT
AA	Hospitals, Schools	50	45	40
A	Residential	55	50	45
B	Commercial	65	60	55
C	Light-industrial	70	65	60
D	Heavy-industrial	75	70	65
Morning Daytime	5 a.m. to 9 a.m. 9 a.m. to 6 p.m.	Evening 6 p.m. to 10 p.m. Nighttime 10 p.m. to 5 a.m.		

Source: National Pollution Control Commission, Rules and Regulations of the National Pollution Control Commission, Official Gazette, No. 23, Vol. 74, 1978.

3.3.1.2 Total Suspended Particulates

The concentration of total suspended particulates in the Laguindingan site is predicted to remain within the present levels without the airport project.

3.3.2 Water Resources and Water Quality

3.3.2.1 Domestic Water Supply and Demand Scenarios, Project Site

The Town Plan (1990-2000) of Laguindingan notes that half of the existing communal water pumps within the municipality and in the vicinity of the proposed project site are out of service due to the high cost of parts to repair or service these pumps, and limited municipal revenues and budgets to finance such work (Table 2-9). Significant improvement or expansion of the existing water system is not presently scheduled or budgeted for. Based on current and predicted rates of annual population growth, domestic water supply will continue to be constrained in the vicinity of the proposed project site due to the geological limitations of the area (porous limestone, a deep and poor aquifer), inadequate municipal budgets and increased population demands.

3.3.2.2 Proposed Projects within the Corridor

To address the water supply, as well as wastewater treatment needs of the Corridor, several projects are currently undergoing feasibility level studies or are proposed, including:

- Cagayan de Oro Wastewater and Water Supply System Project

  Currently, the feasibility study and master planning of the project is in progress, with scheduled completion in December, 1991. The project consists of identifying improvements to the existing water supply system of Metro Cagayan de Oro City, including the municipalities of Jasaan, Tagoloan, Villanueva, Opol, El Salvador and Alubijid. The improvements may consist of new water supply, transmission and distribution systems, wastewater collection, treatment and disposal systems.

- Iligan Integrated Water Supply and Sewerage Program

  Preliminary feasibility studies are underway with funding for the feasibility study, detailed design and project construction pending approval. The program is designed to improve the existing water supply system and provide wastewater facilities for the city of Iligan.

- Water Supply Improvement and Wastewater Program for selected municipalities of the Cagayan de Oro-Iligan Corridor

  As a proposed project, this program would improve existing waster supply and wastewater systems in selected Corridor municipalities which are outside of the described metropolitan projects. The identified project municipalities include Laguindingan.

3.3.2.3 Ground Water Quality

Based on a single sampling of groundwater at two existing wells and a shoreline spring, the groundwater quality in the site vicinity was described as poor, with tested levels of oil and grease, phenols, phosphates, the pesticide Aldrin, as well as total dissolved solids in exceedence of applicable DENR and DOH standards. The comparable values reported for the free flowing spring discredits the potential that domestic use of the existing well sites has resulted in the apparently poor water quality.

Continued agricultural use of the area, including the intensive cultivation of tobacco using high application rates of fertilizers to compensate for the locally poor, porous soils and potent pesticides to maintain high product value, will foreseeably further lower groundwater quality through infiltration of these chemical products as reflected in the initial laboratory testing results.

3.3.2.4 Coastal Water Quality

Currently, studies[3] are underway to quantify present levels of water quality within the Macajalar Bay and to establish baseline data of point sources of pollution within the bay. These point sources presently include industries (heavy metals and organic wastes), domestic sources (sewage and wastewater), agriculture (pesticides and sediment load), hydraulic gold mining (mercury and sediment load) and deforestation (siltation). In the absence of remedial actions, such as the proposed construction of sewage and wastewater collection and treatment facilities, or effective implementations of existing environmental regulations and proposed programs, coastal water quality in the vicinity of the point sources is predicted to continue to decline.

Due to dilution capacity of the adjoining deep bodies of water and the weak, alternating currents which characterize the adjacent Macajalar and Iligan Bays, high water quality conditions are predicted to continue in the proximity of the Sulauan Point. A pending conversion to industrial zoning for the DCIC property may introduce significant land use charges in the site vicinity and in turn, influence local water quality. For example, an increase in sediment load might occur in the coastal area if a cement production facility was constructed on the property.

3.3.3 Oceanography

Without the proposed project, there will be no significant change in the oceanographic conditions currently prevailing at the site. A noted exception would be approval of the pending conversion to industrial zoning which may revive previous plans to construct a cement plant or other unspecified industrial facilities within the DCIC property. Such use might include coastal development, such as expansion of the existing unimproved wharf facility of DCIC which could, in turn, influence local oceanographic processes such as coastal currents and sediment transport.

3.4 BIOLOGICAL ENVIRONMENT

3.4.1 The Corridor, Problems and Proposed Projects

As envisioned, the Corridor will develop as an industrial/agro-industrial center of the southern Philippines (Figure 3-1). Based on field observations and published reports of past and present development practices, the economic benefit of future developmental growth is predicted to incur further negative impact on the biological environment, including:

---

[3]LBII, 1991. Feasibility Study of Wastewater Collection, Treatment and Disposal, and Water Supply and Distribution System for Cagayan de Oro.

- degradation and deforestation of watersheds due to the sustained demand for upland agricultural areas (shifting cultivation, kaingin) and forest products;

- displacement of coastal wetlands and remnant mangrove areas by physical developments including industrial and port facilities and aquacultural (fishpond) use;

- high rates of upland erosion and coastal siltation due to resultant deforestation, disruptive farming techniques, and traditional hydraulic gold mining practices;

- resultant declines in coastal fisheries and associated habitats such as coral reefs and seagrass beds due to point source declines in water quality (particularly siltation), the tendency for non-sustainable, destructive fishing methods and conversion of wetland and mangrove areas which serve as natural breeding grounds.

The proposed industrial master plan for Corridor (LBII, 1991) identifies specific high priority environmental projects to initiate an environmental approach compatible with the economic and social changes that may accompany industrial development. These recommended projects include:

- Coastal Environment and Resources Management Plan

  This project would outline a plan to rationalize utilization of coastal habitats, particularly wetland and mangrove areas, while encouraging technical improvements to existing aquacultural practices to maximize productivity. The proposed project includes a component for rehabilitation of non-productive or degraded coastal areas.

- Integrated Watershed Management Plan

  The plan would design a comprehensive approach to restoring and managing the watersheds of the Corridor for its hydroelectric energy potential and associated economic and multiple resource-use benefits.

- Solid Waste Management Plan

  To accommodate forecasted population and solid waste demands, the plan would identify facility sites and management processes.

- Environmental Pollution Management Plan

  This project would design and implement an environmental pollution control and monitoring system, outline protocol and procedures to ensure continuity in safeguarding the environment of Corridor.

- Social Conflict Resolution Project

  As designed, this projects is a conflict resolution study that would result in identifying strategies and an action plan to resolve social issues of development, such as those associated with the Agus I Hydroelectric and Mt. Apo Geothermal projects.

Actual implementation of these proposed projects would provide substantial mitigation of predicted degradation of the biological environment due to continued development, industrialization and population growth of the Corridor.

On going projects identified by the Provincial Environment and Natural Resources Office (PENRO) of Misamis Oriental include mangrove reforestation in the municipalities of Alubijid (20 ha) and Libertad (10 ha), upland reforestation, also in Alubijid (50 ha), as well as a review of existing foreshore/wetland leases and forest management leases to further evaluate appropriate land use.

3.4.2 Terrestrial Habitats, Laguindingan Site

The project site is characterized as being currently devoted entirely to agricultural use with only borderline areas, including steep slopes, exposed limestone outcrops and sections of the deep ravine, containing remnant pioneer and successional floral communities representative of natural habitats. It is unlikely that present farming in the area would diminish to a point sufficient for natural habitat improvement. The proposed zoning conversion, to industrial use, would foreseeably displace the remaining habitat for floral and faunal species that currently co-exist with the present intensity of agriculture practiced in the area.

3.4.3 Coastal Marine Habitats

The marine habitats in the proposed project site vicinity of Laguindingan are characterized as significant and critical relative to the status (generally developed or seriously impacted) and distribution (scarce) of correspondingly habitats within the Corridor. For example, in a 1984 study of coral reef conditions at seven survey stations within Iligan Bay, Mendoza (in NPC, 1991) described relatively poor to fair coral conditions based on surveys of live coverage. He attributed this condition to both man-made and natural influences, including unlimited coral and shell collections, dynamite fishing, anchor damage, effluents from industrial plants and crown-of-thorns starfish (Acanthaster) infestations. Mendoza reported strong indications that natural and man-made siltation, from river sources around the bay, contributed significantly to the declining condition of coral reefs within Iligan Bay.

In the absence of regulatory actions coupled with community-level programs concerning ecological awareness, the traditional harvest of the clam Phacoides argenta will continue in the reef flat seagrass beds off Tubajon resulting in the predicted depletion of the associated seagrass-clam reef flat community. Displacement of the turf-like seagrass beds will increase wave-generated turbidity over the muddy reef flat which would secondarily impact the silt-sensitive species of the algal-dominated reef front and the coral-dominated reef front.

Sections of the sensitive wetland area identified along the western link of the existing access road to Tubajon (Figure 2-29) are currently used for pasture purposes with an estimated 25 percent of the landward area of these wetlands presently fenced and cleared for grazing. Continued encroachment into this wetland area is anticipated, including potential aquacultural developments near the presently inactive, privately-owned BHT Prawn Hatchery.

CHAPTER 4
ASSESSMENT OF ENVIRONMENTAL IMPACTS

CHAPTER 4

ASSESSMENT OF ENVIRONMENTAL IMPACTS

4.1 REGIONAL LAND USE AND PLANNING

The Feasibility Study recommends that to substantially improve air transport services within the Cagayan de Oro-Iligan Corridor, a new airport facility meeting international standards should be constructed at the Laguindingan site in the short-term future.

The proposed industrial master plan for the Corridor (LBII, 1991) identifies light industrial and/or agro-industrial type development as being the most feasible land use outside the metropolitan population centers of Iligan and Cagayan de Oro (Figure 3-1). The implementation of the proposed airport project prior to extensive planning for economic expansions within the Corridor would foster a more orderly development process. The new airport facility would be centrally located within the Corridor, thus providing more equalized access to the proposed facilities while supporting the identified objective of dispersing development not only within the Corridor but also towards countryside economic development zones outside of the National Capital Region.

4.1.1 Existing Air Traffic Facilities

Following PAL's policy of considering commercial air service areas to generally extend 200 km from an operating airport, the implementation of the project would entail closure of commercial operations at the existing Cagayan de Oro and Iligan airports. Based on the general construction schedule (Table 1-8), commercial operations could be transferred to the new Laguindingan Airport as early as 1996. The disposition of the Lumbia (150 ha) and Balo-i (27 ha) facilities would be the subject of government action. Suggested future use for these public facilities and land areas include agricultural, agro-industrial and housing use. The expansive grassland/pastures adjoining the Lumbia facility are reportedly slotted for land distribution under the agrarian reform program. The continued use of these airports for non-commercial flights, including general aviation, as well as charter and military flights might also be considered by the respective government agencies. For traffic forecast purposes, the Feasibility Study assumes that all air service, commercial as well as non-commercial, will be transferred to the new Laguindingan facility upon completion of construction.

4.1.2 Project Site Land Use and Planning

Implementation of the proposed airport project will directly impact the present, if marginal, agricultural use of the identified 167 ha Laguindingan site, in addition to limited areas displaced within the right-of-ways (ROW) of existing access road alignments. Presently zoned for agricultural use, 40 to 50 percent of the proposed site is owned by Diamond Cement and Industrial Corp. (DCIC) and is under application for zoning conversion to industrial use, supported by municipal resolutions (Appendix D-1). At the same time, the entire DCIC property of 604 ha has reportedly been in the process of land distribution under the Comprehensive Agrarian Reform Program (CARP) since October, 1989 (Appendix D-3).

Recent discussions held with officials of the Department of Agrarian Reform (DAR), indicate that the proposed airport project does not contradict the spirit of agrarian reform as it would be considered a project of national significance and facilitate the transfer of a large private holding to public ownership. According to Region X officials of the Housing and Land Use Regulatory Board (HLURB), for projects of national significance, zoning conversion could be facilitated through a special use variance (approved by the national level office) with a locational clearance (approved by the regional level office). Available procedures for regular zoning conversions are included in Appendix D-12.

Per the Comprehensive Zoning Ordinance for the Municipality of Laguindingan (Section 44 paragraph 5, Town Plan 1990-2000), airport runways:

- cannot be located within 100 m of the nearest residential zone;
- cannot pose a hazard;
- must comply with regulations of the Air Transportation Office (ATO).

4.1.3 Air Traffic Forecasts, Laguindingan Airport

Forecasts of potential air traffic at the designed Laguindingan airport are described in detail within the Feasibility Study. The criteria applied in generating these forecasts include:

- Existing and forecasted air traffic patterns at existing Corridor airports and within the national air transport system;
- Diversion of forecasted air traffic from the Cagayan de Oro and Iligan airports to the completed Laguindingan airport;
- Potential for induced air traffic at the Laguindingan facility with the availability of more convenient flight schedules and routes;

- Capacity of additional air cargo with the introduction of wide body A300 aircraft service;
- Development plans and programs within the Corridor.

A summary of these generated forecasts are included in Tables 4-1 to 4-6, and Figures 4-1 and 4-2.

Table 4-1
SUMMARY OF AIR PASSENGER FORECASTS, LAGUINDINGAN AIRPORT
(without induced traffic)

YEAR	LOW CASE		BASE CASE		HIGH CASE	
	NUMBER OF PASSENGERS	AVERAGE GROWTH RATE (%)	NUMBER OF PASSENGERS	AVERAGE GROWTH RATE (%)	NUMBER OF PASSENGERS	AVERAGE GROWTH RATE (%)
1996	364,787		410,484		456,094	
2001	419,370	2.8	486,312	3.4	553,324	3.9
2006	471,255	2.4	558,957	2.8	651,702	3.3
2011	520,759	2.0	625,344	2.3	757,775	3.1

Source: LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Corridor Airport.

Table 4-2
SUMMARY OF AIR PASSENGER FORECASTS, LAGUINDINGAN AIRPORT
(including induced traffic)

YEAR	LOW CASE					
	NUMBER OF PASSENGERS	AVERAGE GROWTH RATE (%)	NUMBER OF PASSENGERS	AVERAGE GROWTH RATE (%)	NUMBER OF PASSENGERS	AVERAGE GROWTH RATE (%)
1996	384,852		433,061		481,290	
2001	462,101	3.7	535,864	4.4	609,704	4.8
2006	519,314	2.4	615,961	2.8	718,163	3.3
2011	573,905	2.0	689,164	2.3	835,111	3.1

Source: LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Corridor Airport. Draft Final Report.

Table 4-3
SUMMARY OF AIR CARGO FORECASTS, LAGUINDINGAN AIRPORT
(without induced traffic or A300 service)

YEAR	LOW CASE		BASE CASE		HIGH CASE	
	NUMBER OF PASSENGERS	AVERAGE GROWTH RATE (%)	NUMBER OF PASSENGERS	AVERAGE GROWTH RATE (%)	NUMBER OF PASSENGERS	AVERAGE GROWTH RATE (%)
1996	5,238		5,863		6,567	
2001	6,095	3.1	7,019	3.7	8,123	4.3
2006	6,896	2.5	8,127	3.0	9,642	3.5
2011	7,758	2.4	9,141	2.4	11,166	3.0

Source: LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Corridor Airport. Draft Final Report.

Table 4-4
ADDITIONAL CARGO-CARRYING CAPACITY, LAGUINDINGAN AIRPORT
(base case scenario, with A300 service)

YEAR	MOVEMENTS (A300)	ADDITIONAL CARGO CARRYING CAPACITY (MT)
2001	486	9,943
2006	751	15,366
2011	994	20,336

Source: Philippine Airlines, and LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Corridor Airport. Draft Final Report.

Note: Air cargo for 1991 is approximately 4700 MT at existing Corridor airports and forecasted as 9141 MT without A300 service.

Table 4-5
FORECASTED ANNUAL COMMERCIAL AIRCRAFT MOVEMENTS, LAGUINDINGAN AIRPORT
(including induced traffic)

YEAR	LOW CASE					BASE CASE					HIGH CASE				
	REGIONAL MOVEMENTS		MANILA MOVEMENTS		TOTAL MOVEMENTS	REGIONAL MOVEMENTS		MANILA MOVEMENTS		TOTAL MOVEMENTS	REGIONAL MOVEMENTS		MANILA MOVEMENTS		TOTAL MOVEMENTS
	CLASS 1	CLASS 2	CLASS 2	CLASS 3		CLASS 1	CLASS 2	CLASS 2	CLASS 3		CLASS 1	CLASS 2	CLASS 2	CLASS 3	
1996	1,641	1,228	2,097	0	4,966	1,487	1,381	2,360	0	5,588	2,052	1,535	2,621	0	6,208
1997	1,690	1,264	2,256	0	5,210	1,913	1,431	2,555	0	5,899	2,137	1,599	2,854	0	6,590
1998	1,739	1,301	2,394	0	5,434	1,982	1,483	2,728	0	6,193	2,224	1,664	2,190	514	6,592
1999	1,790	1,339	2,462	0	5,591	2,052	1,535	2,824	0	6,411	2,314	1,731	2,190	587	6,822
2000	1,841	1,377	2,534	0	5,752	2,124	1,589	2,923	0	6,636	2,406	1,800	2,190	661	7,057
2001	1,887	1,411	2,596	0	5,894	2,188	1,637	2,190	486	6,501	2,489	1,862	2,190	729	7,270
2002	1,933	1,446	2,660	0	6,039	2,253	1,685	2,190	538	6,666	2,575	1,926	2,190	798	7,489
2003	1,980	1,482	2,726	0	6,188	2,319	1,735	2,190	592	6,836	2,662	1,991	2,190	869	7,712
2004	2,028	1,518	2,792	0	6,338	2,367	1,786	2,190	647	7,010	2,751	2,058	2,190	941	7,940
2005	2,077	1,554	2,858	0	6,489	2,457	1,838	2,190	704	7,189	2,842	2,126	2,190	1,015	8,173
2006	2,120	1,586	2,917	0	6,623	2,515	1,881	2,190	751	7,337	2,932	2,193	2,190	1,088	8,403
2007	2,163	1,618	2,190	433	6,404	2,574	1,925	2,190	799	7,488	3,023	2,262	2,190	1,162	8,637
2008	2,207	1,651	2,190	468	6.516	2,634	1,970	2,190	848	7,642	3,116	2,331	2,190	1,237	8,874
2009	2,252	1,685	2,190	540	6,667	2,695	2,016	2,190	898	7,799	3,212	2,403	2,190	1,315	9,120
2010	2,297	1,718	2,190	577	6,782	2,758	2,063	2,190	949	7,960	3,309	2,476	2,190	1,394	9,369
2011	2,343	1753	2,190	614	6,900	2,813	2,105	2,190	994	8,102	3,409	2,550	2,190	1,475	9,624

Note: Class 1 aircraft correspond to F50 turboprop with about 50 seats; Class 2 aircraft, narrow-body B737 jet with about 140 seats; and Class 3 aircraft, wide-body A300 jet with about 240 seats.
Forecasts assume closure of existing Cagayan de Oro and Iligan Airports.

Source: LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Corridor Airport.

156

Table 4-6
FORECASTED ANNUAL NON-COMMERCIAL AIRCRAFT MOVEMENTS, LAGUINDINGAN AIRPORT
(low, base and high case scenarios)

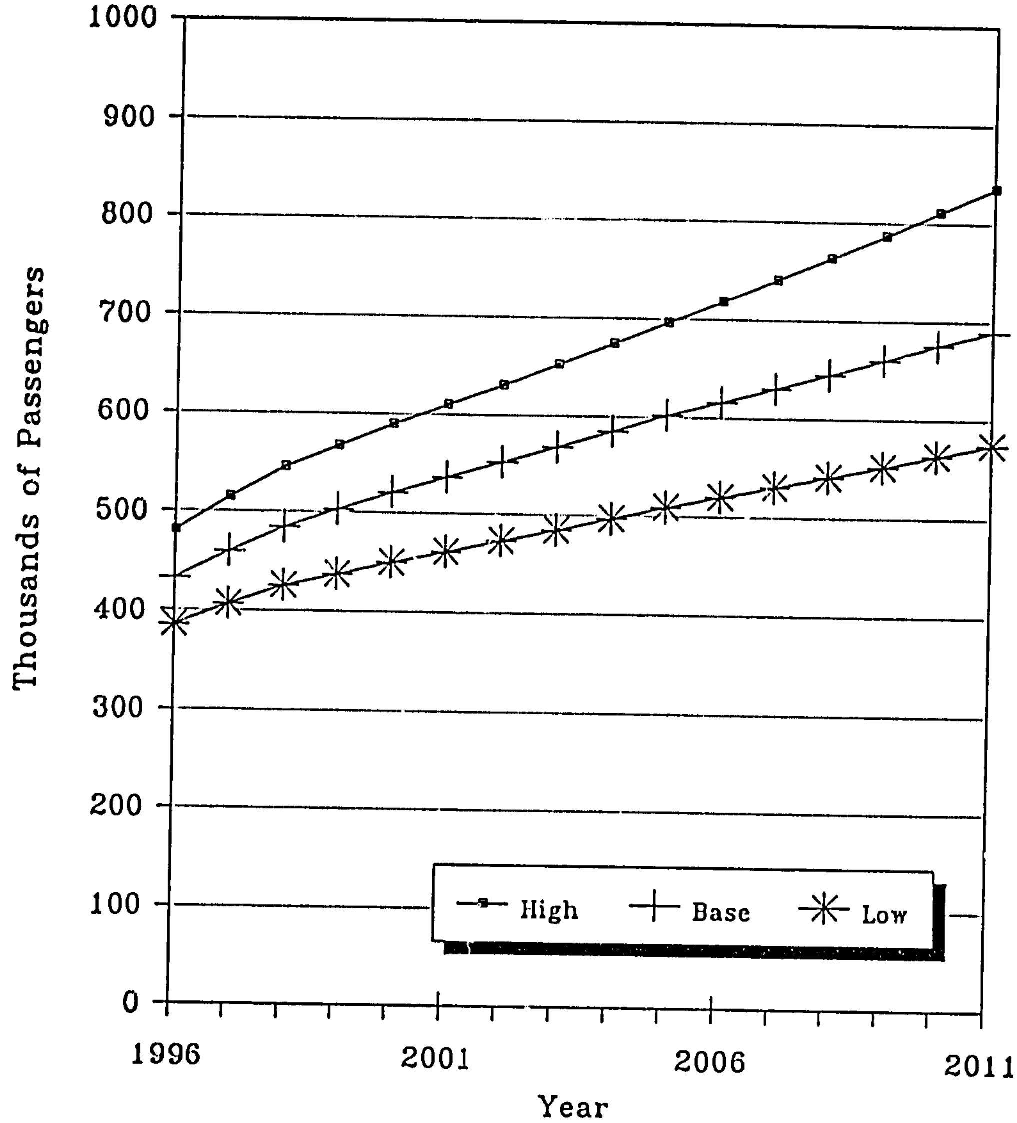
YEAR	LOW	BASE	HIGH
1996	5,780	6,378	6,983
2001	6,301	6,301	7,985
2006	6,788	6,788	8,964
2011	7,312	7,312	9,946

Source: LBII, 1991. Feasibility Study and Master Planning Cagayan de Oro-Iligan Airport. Draft Final Report.
Note: Forecasts assume closure of existing Cagayan de Oro and Iligan airports.

With the noted exception of greatly increased air cargo capacity with the introduction of A300 service, the forecasted air traffic for the proposed Laguindingan airport basically represents the summed, total air traffic forecasted for the existing Corridor airports and presented in the previous chapter. For example, comparison of the base case scenarios (Tables 3-1, 3-2, 4-1 and 4-2) for the year 2011, the number of air passengers utilizing the Laguindingan airport will represent an estimated 4.4 percent (or 5.4 percent with induced traffic) increase over the combined passenger forecasts for the upgraded Cagayan de Oro and Iligan airports. By the end of the forecasting period, the number of passengers at the new airport is expected to be between 573,905 (low case scenario) and 835,111 (high case scenario), with annual average growth rates ranging from 2.6 to 4.5 percent. For comparison, the existing Corridor airports reported a combined total of 333,325 passengers for 1990.

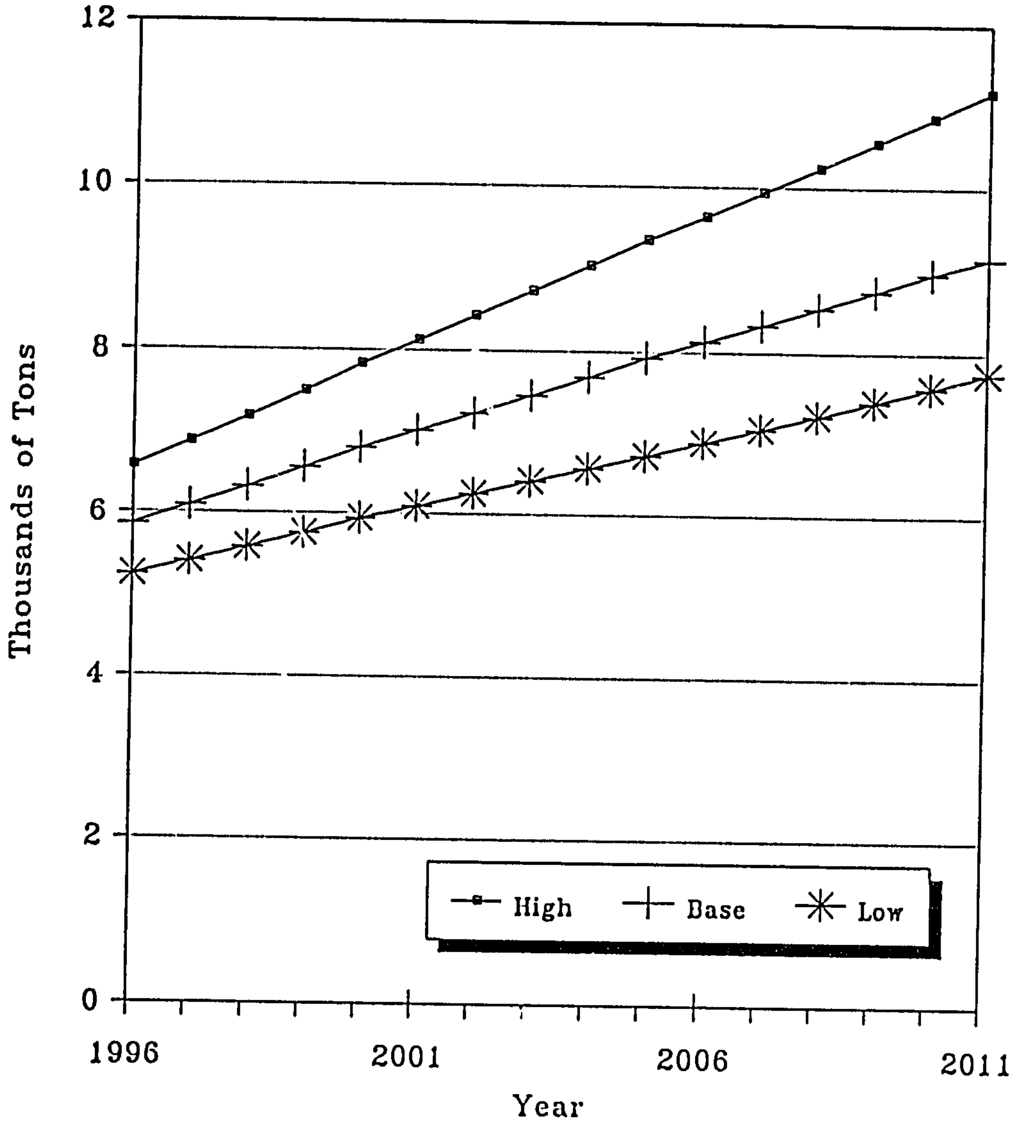
In contrast, the total volume of aircraft movements for the same base case scenario, year 2011 comparison, will decrease an estimated 4.8 percent with the projected use of larger Class 2 (narrow-body B737) and Class 3 (wide body A300) aircraft at the proposed airport. The forecasts for volume of air cargo and number of non-commercial aircraft movements are identical with or without project implementation. The potential introduction of A300 service, as projected for the Laguindingan facility in the year 2001 under the base case scenario, will offer additional cargo carrying capacity, estimated at 20,336 MT by the year 2011. Compared to the air cargo forecast of the existing airports (9141 MT in the year 2011), the additional cargo capacity of A300 service at the end of the study period will represent a 222 percent increase under the base case scenario.

In brief, with the noted exception of air cargo capacity, the air traffic forecasts for the proposed Laguindingan airport represent values that are transferred from existing facilities and Corridor demands rather than reflecting the generation of significant new air traffic within the Corridor.



SOURCE : FEASIBILITY STUDY

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO. : 492 - 0452 - C - 00 - 0099 - 00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 4 - 1
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	AIR PASSENGER FORECAST, LAGUINDINGAN (WITH INDUCED TRAFFIC)	



SOURCE: FEASIBILITY STUDY

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 4-2
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT • GLOBETROTTERS ENG'G. CORP. SERVICES INC.	AIR CARGO FORECAST LAGUINDINGAN AIRPORT (WITHOUT INDUCED TRAFFIC OR A300 SERVICE)	

4.2 EFFECTS ON SOCIO-ECONOMIC CONDITIONS

The proposed airport is predicted to have positive as well as negative impacts on the socio-economic conditions in the three immediate barangays (Moog, Liberty, and Tubajon), the municipality of Laguindingan and the Corridor as a whole.

In the short-term, the local communities will benefit from the employment and income opportunities that will be created, particularly during the construction of the airport, access roads and other related infrastructure:

- Some 300 to 400 workers are estimated to be required during the two to three year construction period. A majority of the construction workers are anticipated to be locally hired.

- Households will be able to establish small-scale enterprises such as "sari-sari" or variety stores and "turo-turo" or food stalls, or engage in business as itinerant vendors and service providers (e.g., laundry needs).

In the long-term, airport operations will have other positive consequences for local residents:

- Local labor may be hired as porters, maintenance and service crews.

- An increased demand for food and personal services will stimulate the growth of small-scale businesses in the area, which may be in addition to the anticipated on-site concessions.

- The improved access road network will enable people to have greater mobility and access to essential services (hospitals, colleges, government offices) and markets which are currently concentrated in the cities.

The local barangays and municipal government will benefit as well from the tax revenue that will be generated, particularly in light of the recent enactment of the national Local Government Code.

- Land values and the volume of airport-related economic activities will increase.

- Given the distance of the proposed airport from the cities of Cagayan de Oro and Iligan, companies (particularly those involved in transport and cargo operations) will be more likely to put up offices in Laguindingan, near the airport facility.

- The municipality's public services and utilities, especially power, water and telecommunication, will also be upgraded as these are considered essential to the efficient operations of the airport.

In a wider context, the proposed airport, along with such projects as described in the Cagayan de Oro - Iligan Corridor Industrial Master Plan (LBII, 1991), will spur further growth in Laguindingan and adjacent municipalities situated midway between the identified growth centers of Iligan and Cagayan de Oro. The development of this zone may help serve to decongest the two principal Corridor metropolitan areas whose populations have rapidly increased while dispersing development and associated benefits within the central Corridor sector.

Implementation of the proposed airport may also incur significant social costs.

- Around 380 households (or 1,700 people) currently living on the property of Diamond Cement and Industrial Corp. (DCIC) may need to be relocated should the corporation decide to develop their 604 ha. property as an indirect result of implementing the airport plans and approved zoning conversion. This number includes the majority of the 220 households currently residing and farming within the proposed airport site.

- The relocation process itself may cause immediate difficulties for the families to be displaced as they will need sufficient resources and materials for demolishing, transferring, or renovating their houses, or building new ones.

- Economic and socio-psychological problems are also to be expected during the resettlement process, as people learn to cope with changes in their lives and adapt to a new site and situation.

- Relocation may require farmers to adjust their production systems and strategies, if not change their livelihood altogether.

- People may be deprived of the kind and quality of utilities (electricity and water) and services (education and health) already available and physically accessible to them, as well as the community conditions with which they currently share

- Families will need to cope with changes in neighborhood and community relationships. The possible shift to a more clustered settlement will rearrange the physical and social distances among neighbors.

4.2.1 Community Perceptions

The socio-economic impacts of a proposed project may be perceived differently by those directly affected by it. For this reason, 62 household heads were interviewed from the 220 households residing within the proposed site. This sample size has a sampling error of 0.10, reliability at 0.95. Appendix A-1 provides the methodological details of the survey while a profile of the respondents is included in the Appendix D-2.

The perception survey provided the following results:

- All the respondents were aware of the proposed airport project prior to their interview.

  The majority of the respondents reported that they had talked to or had seen the Feasibility Study field surveyors (25 respondents), while one out of four had heard about the proposed project from either their barangay captain (15) or their neighbors (11), if not from community members in general (3). Four respondents said they had heard about the proposed project over the radio.

- Sixty-six percent said that they were in favor of the proposed plan to build an airport, 31 percent were opposed, while three percent had no opinion (Table 4-7).

  Those in favor of the airport said that their community would develop as a result of the project or that it was not their land anyway.

  Those opposed to the project felt that they would lose their land and crops, their livelihood, or their homes as a result. Others complained that relocation would be difficult, many of them not having any other place to go to.

- All respondents feel that some things should be done first before the plan is finalized.

  About half of the surveyed residents essentially conveyed the same message: the project should first conduct preliminary studies, convene meetings, discuss and consult with the people, solicit their opinions, inform them about the plan and make them understand it, listen to the voice of the majority, and negotiate with the residents.

  Others suggested that the project should provide a relocation site, provide jobs, or explain the mechanics of compensation, while some cautioned that the project should allow sufficient lead time to avoid disrupting traditional harvest cycles.

- Residents generally felt that the airport would have negative effects on local animal and plant life and on the ambient quality of the air, water, and soil.

  In their view, plants and animals in the area would eventually die or disappear as their natural food supply is reduced or their growth disrupted. It is generally anticipated that the local air and water will be polluted, and the soil eroded.

Table 4-7
SELECTED RESULTS FROM A SURVEY OF 62 HOUSEHOLDS WITHIN THE PROPOSED AIRPORT SITE

ITEM/CATEGORY	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
1. **In favor of airport plan**		
No explanation	13	21
The barangay, the municipality, or the province will be developed	12	19
We don't own the land anyway	9	15
Others are in favor	3	5
We can't oppose the government's decision	2	3
Other single responses	2	3
Opposed to airport plan		
Loss of land, crops, livelihood, home	7	11
Not easy/nowhere to transfer	5	8
Lives will be disrupted	4	6
Other single responses	3	5
2. **Suggestions prior to finalization**		
Make people understand	15	24
Inform/discuss with people	9	15
Call people to a meeting	5	8
Consult/solicit opinions	3	5
Get resident's consent	2	3
Listen to voice of majority	1	2
Provide relocation site	3	5
Provide work	3	5
Explain mechanics of compensation	1	2
Give lead time/don't rush	2	3
Just say when/will readily agree	3	5
Definitely not in favor/better if plan doesn't push through	4	6
Other single responses	6	10

163

Table 4-7 (continued)

ITEM/CATEGORY	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
3. Effects on...		
Animal and plant life		
Don't know	2	3
Bad/negative	16	26
Growth will be disrupted	10	16
Animals/plants will die	11	18
Animals/plants will disappear	20	32
Air, water, and soil quality		
Don't know/no answer	9	15
Bad/negative	14	23
Polluted/no longer fresh	15	24
Soil will be eroded	15	24
Other single responses	9	15
4. Benefits for ...		
Municipality/Province		
Increased taxes/income for government	28	45
Travel and transportation made easier	12	19
Employment and benefits to people	9	15
Progress for the province	6	10
Households		
More jobs/employment	21	34
Increased business/income opportunities	13	21
Greater mobility/easier transportation	10	16

164

Table 4-7 (continued)

ITEM/CATEGORY	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
5. Negative effects on		
Municipality and Province		
Loss of land/farm	17	27
Life will change/be disrupted	7	11
Lower/decreased farm production	6	10
Landscape will change	3	5
Dangerous to cross the airport/runway	3	5
Other single responses	4	6
Households		
Loss of land/farm	13	21
Loss of livelihood	8	13
Loss of jobs	6	10
Life inconvenienced/disrupted	8	13
Sound of planes will be disturbing	6	10
Usual routes to the sea will be blocked	3	5
6. Forms of assistance identified by respondents		
Cash		
Money	19	31
Financial support in order to live	1	2
Money for housing	1	2
Payments		
For farmland	5	8
For crops	4	6
For house	1	2
Lot/farm/free land	20	32
House/free house	19	31
Jobs/livelihood opportunities	11	18

Table 4-7 (continued)

ITEM/CATEGORY	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
7. **Where would respondent want to be relocated, if ever?**		
Some barangay (Moog/Liberty)	28	45
Not too far from the airport	8	13
Close to the sea	4	6
Far from the airport	4	6
Adjacent barangay	7	11
Other single responses	1	2
8. **Reasons for preferred relocation site**		
Native to/born/grew up in the area	12	19
Avoid any danger from airplane	8	13
Close to the sea/can go fishing	7	11
Work opportunities are available	7	11
Family/community won't be separated	4	6
We don't want to live too far	4	6
Owns land there	2	3
Other single responses	8	13
9. **Amount of financial assistance for dislocation which respondent would consider just and fair**		
₱ 20,000 and less (per household)	5	8
21,000 - 40,000	11	18
41,000 - 60,000	9	15
61,000 - 80,000	3	5
81,000 - 100,000	4	6
101,000 - 200,000	6	10
201,000 and over	1	2

♦ People recognize the benefits of the project for the municipality and province as a whole, and for the affected households as well.

Residents cited the potential for increased tax revenue for the government, the employment opportunities and benefits to the people, and the overall progress for the province. Others mentioned that transportation will be much easier -- especially for those who can afford it, some added.

The benefits expected for the households include more jobs and employment, increased business and income opportunities, and greater mobility or easier transportation.

- Residents realize that the presence of the airport will also have negative effects.

  For the municipality, the province and particularly for the households in the area, the construction of the airport is expected to result in loss of land, traditional livelihood and incomes. Lifestyles and livelihoods will change or be disrupted, in part due to the anticipated disturbing sound of the airport operations. Farm land available for cultivation and the total production would be reduced.

  Asked whether they had plans of moving elsewhere, the majority (89 percent) of respondents said they preferred to stay within the area.

- If the proposed airport pushes through and relocation should follow, respondents feel that certain kinds of assistance should be provided to them.

  For the most part, some financial support and cash compensation for the existing farms, crops and houses is expected. One out of three respondents want either a farm lot or a house for free. Others feel that jobs and livelihood opportunities should also be provided.

- If relocation is necessary, almost all respondents would still want to stay nearby, preferably in the same or adjacent barangay. Others specified that they should be either close to the sea or far from the airport.

  Most respondents explained that they grew up in or are native to the area. Some wanted to stay close to the sea so that they could continue fishing, while others wanted to be far from the perceived danger posed by the airport. Other reasons cited include the work opportunities in the area, the desire to be close to neighbors, or ownership of secondary properties.

- Asked what would be a fair and just amount of financial assistance for their displacement, 39 respondents gave estimates ranging from ₱15,000 to ₱500,000, or an average (mean) of ₱68,205.00. The rest did not provide any estimate.

4.2.2 Scoping Sessions

As part of the environmental assessment process, scoping sessions were held at an early stage of the project in Quezon City, Iligan and Cagayan de Oro in order to solicit the concerns, recommendations and perceptions of various parties that might potentially be affected by the project. During these sessions, four initially identified project alternatives were presented:

Alternative 1 - Improve facilities at the two existing airports to support continuation of present airline service patterns;

Alternative 2 - Construct a new airport at Linamon to be able to support daytime narrow-body jet operations, while making minor improvements at Lumbia to support continuation of present service patterns;

Alternative 3 - Implement a new airport at Laguindingan in the short term future;

Alternative 4 - Implement a new airport at Laguindingan in the future, as required to accommodate efficient commercial air traffic movements.

Public comments to the project alternatives presented during the scoping sessions essentially focused on the following points:

- Participants from the Lanao provinces, particularly from Iligan City, expressed strong preference for the construction of a new airport at Linamon.

  While recognizing the long-term benefits of an airport at Laguindingan, participants stressed that the need for an airport at Linamon is more urgent and immediate. They argued that the latter alternative will benefit a greater number of people inasmuch as it would be serving a wider area consisting of five provinces and three or more cities. Some of the physical or geographic features of Linamon were also cited in support of their proposal.

- Participants were concerned about the lands that will have to be converted for the airport, the families that may be dislocated, and the need for continued consultations with the parties affected.

  Representatives from non-government organizations asked about the ownership of the agricultural lands in Laguindingan and about possible problems of acquisition. They suggested that discussions should be held with the people affected. In turn, the local government representative of Laguindingan was optimistic that arrangements could be made with the current owner, the Diamond Cement and Industrial Corporation/Ayala Corporation

- The need to identify the cultural communities and archaeological resources that may be present in the proposed sites.

  Representatives from tribal communities expressed the hope that cultural communities were not unduly affected or displaced by the proposed airport. The need to conduct an archaeological investigation of the proposed project vicinity was also raised.

4.2.3 Employment Effects of the Laguindingan Airport

4.2.3.1 Construction

The construction of an international standard airport at Laguindingan is expected to have a three-fold effect on employment activities within the project's immediate vicinity:

- Direct employment impact of airport construction and operation;
- Induced employment that will be generated by concessionaires and related service-oriented businesses that could be established within the airport facility and vicinity;
- Indirect employment related to associated development of the adjoining areas.

During the proposed three year construction period of the new airport (1993-1995), the following breakdown of man-months will most likely be sourced from within the Corridor area:

DIRECT CONSTRUCTION PERSONNEL

TYPE OF SKILLS	NO. OF MAN MONTHS
- Foreman	61
- Leadmen	125
- Carpenters	585
- Masons	310
- Pipefitters/Plumbers	200
- Welders	80
- Riggers	75
- Painters	95
- Steelmen	160
- Electricians	171
- Tinsmiths	100
- Rebarmen	505
- Laborers	1,870

	4,337

In addition to personnel who will be involved directly in construction, support personnel will be required with the following breakdown of man-months:

INDIRECT CONSTRUCTION PERSONNEL

TYPE OF SKILLS	NO. OF MAN-MONTHS
- Timekeepers	90
- Accounting	84
- Warehousemen	85
- Equipment Management	583

	842

Based on traditional practices in the Philippines, it is expected that the construction company designated to build the airport will hire the majority of its personnel, notably, the semi-skilled and unskilled category from within the project vicinity and Corridor communities. The estimated total value of the payroll for the entire project (including supervisory personnel) for the 34-months construction period is ₱86.793 million.

It is estimated that, of the ₱314,937,000 local component of the airport project, 61 percent, or ₱192,112,000 will be spent within the Corridor for labor, materials, food, rent, and similar items. The cement industry in Iligan is perhaps the most obvious beneficiary among local sectors during the construction period. Some 944,000 bags of cement are required for project construction, with a current market value of approximately ₱94.4 million. Sand, gravel and other quarrying activities, along with truck transport firms, will receive some ₱100 million in new business.

In addition, these expenditures will have multiplier, or secondary effects: individuals and firms receiving these benefits may spend most of the income in the form of goods, services, and real estate, stimulating civil construction, production of foodstuffs, services, and other businesses. They may also deposit part of their earnings in local banks, increasing reserves and the ability of the local financial market to make additional loans.

4.2.3.2 Operations and Maintenance

The personnel that will be required to operate and maintain the new Laguindingan airport could be selected from the existing personnel of Lumbia and Balo-i airport facilities, including supervisory and technical positions and personnel occupying permanent career (plantilla) positions.

It is expected that the consolidation of operations at Laguindingan will,however, have a negative impact on some non-permanent, casual employees and concessionaires. Some employees and concessionaires might find it difficult to transfer their families and/or the additional transportation cost to Laguindingan may too prohibitive for them to relocate their source of employment to the new airport.

4.2.3.3 Induced Employment

Closure of commercial flight operations at the existing airports will directly affect concessionaires currently operating shops and businesses within these facilities. For example, there are presently seven restaurants, four gift shops, 21 snack stands and 12 porters at the Cagayan de Oro Airport facility. In addition, there are also public transportation utilities (PUs) that service the airport, reportedly involving 45 vehicles (taxis and tricycles) and 128 employees. Subject to adapted policies at the proposed airport, many of these existing concessionaires could be accommodated at the new airport facility.

Within the designed terminal building of the new airport, ample space has been provided to accommodate concessionaires, including a moderate size restaurant and eight other concession areas for food stands, gift shops, newspaper/magazine stands and others. These businesses have the potential for generating permanent employment for an estimated 30 to 50 employees.

Considering the traffic forecasts and the importance of this new airport to the Corridor and the corresponding service area, other complimentary establishments are expected to be put up outside of the terminal building or airport facility. These additional establishments collectively have substantial potential for employment generation within the airport vicinity.

On a broader perspective, the availability of more cargo-carrying capacity within the airport service area with the introduction of the wide-body A300 aircraft is anticipated to induce income-generating and employment generating activities including the production of perishables, such as fruits, seafoods and cut-flowers and value added agro-processing.

The service area, notably Bukidnon and Misamis Oriental, has substantial potential for the production of high value, perishable agricultural crops and other commodities:

- *Fruits.* Bukidnon and Misamis Oriental currently produce a significant volume of mangoes, papaya, bananas, guyabano, pineapple, and other fruits that command high demand and prices in Metro Manila. Lanzones produced in Camiguin, Gingoog, Balingoan, and Kinoguitan are currently shipped by sea to Cebu and Metro Manila.

- *Vegetables.* Vegetables produced in Claveria, Misamis Oriental, and Bukidnon, including tomatoes, cabbages, cauliflowers, carrots, ampalaya, and eggplants, are also presently shipped by sea to Cebu, Dumaguete and Metro Manila.

- *Tropical flowers and ornamental foliage* (orchids, leather leaf ferns, etc.) have demonstrated their productive potential in the region. The Corridor's excellent climate and relatively typhoon free location is ideal for commercial production of these items.

- *Meat products.* The provinces within the service area are likewise emerging as important suppliers of fresh and processed meat (beef and pork) to Metro Manila, Cebu, and other areas.

An analysis of the composition of the outgoing cargo of the existing Cagayan de Oro Airport over a six month period (July to December 1989) revealed the cargo breakdown shown in Table 4-8.

Table 4-8
CARGO BREAKDOWN AT CAGAYAN DE ORO AIRPORT
(July to December 1989)

TYPE OF CARGO	WEIGHT (kilograms)	% DISTRIBUTION
Documents	48,870	3.7
Consolidated Cargo	58,129	4.4
Perishables	73,864	5.6
Fruits/Vegetables	1,021,099	77.0
Wet Shipments	23,220	1.8
Clothing/Textiles	105,844	0.8
Others	89,553	6.8

Source: Air Transportation Office, DOTC

These figures indicate that close to 85 percent of the total outgoing cargo from the Cagayan de Oro Airport consists of perishables, fruits, vegetables, and wet shipments for which efficient, dependable, and fast air transport is essential.

- Fruits and vegetables traders in Cagayan de Oro indicated that one of their main problems and/or constraints is lack of sufficient and dependable air cargo space to accommodate their products. Transporting by ship is unreliable, time-consuming and spoilage-prone. Results of discussions with PAL operations officials in Cagayan de Oro seem to strengthen this contention; PAL currently lacks the capability to accommodate large-scale shipment of agricultural products from the Corridor, since most of the limited cargo space available in the B737 is reserved to accommodate excess baggage.

- There are also indications that because of limited cargo-carrying capacities in other airports within Region X (Northern Mindanao), cargo emanating from such cities as Ozamis, Pagadian, and Butuan are being shipped out of Cagayan de Oro.

PAL has indicated that a significant volume of the marine products shipped out of the Cagayan de Oro Airport come from as far away as Ozamis and Pagadian.

- Discussions with Department of Agriculture officials of Region X revealed the availability within the service area of substantial agricultural lands that could be harnessed for commercial agriculture or for production of higher value-added goods. Within the areas currently used for commercial crop production, the potential exists for increasing productivity and yield.

- There is also evidence pointing to the high response-capability of farmers to perceived market opportunities. For example, when San Miguel Corporation announced it was interested in buying on a long-term basis large quantities of guyabano (soursop) for its fruit-juice operations, many farmers in the municipalities as Claveria, Gingoog and Balingoan (Misamis Oriental) responded by planting guyabano.

The availability of substantial cargo-carrying capacity (Table 4-4) between the Corridor and the country's major market for high-valued perishable crops in Metro Manila could provide the following incremental economic benefits:

- Additional revenue to Philippine Airlines from additional cargo transport over and above passenger revenues (passenger revenues alone are estimated to more than cover the cost of the A300 service).

- Induced cargo traffic, because of the availability of more dependable, efficient air cargo transport service, the possibility of reduced, more competitive air cargo transport rates, and better accessibility to the larger markets of Metro Manila and abroad.

- The possibility of higher employment, better farmer's incomes, and higher foreign exchange earnings from the sale of high value-added products for export.

- Improved transportation and access will likewise have the effect of reducing the spoilage of agricultural output.

4.2.3.4 Impact of the Project on Taxes

The proposed airport is estimated, by the Feasibility Study, to have an aggregate financial cost of ₱737.85 million calculated to generate a total tax take for the government of ₱138.39 million, which is approximately 18.8% of the total project cost. These payments are in the form of payments for tariffs, value-added taxes, import levies, sales and contractors taxes for direct project inputs.

In addition, taxes from the indirect effects of the project are calculated to range between ₱208 million to ₱277 million. These will be derived from the induced economic activities that the project and the project expenditures will generate within the airport service area.

The establishment of concession business in the airport and the complimentary activities that are expected to take place near the new airport are likely to stimulate developments which will have the potential of increasing the tax income for the national and local governments.

4.2.4 Social Soundness Analysis

A social soundness analysis essentially examines the relevant social issues that need to be addressed as a result of a proposed project. It often takes into account the concerns and perspectives of the various sectors involved in or affected by a project. Among the major considerations in this kind of analysis are the degree to which a project is compatible with the socio-economic environment, the relative benefits and negative impacts it may have on the affected populace, and the ways by which benefits may be sustained and diffused, while the costs minimized.

This section focuses on the benefits and costs of the proposed airport, its socio-cultural feasibility, and ways by which negative impacts may be mitigated.

4.2.4.1 Benefits and Costs

The proposed airport will have direct benefits to specific sectors of the society. Moreover, by contributing to an efficient and dynamic economy, the airport will provide indirect benefits to the larger population in the service area and the nation as a whole.

The direct and immediate beneficiaries of an upgraded airport are primarily the riding public. The majority of the passengers are derived from middle and upper income groups which can afford the costs of air transport services. An airline market profile conducted in May, 1989, describes the typical domestic plane passenger as male (60 percent of the travelling population), married, around 35 years old, a college graduate, and a businessman who earns an average of ₱ 10,500 per month.

An improved airport facility will enable these passengers to enjoy greater mobility, more reliable service, more time savings, added comfort and convenience, and increased safety, all of which translate into concrete socio-economic benefits.

But the proposed project will also have benefits to other sectors of society. In the short-term, the local communities near the airport will benefit from the employment and income opportunities that will be created, particularly during the construction of the airport, access roads and other related infrastructure. For one, households will be able to establish micro-enterprises (e.g., "sari-sari" or variety stores and food stalls) providing various goods and services to the workers. More importantly, some 300 to 400 laborers are estimated to be locally hired during the two to three year construction period. Preliminary estimates indicate that project construction will require a total of 5,179 man-months of skilled and unskilled labor, amounting to a total payroll value of 86.8 million pesos.

In the long-term, airport operations will have indirect positive benefits for the local population. Local labor may be hired as airport porters, maintenance and service crews. An increased demand for food and personal services will stimulate the growth of small-scale businesses in the area, in addition to usual on-site concessions. An improved road network will enable people to have greater mobility and to have easier access to essential markets and services (hospitals, colleges, government offices) which are currently concentrated in the cities.

Along with the other projects planned for the Corridor, the proposed airport will spur further growth in Laguindingan and adjacent municipalities situated between the population centers of Iligan and Cagayan de Oro. The development of this zone may help serve to decongest the two principal Corridor cities whose populations have rapidly increased, while dispersing development and associated benefits within the central Corridor sector.

With its estimated aggregate financial cost of 737.85 million pesos, the new airport is expected to generate a total direct tax take of 138.39 million pesos for the government, or around 19 percent of the total project cost. This amount will come in the form of payments for tariffs, value-added taxes, import levies, sales and contractors taxes for direct project inputs. In addition, taxes from the indirect effects of the project are calculated to range between 208 to 277 million pesos. Recent passage of the Local Government Code will increase the value of this tax base to local government units as well as increasing their responsibility for providing public services.

Ultimately, these and other consequent benefits will be shared by the larger economy and population in the wide service area of the airport, namely the provinces of Bukidnon, Lanao del Sur and Lanao del Norte, Misamis Oriental, and Camiguin. The estimated population in the entire service area as of 1990 is close to 3 million (around 533,809 households), and is projected to grow to 4.6 million by the year 2015.

The primary social cost of the proposed airport at Laguindingan will be the displacement of an estimated 220 families who are potential agrarian reform beneficiaries. The proposed 167 ha project site in Laguindingan includes portions of barangays Moog, Liberty, and Tubajon which form a contiguous area on the peninsula near Sulauan Point. Spread out in these and neighboring barangays are some 604 hectares of land owned by Diamond Cement and Industrial Corporation (DCIC), a subsidiary of Ayala Land, Inc.. Based on available information, 40 to 50 percent of the airport area and 70 percent of barangay Moog are within DCIC's property.

Currently, some 380 households are living within DCIC's property, as tenant farmers. This number includes the majority of the 220 households currently residing and farming within the proposed site. Should the airport be implemented and DCIC subsequently decide to develop its property, these households will be dislocated.

In addition to being landless, the majority of these households have incomes below the poverty threshold. As a result, these families live in poorly built houses, suffer from malnutrition, and can only afford an incomplete elementary education.

The displacement of these households will require sacrifice on their part, for they may be forfeiting the chance to finally own their land. The Department of Agrarian Reform (DAR), has thus far maintained that a major portion of DCIC's property is subject to agrarian reform (Appendix D-3). If this decision is implemented, the current residents will be the principal beneficiaries.

4.2.4.2 Socio-cultural Compatibility

Initial social investigations indicate that the project is socially and culturally feasible based on several considerations.

An international standard airport addresses an increasingly felt need for modern transport facilities, consistent with the vision for the Cagayan de Oro-Iligan Corridor of becoming a major industrial and agro-industrial center in the Southern Philippines.

The Corridor is currently the focus of major development efforts. The growth centers of Cagayan de Oro and Iligan have an existing base of heavy and large industries and ample space for expansion of manufacturing and processing. This spatial layout creates potential for intra-regional linkages and complementary growth which are expected to spread to the surrounding areas.

The planned US$ 1.9 billion expansion program of the National Steel Corporation within the PHIVIDEC Industrial Estate (Tagoloan, Misamis Oriental) further reinforces the region's comparative edge and attractiveness. This initiative may stimulate the growth of related downstream and ancillary industries, possibly transforming the Corridor into a dynamic industrial steel center in the country and in the ASEAN region within the next 20 years.

In addition, the Corridor is foreseen as a major agro-industrial center for processing local agro-based resources into industrial inputs, and as a trade center for gathering raw materials and unfinished goods and for forwarding intermediate and finished products.

The proposed airport is locally viewed as an important element in the realization of this vision. Existing facilities are already limited, rendering present service unreliable. The expected demand for improved air transport services that will accompany the Corridor's development supports the establishment of an international-standard airport.

4.2.4.3 Political Concerns

There appears to be adequate support from key political and economic leaders at the regional, provincial, and municipal levels, even if questions remain about other alternative sites. Initial and subsequent consultations with various sectors indicate that there is agreement on the long-term, comparative advantages of the Laguindingan airport site.

The frequent flight cancellations at the existing airports and their inability to accommodate wide-body aircraft due to infrastructural and climatic constraints are factors that are increasingly recognized.

Strong claims have been expressed for the Linamon site in Iligan City. These sentiments appear to have been voiced not so much to directly oppose the merits of the Laguindingan site (largely perceived as a long-term option), but to emphasize the immediate needs of Region XII, its perceived neglect and lack of infrastructure relative to neighboring areas.

This observation is supported by the comments of some participants of the scoping sessions. As one participant remarked:

> If you are not going to build the airport at Laguindingan within the next five years, we feel that the transfer of the airport to Linamon (from Balo-i) should be done right away. Let us start it. There will be 6-15 years of delay in the construction of an airport at the new site which will serve both Cagayan de Oro and Iligan, so we feel we should continue the construction at Linamon.
>
> But, if you have the funds to build the airport (at Laguindingan), I won't object. But I would say we must keep the airport at Linamon... I have talked with consultants who recommend it (construction of Linamon Airport) for the short-term. (proceedings from the Scoping Session in Iligan City, July 17, 1991).

Another participant in the same session, added:

> I think I am in favor of the location at Laguindingan. However, I would agree with everybody here that for our immediate use and immediate needs we must have the airport at Linamon. It can serve the purpose for the next few years, until, probably, by then there will be a need to build an international airport. Laguindingan must have the technical advantage.

Support from Laguindingan's municipal officials is firm and clearcut, as they have recently petitioned higher authorities to have the area identified for the airport converted from agricultural to industrial zoning compatible with airport use (Appendix D-1).

As of 1990, Laguindingan's town plan indicated that major portions of barangays Moog, Tubajon and Liberty, including the proposed airport site, are agricultural lands. For this reason and because many of the lands in question are owned by a private corporation rather than by small farmers, the Department of Agrarian Reform has ruled that the property is subject to agrarian reform.

In response, the municipal officials of Laguindingan passed a resolution on July 5, 1991 requesting the Housing and Land Use Regulatory Board to conduct a special zoning survey and to amend their town plan so that portions of the land can be converted from an agricultural to an industrial zone. Similar resolutions were submitted to the Provincial Board, asking its endorsement of the conversion plan for the Regional Development Council, and to the Department of Environment and Natural Resources, requesting its certification that the area is "ecologically sound and once industrialized will be safe from the hazards of pollution."

Mixed feelings about the airport plan exist at the barangay level, although households who are in favor of it outnumber those opposed. However, everyone feels that should relocation be needed, its terms and conditions must first be agreed upon with the affected residents.

A sample survey of the households in the area showed that 66 percent favor the proposed plan, 31 percent oppose it, while three percent have no opinion. All respondents felt that the project must first be thoroughly discussed with the people before being finalized. Particularly important are the terms and conditions of relocation and resettlement, e.g., financial compensation, ownership of land in the relocation site, job and income benefits, on-site services, etc.

Field visits and interviews with community informants did not indicate organized groups who are unconditionally opposed to the airport plan and the consequent relocation of the residents. Nonetheless, further consultations will be needed especially with those farmers reported by the Department of Agrarian Reform to have opposed Diamond Cement's petition for land conversion.

The socio-economic benefits that are likely to result from the project appear to outweigh its social costs, but only if the latter are properly mitigated by a responsive relocation and resettlement program.

4.3 EFFECTS ON PHYSICAL ENVIRONMENT

4.3.1 Air Quality

4.3.1.1 Noise Impacts From Construction

The construction of the project will require the operation of a variety of construction equipment (Table 1-9). A list of typical construction equipment and their corresponding sound pressure levels in dB(A), measured 15m from the source, is provided in Table 4-9. The predicted attenuated sound pressure levels at various distances (30, 60, 120 and 240 m) is shown in Table 4-10.

Table 4-9
TYPICAL NOISE EMISSIONS OF CONSTRUCTION EQUIPMENT

EQUIPMENT	SOUND PRESSURE LEVELS IN dB(A) MEASURED 15 M FROM THE SOURCE
Air Compressor	75 - 87
Backhoe	71 - 92
Compactor	72
Concrete Pump	75 - 85
Cranes	82
Front Loader	76 - 88
Generator	72 - 81
Grader	72 - 82
Jack Hammer	80 - 93
Paver	81 - 97
Pile Driver	87 - 88
Pumps	95 - 105
Tractors, Bulldozers	70 - 90
Trucks	78 - 95
Vibrators	83 - 93
	68 - 81

Source: Canter, Larry W., 1977: Environmental Impact Assessment McGraw Hill, New York, 331 pp.

179

Table 4-10

PREDICTED ATTENUATED SOUND PRESSURE LEVELS OF CONSTRUCTION EQUIPMENT IN dB(A)

EQUIPMENT	DISTANCE (M)			
	30	60	120	240
Air Compressor	69-81	63-75	57-69	51-63
Backhoe	65-87	59-81	53-75	47-69
Compactor	66	60	54	48
Concrete Mixer	69-82	63-76	57-70	51-64
Concrete Pump	76	70	64	58
Cranes	70-80	64-74	58-68	52-62
Front Loader	66-75	60-69	54-63	48-57
Generator	66-76	60-70	54-64	48-58
Grader	74-87	68-81	62-75	59-69
Jack Hammer	75-91	69-85	63-79	57-73
Paver	81-82	75-76	69-70	63-64
Pile Driver	89-99	83-93	77-87	71-81
Pumps	64-84	56-78	50-72	44-66
Tractors, Bulldozers	72-89	66-83	60-77	54-71
Trucks	77-87	71-81	65-75	59-69
Vibrators	62-75	56-69	50-63	44-57

Source: Consultants estimates.

Since noise generating construction equipment are normally operated intermittently, the typical exposure times of a receptor in the vicinity of the construction site would be generally less than eight hours a day. The noise levels at the edge of the construction area are not expected to exceed the maximum allowable limits defined by the national standards. The maximum allowable noise levels for construction activities, together with the allowable working hours per area, are shown in Table 4-11.

Table 4-11
NOISE STANDARDS FOR CONSTRUCTION ACTIVITIES
AND ALLOWABLE WORKING HOURS PER AREA

ACTIVITY	MAXIMUM NOISE LEVEL	ALLOWABLE WORKING HOURS	AREA
Class 1	90 dB(A)	7:00 am - 7:00 pm	AA, A, B
Class 2	85 dB(A)	7:00 - 7:00	AA, A, B
Class 3, 4	75 dB(A)	7:00 - 9:00	AA, A, B

Class 1 - Work which requires pile drivers (excluding manual type), pile extractors, riveting hammers or combination thereof. This classification does not include work in which pile drivers are used in combination with earth augers.

Class 2 - Work which requires rock drills or similar equipment like jack hammers or pavement breakers.

Class 3 - Work which requires air compressors (limited to those compressors which use power other than electric motors with a rated output of 15 KW or more and excludes air compressors, rock drills, jack hammers and pavement breakers).

Class 4 - Operations involving batching plants (limited to those with a mixer capacity of 0.5 or more cubic meters) and/or asphalt plants (limited to those with mixer capacity of 200 kg or more). Batching plants for the making of mortars are excluded.

Area: AA - Hospital, School
A - Residential
B - Commercial

Source: NPCC Memorandum Circular No. 002 (May 12, 1980).

4.3.1.2 Noise Impacts From Increased Vehicular Traffic

The operation of the proposed airport is expected to increase the traffic density along the Laguindingan - Alubijid portion of National Highway 1. It is also expected to generate traffic along the proposed airport access roads. Based on the projections of the Feasibility Study, the expected daily traffic density along the Laguindingan - Alubijid highway section and along the airport access roads is given in Table 4-12.

Table 4-12
PREDICTED TRAFFIC DENSITY (NO. OF VEHICLES/DAY)

YEAR	LAGUINDINGAN-ALUBIJID			AIRPORT ACCESS ROADS		
	LIGHT	HEAVY	TOTAL	LIGHT	HEAVY	TOTAL
2001	3952	692	4644	1065	185	1250
2011	6512	1021	7533	1524	240	1764

The noise levels that would result from predicted vehicular traffic was estimated using the noise model described in Section 3.3.1.1. The average noise levels expected at various roadside distances along the Laguindingan - Alubijid highway section and the proposed airport access roads are presented in Table 4-13, together with computed noise levels without the project.

Table 4-13
PREDICTED NOISE LEVELS ALONG ROADS, IN dB (A)

LAGUINDINGAN - ALUBIJID HIGHWAY SECTION			
DISTANCE FROM ROADSIDE (m)	YEAR 2001		
	WITH PROJECT	WITHOUT PROJECT	PERCENT CHANGE (%)
20	58.3	56.0	4.1
50	55.6	54.1	2.8
100	51.4	51.3	0.2
	YEAR 2011		
20	61.2	59.4	3.0
50	57.7	56.3	2.5
100	54.6	53.3	2.4
AIRPORT ACCESS ROADS			
DISTANCE FROM ROADSIDE (m)	YEAR 2001		
	WITH PROJECT	WITHOUT PROJECT	PERCENT CHANGE (%)
20	47.9	45.0	6.4
50	47.5	45.0	5.5
100	46.3	45.0	2.9
	YEAR 2011		
20	50.6	48.0	5.4
50	49.9	48.0	3.9
100	48.1	48.0	0.2

182

Table 4-13 indicates minimal impact of airport-generated vehicular traffic noise along the main highway as well as along the proposed airports access roads. Even with the operation of the new airport, the predicted noise levels along around the access roads would still satisfy the national ambient noise standard for residential areas (see Table 3-9). Along the Laguindingan - Alubijid section of the national highway, the 50 m strip along the roadside would satisfy the noise standards for commercial areas, while the strip beyond 50 m would still be suitable as residential areas. The predicted noise limitations to residential land use based on national standards will potentially exist with or without the proposed project.

4.3.1.3 Noise Impacts From Airport Operations

Noise generated by aircraft operations is generally considered one of the important concerns in the assessment of the environmental impact of an airport. The specific impact of aircraft noise on a community is determined by various factors including:

- magnitude and frequency distribution of sound;
- duration of noise;
- flight path;
- number and types of operations;
- operating procedures, such as the excessive use of reverse thrust upon landing;
- aircraft mix;
- runway system utilization;
- time of day and season;
- meteorological conditions.

There are several noise exposure measures used for rating the cumulative effects of aircraft noise over a specified period of time. One of the most commonly used measure is the Day-Night Level (L_{dn} or DNL) which is widely used internationally for airport assessments. The DNL is the equivalent noise level for a 24-hour period with a correction of 10 dB(A) added to the single-event noise levels occurring in the nighttime (10:00 pm - 7:00 am). The approximate mathematical expression[1] for DNL is:

---

[1]Horonjett, Robert and F.X. McKelvey, 1983. Planning and Design of Airports. Third Edition, McGraw-Hill.

$L_{dnij} = NEL_i + 10 \log N_e - 49.4$

where:	DNL	=	day-night average noise level, in dB(A)
	NEL_i	=	single flyover noise level of aircraft i on flight path j, in dB(A), corrected for the duration of sound
	N_e	=	equivalent number of daily operations, $= N_d + 10N_n$
	N_d	=	total number of operations between 0701 and 2200 h
	N_n	=	total number of operations between 2201 and 0700 h

The nighttime penalty is based on the precept that people are more disturbed by noise at night than at any other time. The DNL, or L_{dn}, must be differentiated from the usual dB(A) ratings used for stationary sources. The land uses normally compatible with various noise levels in DNL are shown in Table 4-14. The table indicates that noise levels below DNL 65 are compatible with all land uses including areas for residences, schools, hospitals, churches, auditoriums, and amphitheaters.

The impact of aircraft noise on the neighboring communities of the proposed airport was assessed through the application of the Integrated Noise Model (INM, Version 3) developed by the US Federal Aviation Administration. The noise simulation was based on the predicted daily aircraft movements at the proposed airport summarized in Table 4-15 for the base case scenario forecasted for the year 2011. The assumed flight paths are directly aligned with the center of the runway. Based on predicted daily aircraft movements and forecasted schedules provided in the Feasibility Study, flight operations were confined in the simulation to the hours between 6 a.m. and 10 p.m., hence no 10 dB(A) nighttime penalty was imposed.

Table 4-14
LAND USES NORMALLY COMPATIBLE WITH VARIOUS NOISE LEVELS

LAND USES	YEARLY DAY-NIGHT AVERAGE SOUND LEVEL (DNL) IN DECIBELS d B(A)					
	BELOW 65	65 - 70	70 - 75	75 - 80	80 - 85	OVER 85
<u>Residential</u>						
Residential, Other than Below	Y	N	N	N	N	N
Mobile Home Parks	Y	N	N	N	N	N
Transient Lodgings	Y	N	N	N	N	N
<u>Public Use</u>						
Schools, Hospitals, Nursing Homes	Y	5	10	N	N	N
Churches, Auditoriums, Concert Halls	Y	5	10	N	N	N
Governmental Services	Y	Y	5	10	N	N
Transportation	Y	Y	Y	Y	Y	Y
Parking	Y	Y	Y	Y	Y	N
<u>Commercial Use</u>						
Offices, Business and Professionals	Y	Y	5	10	N	N
Wholesale	Y	Y	Y	Y	Y	N
Retail, Building Materials, Hardware	Y	Y	Y	Y	Y	N
Retail, General	Y	Y	5	10	N	N
Utilities	Y	Y	Y	Y	Y	N
Communications	Y	Y	5	10	N	N
<u>Manufacturing and Production</u>						
Manufacturing General	Y	Y	Y	Y	Y	N
Photographic and Optical	Y	Y	5	10	N	N
Agriculture and Forestry	Y	Y	Y	Y	Y	Y
Livestock Farming and Breeding	Y	Y	Y	N	N	N
Mining and Fishing	Y	Y	Y	Y	Y	Y
<u>Recreational</u>						
Outdoor Sports Arenas, Spectator Sports	Y	Y	Y	N	N	N
Outdoor Music Shows, Amphitheaters	Y	N	N	N	N	N
Nature Exhibits, Zoos	Y	Y	N	N	N	N
Amusements, Parks, Resorts, Camps	Y	Y	Y	N	N	N
Golf Courses, Riding Stables, Water Recreation	Y	Y	5	10	N	N

Notes:

Y - Yes, the use is compatible with the indicated noise level.
N - No, the use is not compatible with the indicated noise level.
5, 10 - Land use and related structures are generally compatible but measures to achieve noise levels reductions of 5 or 10 DNL, outdoor to indoor, beyond that obtained by normal construction, should be incorporated into design and construction of structures.

Source: US Department of Transportation, Federal Aviation Administration, Advisory Circular 150/5020-1, *Noise Control and Compatibility Planning For Airports, August 5, 1983*

Table 4-15
PREDICTED DAILY AIRCRAFT MOVEMENTS
(base case scenario, year 2011)

YEAR	COMMERCIAL AVIATION				GENERAL AVIATION
	F50	B737	A300	C130	
1995	6	10	0	2	18
2007	8	12	2	2	22
2011	8	12	2	2	22

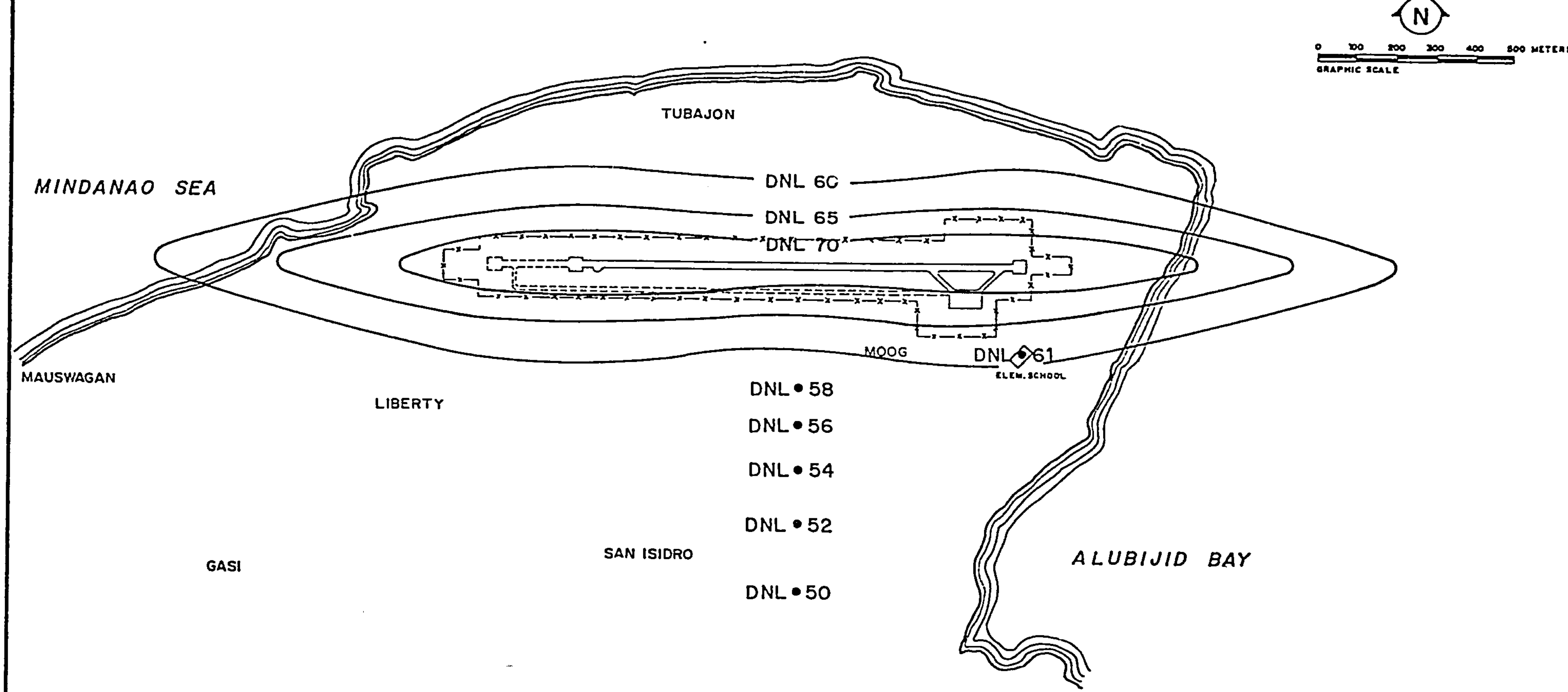
Source: LBII, 1991. Feasibility Study and Master Planning. Cagayan de Oro - Iligan Corridor Airport. Draft Final Report.

The resulting DNL contour lines are shown in Fig. 4-3. The figure shows that the airport property will be enclosed by a DNL 70 contour. The contour DNL 65 extends slightly beyond the airport property line which results in a thin strip of land beyond the airport property where the DNL value lies between DNL 65 and DNL 70. This strip is approximately 150 m wide along the outer sides of the perimeter fence which based on Table 4-14 may be suitable for commercial, manufacturing and recreational use. The area enclosed by the DNL 65 contour line is approximately 310 ha which includes the fenced airport property (167 ha) as well as intertidal and bay areas off both the eastern and western approaches. The predicted noise level at the nearby Moog Elementary School is estimated at DNL 61 which is within the acceptable limit of DNL 65 for residential and school uses.

While averaged measures of aircraft-generated noise, such as DNL values, are useful for prediction and planning purposes, momentary noise events such as during peak busy hours may be locally perceived as a more accurate measure of immediate impact. The Feasibility Study reports that under the base case scenario for year 2011, 11 aircraft movements are anticipated during a hypothetical busy hour at the proposed airport, including four commercial aircraft movements (two B737s and two A300s) and seven general aviation movements. In addition to daily busy hours, air traffic may peak seasonally with holiday and school schedules. Significant peaks in air traffic are noted for the existing Cagayan de Oro Airport during the months of January, May, August and December.

4.3.1.4 Total Suspended Particulates During Construction

There would be a slight increase in the total suspended particulates (TSP) concentration in the project site, particularly during the clearing and grubbing stage of the construction of the airport and the access road. This short-term negative impact on air quality is predicted to be minimal and localized owing to the light wind conditions that are expected to prevail in the area.



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492 - 0452 - C - 00 - 0099 - 00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT

PREDICTED NOISE LEVEL CONTOURS FOR AIRCRAFT OPERATIONS
(BASE CASE SCENARIO YEAR 2011)

FIGURE 4 - 3

4.3.1.5 Total Suspended Particulates During Operation

The normal operation of the airport facilities is not expected to affect the total suspended particulate concentration in the area. There may be very slight increases along the access roads due to resuspension of dust due to vehicular traffic. This impact, however, is very minimal and not expected to significantly contribute to the ambient concentration.

4.3.2 Water Resources and Quality

4.3.2.1 Domestic Water Demands

In addition to the increased demand on existing groundwater supplies by normal population growth within the project vicinity, the construction and subsequent operation of the proposed airport facility will introduce further demands upon the locally limited domestic water resource. Accelerated development of areas and activities outside the specific project site and direct operations, in the form of secondary or induced development, is anticipated to further increase water demand scenarios.

During the construction phase of approximately 34 months, freshwater will be required for concrete admixtures, work camp domestic use and dust control. Estimates of the water requirements for designed concrete structures (runways, access roads and structures) are in the range of five million gallons, or approximately 30,000 l/day during the peak 24 month construction period, while related work camp and dust control demands might be in the range of an additional 10,000 to 20,000 l/day.

Table 4-16 provides a rough estimate of operational requirements for the completed airport facility, based on the forecasted staffing and traffic forecasts for the years 1996 and 2011, and the assumptions of one "well wisher" or visitor per air passenger and pro-rated water demand of seven liters/day per passenger, well wisher or visitor and 14 l/day per employee (airport and concession staff).

The estimates of operational domestic water demands are considered only approximate as actual operating procedures (maintenance, landscaping needs, conservation programs) and on-site concession requirements are difficult to determine at a feasibility study stage. Accepting the roughness of these estimates, anticipated average domestic water demand of airport facility operations may be in the range of 20,000 l/day (1996) to 30,000 l/day (2011), while peak demands might be several times these average values. Combined with potential off-site but related developments, a substantial water demand will be created with implementation of the project.

Table 4-16
ESTIMATED DOMESTIC WATER DEMAND OF AIRPORT OPERATIONS (1996-2011)

	1996	DOMESTIC WATER DEMAND (l/day)	2011	DOMESTIC WATER DEMAND (l/day)
No. of Employees[1]	200	2,800	300	4,200
Ave. No. of Passengers/day[2]	1,186	8,302	1,888	13,216
Well Wishers, Visitors/day	1,186	8,302	1,888	13,216
		-------		-------
		19,404		30,632

Source: Consultant's Estimates
Notes: [1]Domestic water demand estimated at 14 l/day per employee
[2]Domestic water demand estimated at 7 l/day per passenger, visitor

For comparative value, the principal Moog well was described in 1982 (Table 2-16) to have a specific capacity of 0.07 l/sec/m, or a calculated yield of 17,280 l/day assuming a 16 hour pumping cycle. This principal well, which tested poor for water quality (Table 2-17), currently services a significant proportion of the local population. Overdrafting of limited groundwater resources in the site vicinity as a direct, or indirect, result of project implementation could cause the:

- decline of static water levels with associated increase in pumping costs due to higher lifts and greater drilled well depths;
- further deterioration in groundwater quality;
- adverse effects on other traditional water rights in the area; and
- upset in recharge balances.

4.3.2.2 Wastewater and Sewage Generation

Presently, wastewater generation within the project vicinity is minimal and limited to household sources and residential sanitation facilities. As a result of airport operations, the concentration of air passenger and visitor traffic, in addition to employed and concessionaire staff, will create a point source of wastewater which is addressed in the preliminary designs and cost estimates of the Feasibility Study to include an on-site septic treatment system.

Wastewater generation, calculated at 80 percent of the domestic water demand, will reach over 15,500 l/day in 1996 and nearly 25,000 l/day in the year 2011 based on estimates of airport operation demands provided in the previous section. Peak demands could reach 45,000 l/day and 65,000 l/day during these respective years.

4.3.2.3 Coastal Water Quality

Alteration of the existing landscape, such as drainage surface characteristics, due to the airport construction will include an increase in impervious cover and generally accelerated flow patterns as a result of paving, grading and designed structures. Due to the coastal location of the site, increased runoff as a result of project implementation could impact coastal water quality.

The designed runway alignment crosses one major ravine and one secondary ravine that serve as intermittent watercourses within the project's catchment area. Figure 4-4 provides the preliminary drainage diagram for the proposed airport facility while Figure 4-5 indicates the respective catchment areas of the designated subsurface drainage culverts.

Table 4-17 provides a breakdown of project areas that are presently designed to be to paved, by concrete or asphalt, to be occupied by constructed buildings, and unpaved areas of the designated airport property and associated access roads.

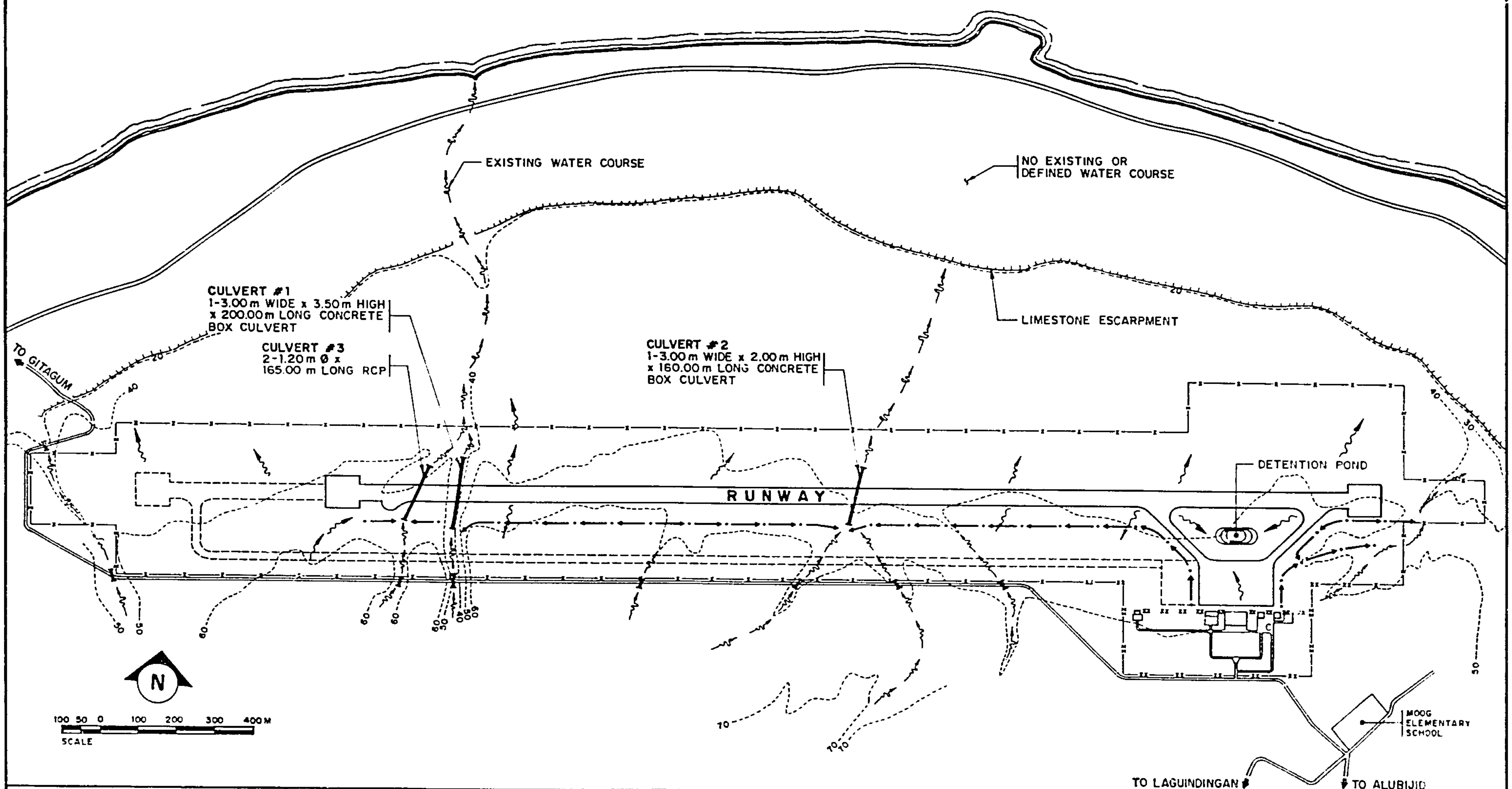
Table 4-17
SURFACE AREA TREATMENTS, AIRPORT PROPERTY AND ACCESS ROADS

AREA DESCRIPTION	AREA (Ha)
Area to be paved with concrete	16.83
Area to be paved with asphalt	4.71
Area occupied by buildings	0.46
Unpaved area, airport property	145.08
Total airport property	167.08
Area to be paved with concrete, access roads	9.5

Source: LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Corridor Airport. Draft Final Report.

Based on this breakdown and runoff calculations included in Appendix D-13 and summarized in Table 4-18, for a five year storm return period, estimated additional runoff generated from the designed airport facilities is approximately 39 percent. This generated runoff estimate incorporates a nearly 20 percent increase (from 0.55 to 0.65) in the runoff coefficient applied to catchment areas outside of the airport property (approximately 175 ha) to reflect secondary-induced or indirect changes in local land use and level of development as a potential result of project implementation.

190



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO. 492-0452-C-00-0099-00

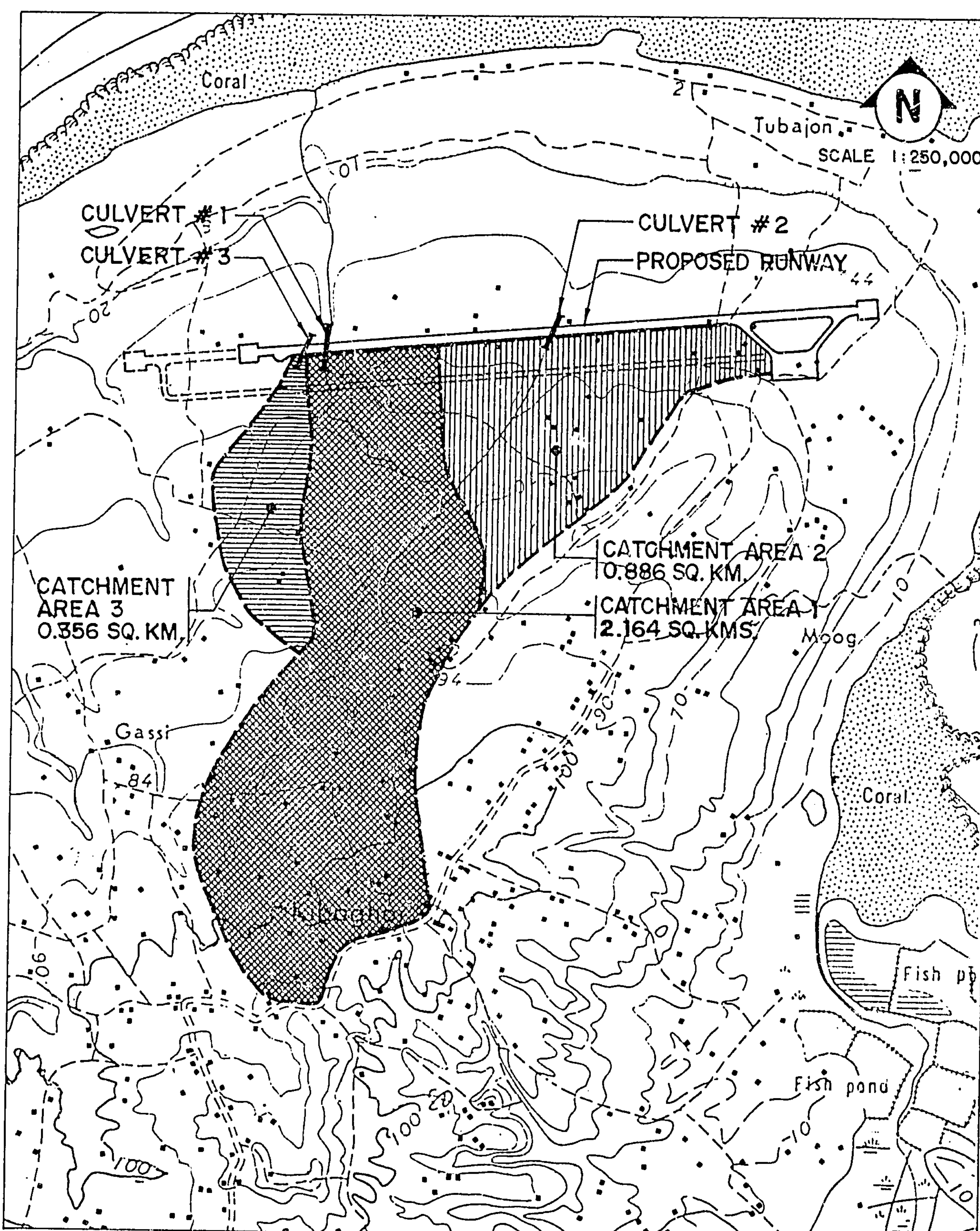
LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L • ERNST & YOUNG INT'L • GLOBETROTTERS ENG'G CORP. • TRANS-ASIA (PHIL.), INC. • CONSULTANT MANAGEMENT SERVICES, INC.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT

DRAINAGE DIAGRAM

FIGURE 4-4

191



SOURCE: NAMRIA

PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492-0452-C-00-0099-00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 4-5
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	CATCHMENT AREA PLAN	

Compared to existing capacities of offshore coastal habitats, the calculated additional runoff directly related to project implementation is considered acceptable. For example, at an average tidal depth of 0.5 m, the surveyed reef flats described in Section 2.5.2 would contain an estimated volume of 1.3 million cu.m. of seawater. The runoff ravines discharge onto expansive reef flats which are dominated by highly tolerant species, such as eel grass, which are exposed regularly to extremes in water quality (salinity) as well as exposed at low tide to atmospheric conditions, including rainfall (Plate 2-8).

Table 4-18
SUMMARIZED RUNOFF CALCULATIONS
(cu.m./sec)

CULVERT NO.	CALCULATED EXISTING RUNOFF	RUNOFF WITH AIRPORT AND CATCHMENT AREA DEVELOPMENT	ADDED RUNOFF DUE TO AIRPORT AND CATCHMENT DEVELOPMENT	PERCENTAGE INCREASE, CALCULATED RUNOFF
1	22.48	31.70	9.22	41.01%
2	12.47	16.91	4.44	35.60%
3	4.74	6.55	1.81	38.18%
1,2 and 3	39.69	55.16	15.47	38.98%

Source: Consultant estimates, Appendix D-13

4.3.3 Oceanography

The scale of the proposed construction activities, including an international standard airport and 14 km of access and service road improvements, creates the potential for increased sediment load in the adjoining coastal waters as a result of erosion of exposed slopes and surfaces. The apparently weak coastal currents and sediment transport systems along the immediate coastline will tend to concentrate the impact of project, particularly construction-related siltation in localized plumes at discharge point sources. As previously noted, in Section 2.4.4.3, aerial surveys, including review of available NAMRIA aerial photographs, as well as aerial surveys conducted during the study (Plate ES-2), indicate coastal sediment plumes offshore of the runoff ravines crossed by the designed runway alignment. In the absence of protective mitigative measures, construction activities involving some 2 million cu.m. of cut and fill, and substantial topographic alterations, could significantly impact the sediment carrying capacity of the surrounding coastal waters.

4.3.4 Geology and Soils

The primary impact on geology and soils will be in terms of volume, of cut and fill requirements estimated in Table 1-10 at 1.9 million cu.m. and 460,000 cu.m. respectively, and of concrete aggregate requirements of approximately 50,000 cu.m. The relative magnitude of these volumes dictates careful construction management practices to avoid serious secondary impacts on the environment.

Based on the soil boring results and preliminary design calculations included in the Feasibility Study, the required fill with a high California Bearing Ratio (CBR) will be supplied from the deeper cut sources comprised largely of limestone material. In the process, the shallow soil horizons, which generally extend in depth to about 50 cm, might be stockpiled for subsequent landscape applications. The relative scarcity of soil materials within the uplifted limestone terraces of the project vicinity places a premium on the highest use (recycling) of the volume of soil displaced by the projected constructional activities. Disposition of excess cut materials must be carefully evaluated within the detailed design stage to avoid necessary off-site impacts. Mitigation activities recommended in the next chapter include planning options of near-site use of surplus cut materials.

The recommended material sources of concrete aggregates within the vicinity of the Laguindingan site are included in Table 4-19 and Figure 4-6. With the exception of the Cagayan River/Tuguanao Site, which is a Department of Public Works and Highways (DPWH) quarry, the remaining material source identified are privately operated and permitted quarries. Based on laboratory test results described in the Feasibility Study, these identified material sources can adequately fulfill the aggregate requirements of the project.

For environmental and economic reasons related to traffic (trucking) generation and distance, the nearest source of satisfactory aggregate materials is recommended. As all of the identified aggregate material sources are river quarries, secondary impacts associated with extraction are addressed in their operating permits, subject to the Mines Administrative Order No. MRD-27, Series of 1990 regarding rehabilitation of excavated areas. The Cagayan River/Taguanao Site quarry has specific archaeological concerns which are discussed in Section 4-5.

4.3.4.1 Geological Hazards

Within practical reason, the proposed project may be impacted by, rather than cause impact to, the identified geological hazards of the site vicinity, which includes the potentially active Alubijid Fault (Figure 2-22). Based on available records included as Figures 2-26 and 2-22, the geological hazards of the proposed site are acceptable within the seismically and volcanically active Philippine framework and will be addressed within the detail design phase of the project. The recommendation for further seismic studies of the area is included in Section 2.4.5.5 with an on-going DENR project described in Appendices D-4 and D-5.

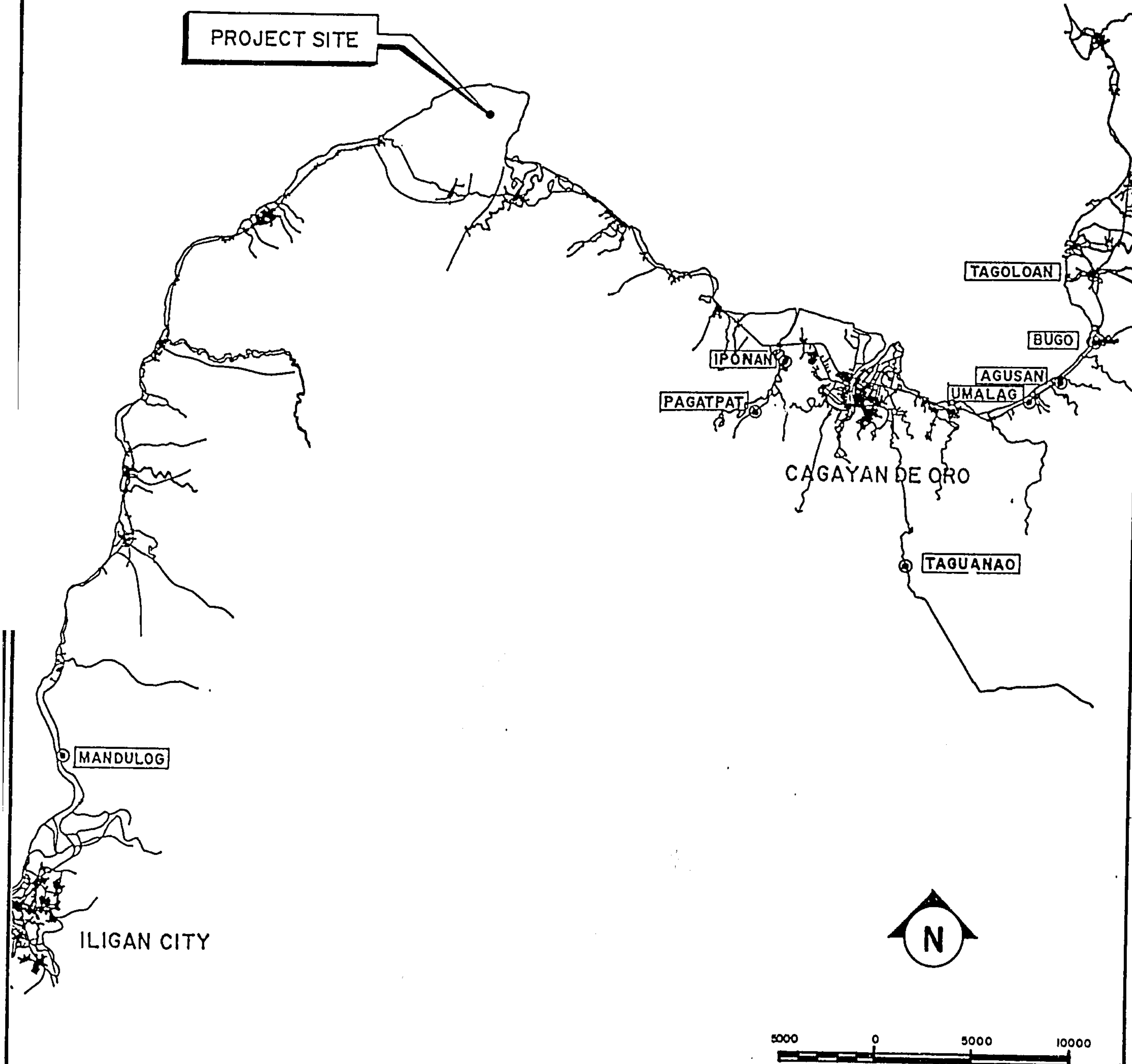
Table 4-19

RECOMMENDED MATERIAL SOURCES OF CONCRETE AGGREGATES IN THE VICINITY OF THE PROPOSED LAGUINDINGAN AIRPORT SITE

SOURCE	APPROXIMATE DISTANCE FROM SITE (KM)	ESTIMATED VOLUME AVAILABLE (CU.M.)	DESCRIPTION OF LABORATORY TEST RESULTS
Iponan River (Iponan Site)	22.0	30,000	69% gravelly sand, cobbles and boulders 31% coarse to fine sand with presence of fine sediments
Iponan River (Pagalpat Site)	37.25	6,000	65% gravel, cobbles and boulders boulders 35% coarse to fine sand with presence of fine sediments
Cagayan River (Tuguanao Site)	43.0	40,000	82% gravels, cobbles and boulders 18% coarse and fine sand
Umalag River	46.5	10,000	66% gravels, cobbles and boulders 34% coarse to fine sand
Agusan River	47.5	5,000	70% gravels, cobbles and boulders 30% coarse and fine sand
Ala-e River (Bugo Site)	50.7	20,000	70% sandy gravel, cobbles and boulders 30% coarse to fine sand
Tagoloan River	54.25	Unlimited	73% gravels, cobbles and boulders 37% coarse to fine sand with presence of fine sediment
Mandulog River	61.5	Unlimited (Total of 3 separate sites)	52% massive fragments of gravels, cobbles and boulders 48% coarse sand with presence of fine sediments

Source: LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Corridor Airport. Draft Final Report.

195



SOURCE : DPWH, 1990. REPORT ON NATURAL OCCURRING MATERIAL SOURCES, REGION X
FEASIBILITY STUDY FIELD SURVEY

PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO. : 492 - 0452 - C - 00 - 0099 - 00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC.
• GLOBETROTTERS ENG'G. CORP.

ENVIRONMENTAL ASSESSMENT
CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

RECOMMENDED MATERIAL SOURCES - CONCRETE AGGREGATES

FIGURE 4 - 6

196

A geologic cross-section of the Alubijid Fault and uplifted limestone terrace of Tubigan is included in Figure 4-7. Based solely on this cross-section, the underlayment of the Indahag Limestone consists primarily of Opol Formation which is a composite of conglomerates and agglomerates. This underlayment, which may be typical for the project site vicinity, does not indicate a high risk of liquefaction as a result of seismic movement.

4.3.5 Hazardous Materials

Hazardous materials associated with the operation of a commercial air transport facility may include:

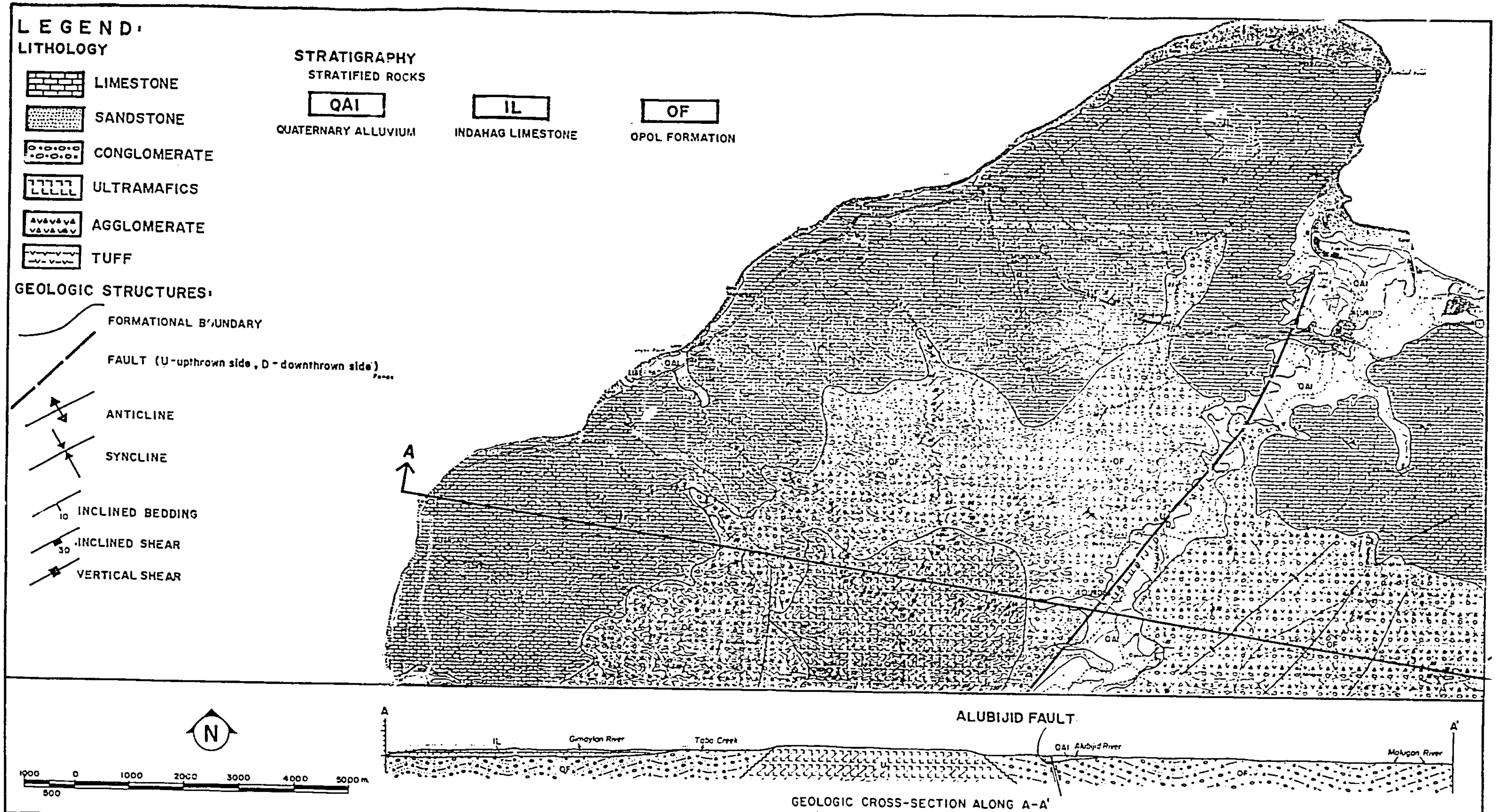
- Those substances used in the normal operation of the airport, mostly petroleum-based;
- Those hazardous materials that are shipped as cargo.

Air transport services for hazardous cargo have their own industry standards on the requirements and specifications for the composition of packing materials and provisions for containment, upset, and safety. The discussions below focus on those hazardous materials involved in normal airport operation.

The following materials have been identified as likely to be present at an airport such as the one proposed for Laguindingan:

- Jet Fuel (for jet aircraft)
- Gasoline (for piston-engine aircraft and small vehicles)
- Diesel Fuel (for diesel-engine trucks)
- Lubricating Oil
- Grease
- Degreasers
- Methanol
- Ethylene Glycol
- Fire Extinguishing Agents
    - AFFF (Aqueous Floro-Florene Foam)
    - Halogenated Hydrocarbons (halons)
    - Dry Chemical Compounds

The need for addressing the potential impacts of hazard materials mismanagement is particularly significant at the Laguindingan site due to the potential for spot or leaked materials to infiltrate groundwater during periods of rainfall. There is virtually no rainfall residence time on or near the surface in the area owing to the very porous characteristic of the karst coralline substrate.



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0089-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT
• GLOBETROTTERS ENG'G. CORP. SERVICES INC.

ENVIRONMENTAL ASSESSMENT, CAGAYAN DE ORO – ILIGAN AIRPORT PROJECT

GEOLOGIC MAP INCLUDING CROSS-SECTION OF ALUBIJID FAULT AND INDAHAG LIMESTONE FORMATION

FIGURE 4-7

Permeability tests conducted by the Bureau of Soils in 1986 showed that soils in the project area have variable permeability values, ranging from moderate (0.62 m/day) to rapid (15 m/day).

4.3.5.1 Handling

Handling of hazardous materials such as jet fuel refers to delivery to the airport from the supplier and from the airport storage facility to the aircraft. It is anticipated that early in the operation of the new facility the necessary fuels and lubricants would arrive by truck transport. In the future it is possible an off-loading marine-based fuel supply facility could be constructed along the shore of Alubijid Bay at the site of the existing DCIC wharf; however, no such delivery system is planned at this time. To limit on-site handling, an underground hydrant delivery system from the storage facility to the apron is proposed in the preliminary designs of the Feasibility Study.

Table 4-20 provides the annual projected commercial aviation fuel consumption for the forecasted traffic scenarios of the Laguindingan airport facility. The fuel consumption, or as commonly referred to as the fuel processing, of the proposed facility assumes on-site refueling to maximize aircraft passenger and cargo capacity on the Manila to Laguindingan route as well as on regional routes.

Table 4-20
ANNUAL PROJECTED COMMERCIAL AVIATION FUEL CONSUMPTION LAGUINDINGAN AIRPORT SITE

YEAR	AVIATION FUEL CONSUMPTION (USG)		
	LOW CASE	BASE CASE	HIGH CASE
1996	1,608,432	1,809,972	2,010,933
2001	1,848,882	2,144,298	2,439,545
2006	2,077,615	2,464,151	3,358,136
2011	2,296,203	3,185,889	4,337,533

Source: PAL Fuel Management and Control Division

Based on these projections, and assuming a typical 10,000 gal. fuel truck delivery, an average of nearly one truck delivery a day would be required to supply the base case, year 2011 requirements. For comparison, the existing Cagayan de Oro Airport currently utilizes about 2.3 million gallons per year.

4.3.5.2 Storage

An above-ground, 40,000 gal. capacity fuel tank storage facility is proposed by the preliminary designs of the Feasibility Study to accommodate the projected fuel requirements. The fuel farm would be surrounded by a secondary containment berm designed according to ICAO standards, with a fire wall topped by barbed-wire fence and perimeter lighting for security purposes.

Due to the potentially high permeability of the underlying tank farm soils, a non-porous, non-degradable membrane should be incorporated into the containment berm structure and foundation subsurface. For monitoring potential leakages, the integration of detection wells adjacent to the tank farm is recommended for inclusion in the detailed design.

4.3.5.3 Wastes

In addition to the projected wastewater and sewage generation discussed in Section 4.3.2.2, airport operations will generate both solid wastes as well as potentially hazardous petroleum-based wastes.

Based on an approximate generated solid waste value of 0.12 kg/passenger[2] and base case forecast scenarios, airport operations will generate an estimated 49 MT of solid wastes in 1996, increasing to about 75 MT in the 2011. As established dumping sites do not currently exists within the municipality of Laguindingan, a sanitary landfill facility should be established in cooperation with the municipal government prior to project implementation to accommodate both construction and operation levels of generated solid wastes. For planning purposes, Section 44 of the Comprehensive Zoning Ordinance for the municipality of Laguindingan requires that dumping sites:

- be adequately fenced to retain wastes;
- that pest control is applied;
- if a private facility, within the premises;
- if a public facility, located more than 100 m from water sources and residential zones; and
- in compliance with the Municipal Sanitation Code.

Petroleum-based wastes will be handled separately from generated solid waste to avoid contamination to sensitive groundwater supplies. Operational policies would incorporate the collection and storage of used petroleum products for appropriate disposal or recycling. The

---

[2]Wilbur Smith Associates, 1991. Environmental Assessment, General Santos City Air Service Improvement Feasibility Study.

detailed drainage designs of petroleum spill prone areas, such as the apron, parking lot, and tank farm, will include oil and grease traps such as depicted in Figure 4-8 to reduce effluent runoff.

4.4 EFFECTS ON THE BIOLOGICAL ENVIRONMENT

4.4.1 Terrestrial

4.4.1.1 Vegetation

The vegetation within the proposed Laguindingan airport site consists of plant communities comprised of species typically found in pioneer and early successional stages. The abundance of such assemblages is a result of the continuous disturbances caused by the cultivation of crops and livestock grazing. The biological field survey of the proposed site did not reveal the presence of any sensitive habitat or noteworthy stands of natural vegetation. According to local botanists, none of the species of plants recorded from the site is considered endangered. They generally fall into the category of being "weeds" and are typical of disturbed environments.

It is concluded that there is no adverse impact on the vegetation associated with airport implementation at this site. Nevertheless, the construction of an airport near Sulauan Point more or less precludes that the area will ever be allowed to return to its natural state.

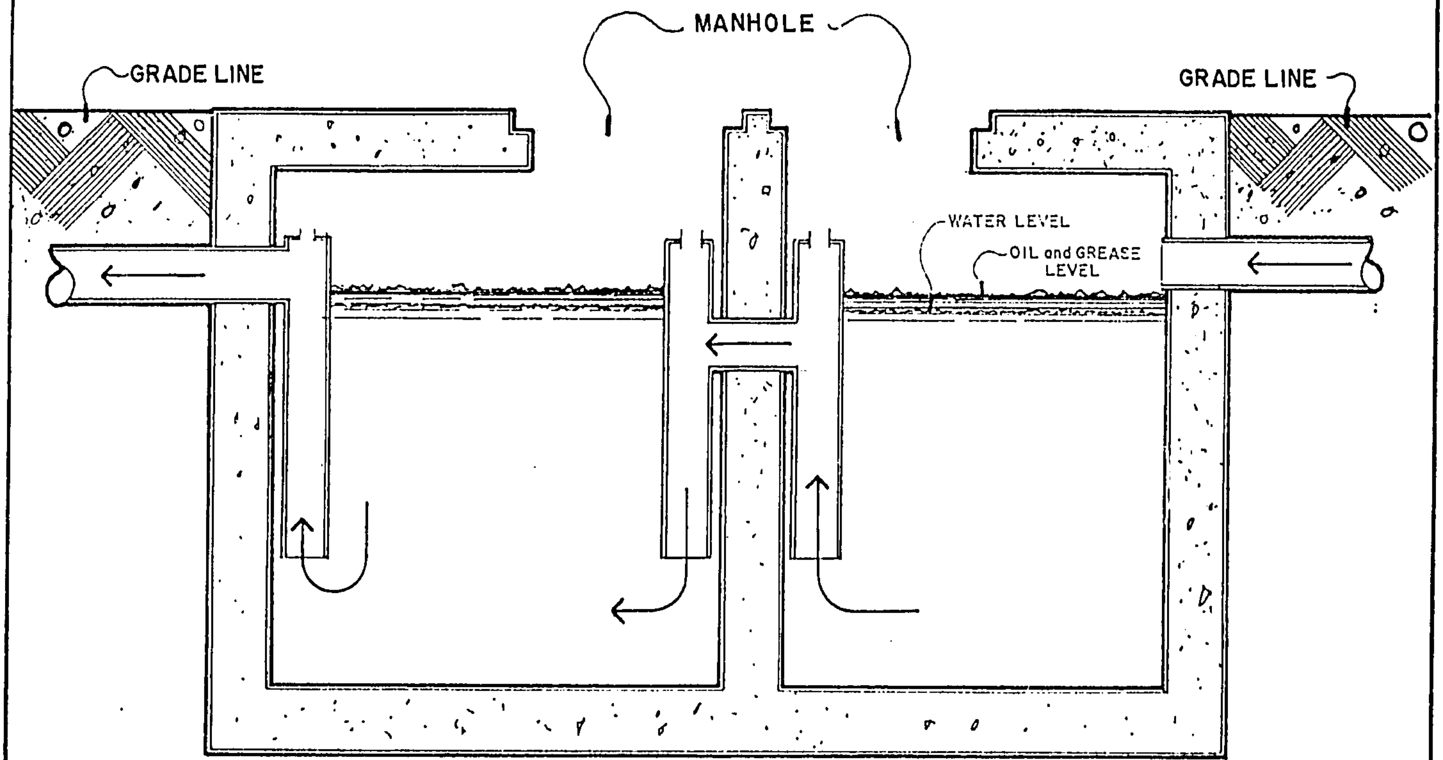
4.4.1.2 Wildlife and Avifauna

Wildlife species observed in the area fall into the same category as described for the vegetation, namely those typical of disturbed environments. No rare or endangered species were identified or recorded for the vicinity of the project site. It should be noted, however, that the biological survey team remarked on the unusually low numbers of individuals and species of wildlife and avifauna in the area.

4.4.2 Coastal Marine Habitats

In contrast to the largely cultivated terrestrial habitats of the project site vicinity, the marine habitats of the area are described by the Consultant as critical relative to their rarity within the Corridor. These marine habitats include:

- extensive seagrass-dominated reef flats and algal-dominated reef crests;
- comparatively pristine coral-dominated reef fronts;
- remnant undisturbed mangrove-dominated wetlands.



PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492 - 0452 - C - 00 - 0099 - 00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE 4 - 8
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES INC. • GLOBETROTTERS ENG'G. CORP.	OIL AND GREASE TRAP SCHEMATIC DIAGRAM	

202

In addition to their inherent habitat/biodiversity value, these coastal marine habitats support traditional subsistence-level fisheries as well as apparently migratory avifauna populations.

While the actual project does not physically displace any coastal marine habitats, secondary impacts related to runoff and sediment loads, generated noise, light or glare, potential population and development influx could significantly affect these adjoining areas. A reassuring consideration is that the comparable upland vicinities of the existing Corridor airports have not been visibly impacted by operations which have existed for over thirty years. Development of these airport facilities has tended not to extend beyond property lines, with adjoining areas still remaining agricultural in nature.

4.4.3 Protected Areas, Critical Habitats and Endangered Species

The proposed flight paths of the new Laguindingan airport facility will not impact the existing designated protected areas identified in Figure 2-30. The wetland areas surveyed by the 1991 Asian Waterfowl Census (Alubijid and Opol) paths are outside of the proposed flight paths though within the present Cagayan de Oro (Lumbia) Airport approach path.

4.5 EFFECTS ON CULTURAL ENVIRONMENT

As noted in Section 2.6.1 and identified in Figure 2-31, the Huluga Cave site is apparently about 0.5 km upstream of the DPWH Cagayan River/Taguanao quarry site. Within the immediate vicinity of this operating quarry, in Sitio Taguanao, Barrio Macasandig, archaeological artifacts have been uncovered based on National Museum records including flake tools, earthenware angular vessels, porcelain shards dating to the Ming and Sung Dynasty periods as well as possible Annamese and Thai potteries strongly indicate that this identified aggregates material source is sensitive from an archaeological viewpoint. Utilization of this quarry site would be conditional on prior archaeological surveys of the vicinity.

The historic site and structural remains of a Spanish-era watchtower is located near Sulauan Point, approximately one kilometer northeast of the eastern terminus of the proposed airport property (Figure 2-31). While no constructional or operational activities are planned near the site, special consideration should be made through the municipality of Laguindingan and the present owners (DCIC/Ayala Land, Inc.) to preserve the site from potential related developments in the airport area.

4.6 AESTHETIC EFFECTS

The proposed airport facility is located in an upper limestone terrace, low population density area that is currently utilized primarily for agricultural purpose. Aesthetic impacts are considered minimal. Attractive white sandy beaches border the coastal area of barangay Tubajon (Plate 2-7) and the mitigation of project-generated siltation described in the next chapter includes this specific consideration.

Light and glare related to airport operations might also detract from the existing aesthetic environment. As proposed, all facility lighting will be screened and generally down-focused to limit off-site impact, including potentially hazardous confusion to coastal shipping and existing navigational lighting signals.

4.7 UPSET AND SAFETY ANALYSIS

4.7.1 Existing Airways

The entire Philippines air route structure is included within the Manila Flight Information Region (FIR). Enroute air traffic services are provided by the Manila center for all oceanic approaches to the country as well as the northern portion of the Philippines. Airspace in the southern Philippines is controlled by the Mactan sector control, based at Mactan Airport in Cebu.

With the exception of the Mactan approach control, there is no radar coverage in the southern area. Aircraft in the vicinity of the Corridor airports are controlled by the Mactan sector until contact is made with the airport control tower (the tower at Balo-i is under construction and will be in service in the near future).

Because there are no navigational aids at Balo-i, there are no established airways to the airport. The Cagayan de Oro Airport VOR is used to define three airways in the southern region:

- W-6 between Cagayan de Oro and Mactan;
- W-7 between Cagayan de Oro and Iloilo;
- B-473 between Manila and the southern boundary of the FIR, via Roxas, Cagayan de Oro, and Davao.

These airways are sufficient to accommodate all Corridor air traffic as well as overflights. The level of air traffic, both existing and forecast throughout the study period, can be easily accommodated by the existing airway structure. The national airways system will not pose capacity or operational constraints on development of the Corridor's existing airports or any new airport which might be constructed.

4.7.2 Proposed Laguindingan Airport Facility

4.7.2.1 Capacity and the Number of Runways Required

According to FAA criteria, the hourly capacity of a single runway configuration under Visual Flight Rules (VFR) is somewhere between 50 and 100 operations per hour, while under Instrument Flight Rule conditions the capacity is reduced to 50 or 70 operations per hour, depending on the aircraft mix and navigational aids available.

These capacities are based on optimum conditions, with no support facility constraints. Airport capacity is not an absolute concept, however, as it is directly related to the level of service provided by airport facilities.

Runway capacity is defined as the number of aircraft movements, the combined total of landings and take-offs, which can be accommodated within an hour. Capacity is determined by average runway occupancy time - the average time between consecutive aircraft movements.

Simulation studies reviewed by the Feasibility Study for other Asian airports have shown that the effective hourly capacity of a single runway with no parallel taxiway is approximately 16 aircraft movements. By way of comparison, the capacity of a runway with a parallel taxiway is approximately 30-35 aircraft movements per hour.

At the end of the study period, 2011, the air traffic forecast for the Laguindingan airport is estimated at 19,570 commercial and non-commercial aircraft movements, which results in 11 peak-hour aircraft operations, four commercial and seven non-commercial. Therefore, since the expected number of peak-hour movements is two-thirds the effective hourly capacity, and only one-fifth of the ultimate hourly capacity of a single runway configuration, a single runway is considered adequate with respect to upset and safety at the proposed Laguindingan airport.

4.7.2.2 Runway Orientation

As a general rule, an airport's runway should be oriented as closely as practicable into the direction of the prevailing winds. When landing or taking-off, aircraft are able to maneuver on a runway as long as the wind component at right angles to the direction of travel (*"crosswind"*) is not excessive.

The ICAO recommends that runways for transport category aircraft, including all commercial jets, be oriented so that crosswinds do not exceed 20 knots at least 95 percent of the time.

Although the prevailing winds in the Corridor are in the north-south direction, they are light. As discussed in Section 2.4.1.2, based on the available wind data recorded by the Philippine Atmospheric, Geophysical, Astronomical Service Administration (PAGASA) station at the Cagayan de Oro Airport, the ICAO criterion of 95 percent wind coverage can be met with any runway orientation.

For the Laguindingan airport site, terrain and the surrounding topography limit runway orientation to a generally east-west direction.

Airport wind data is typically analyzed through the preparation of a "*wind rose*", a graphic depiction of wind direction and speed. The windrose included in Figure 1-13 has been prepared from the PAGASA Cagayan de Oro station wind data using the maximum daily speed and direction. The shaded area in the figure represents the percentage of winds with speeds of 20 knots or less for the 09/27 runway orientation proposed for Laguindingan. This orientation results in 98.8 percent wind coverage and, therefore, meets ICAO criteria.

Another aspect of runway orientation is its affect on aviation operations. The ICAO has developed imaginary obstacle limitation surfaces which define the limits to which obstacles may project into the airspace. Since these surfaces extend up to 15 km from the runway, the orientation of the runway can greatly reduce the number of terrain-related obstructions, and thus significantly improve the aviation operations at the airport. The limitation surfaces for a ICAO Code 4D airport, with a Category I precision approach are described as follows:

(a) Primary Surface

Longitudinally centered on the runway, the primary surface extends 150 m left and right of the centerline and 60 m beyond the end of the runway.

(b) Horizontal Surface

This surface consists of a horizontal plane, 45 m above the established elevation of the runway, the perimeter of which is defined by 4,000 m radii arcs centered at each end of the primary surface and connected by tangents. At Laguindingan, the airport reference point is 54.46 m above mean sea level, and the horizontal surface has an elevation of 99.46 m.

(c) Conical Surface

This surface extends 2000 m from the horizontal surface at a slope of 20 to 1 (5 percent). The lower and upper elevations of this surface are 99.46 m and 199.46 m, respectively.

(d) Approach Surface

A surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface. The three sections of the instrument approaches at the Laguindingan airport are defined as follows:

First Section:

Length	3,000 m
Slope	50:1 (2.0 percent)

Second Section:

Length	3,600 m
Slope	40:1 (2.5 percent)

Horizontal Section:

Length	8,400 m
Slope	none (0 percent)

Total length of approach surface	:	15,000 m
Length of inner edge	:	300 m
Length of outer edge	:	4,800 m
Divergence at each side	:	15 percent

(e) Transitional Surfaces

These surfaces extend outward and upward at right angles to the runway centerline plus the runway centerline extended at a slope of seven to one from the sides of both the primary and approach surfaces.

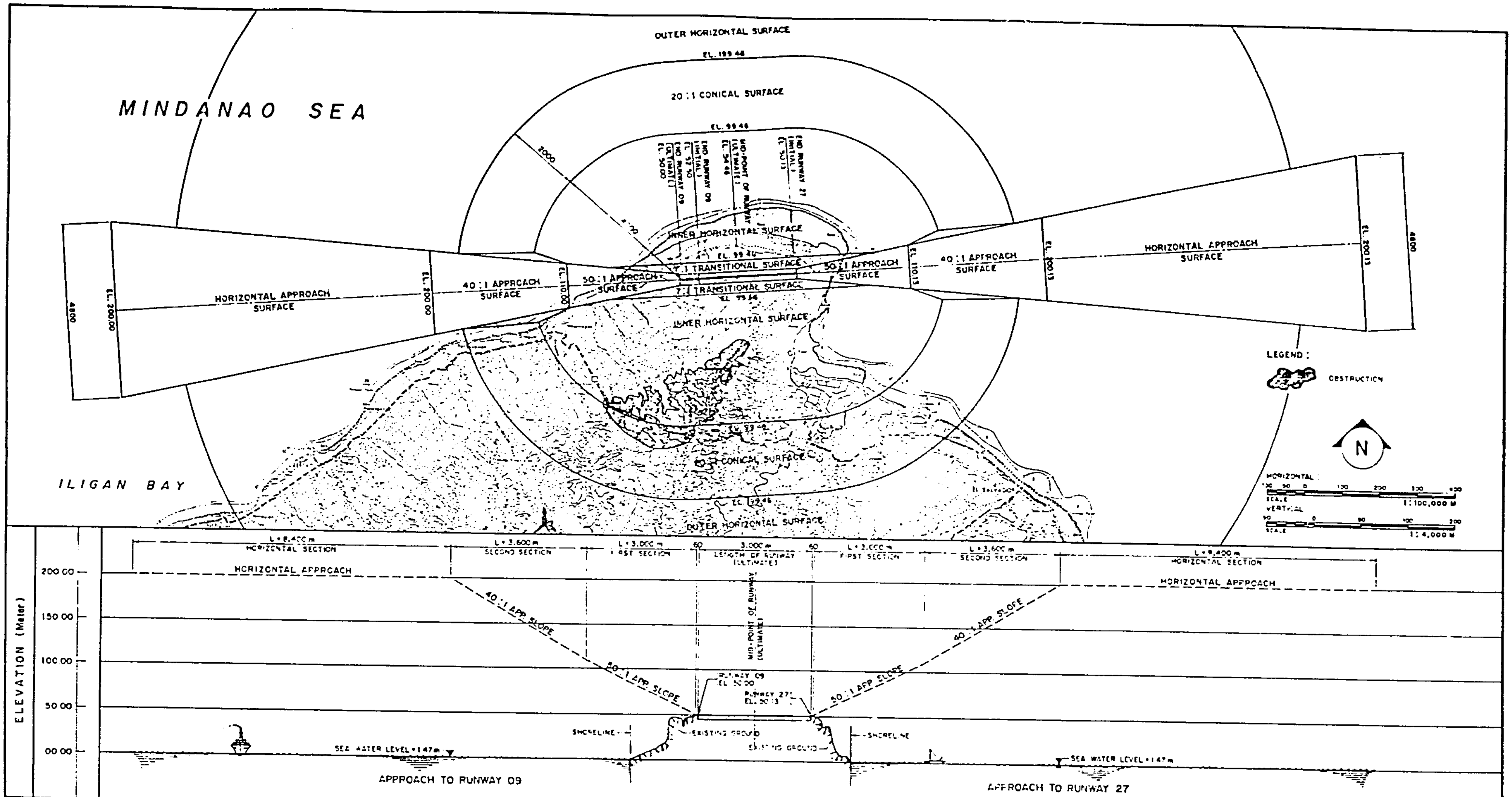
Figure 4-9 shows the airspace obstruction identification plan prepared for the proposed 09/27 runway orientation of the Laguindingan airport. Minor non-standard terrain elevation exists south of the site in the inner horizontal and conical surfaces. Both runway approaches are over water and unconstrained, in sharp contrast to the prevalence of obstructions in the vicinity of the existing Cagayan de Oro and Iligan airports (Figures 1-6 and 1-8).

4.7.2.3 Runway Length

The runway length required for a given airport depends on such factors as aircraft performance characteristics, flight length, altitude slope, pavement surface condition, wind conditions, and temperature.

The runway length required by various aircraft in the Philippine Airlines fleet, based on typical mission requirements and meteorological conditions, is shown in Table 4-21.

207



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO.: 492-0452-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
• LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.), INC.
• ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT SERVICES, INC.
• GLOBETROTTERS ENG'G. CORP.

FEASIBILITY STUDY AND MASTER PLANNING
CAGAYAN DE ORO - ILIGAN AIRPORT

AIRSPACE OBSTRUCTION IDENTIFICATION PLAN

FIGURE 4-9

207

Table 4-21
REQUIRED RUNWAY LENGTH
TYPICAL COMMERCIAL DOMESTIC AIRCRAFT

AIRCRAFT TYPE	REQUIRED RUNWAY LENGTH (m)	
	AVERAGE OPERATING WEIGHT	MAXIMUM WEIGHT
Fokker F50	1,180	1,415
BAC 1-11	1,000	2,685
Boeing B737-300	1,650	2,100
Airbus A300 B4	2,500	2,930
Boeing B747-200	3,000	3,470

Source: Technical Department, Philippine Airlines

An initial runway length of 2,500 m is recommended for the new airport at Laguindingan. This runway will accommodate an ICAO reference Code 4D aircraft, the A300, which is the largest aircraft expected to service the airport over the study period (1991-2011). The airport land area and facilities have been laid out to allow for future expansion (3000 m runway, parallel taxiway) in order to accommodate ICAO Code 4E aircraft, such as the B747.

Basic criteria in determining runway length include:

- *Altitude*

  The higher the altitude of an airport, the longer the runway because the lower density air at higher altitudes degrades the performance of aircraft engines. In general, a 300 m increase in altitude will result in a seven percent increase in runway length required.

- *Slope*

  An uphill requires more runway length thana a level or downhill gradient because aircraft acceleration is adversely affected. A one percent increment in uphill slope will increase runway length required by seven to ten percent.

- *Temperature*

  The higher the temperature, the longer the runway required because higher temperatures reflect lower air density, which results in lower engine thrust output.

- *Humidity*

  Higher humidity adversely affects engine performance, requiring an increased runway length.

- *Surface Condition*

  A contaminated runway surface, such as that caused by the presence of water on the runway, will increase the length required.

- *Wind*

  The greater the headwind down a runway the shorter the length required. Conversely, the presence of a tail wind increases required runway length.

4.7.2.4 Runway Slope

A new airport in the Corridor should be designed to accommodate ICAO Code 4 aircraft, the largest class of commercial aircraft. The B737, which presently operates at the Cagayan de Oro Airport, is a Code 4 aircraft, as are the A300 and B747.

ICAO recommends that the Code 4 Airport runways not exceed a longitudinal slope of one percent. Runway slope is computed by dividing the difference between the maximum and minimum elevation along the runway centerline by runway length. A 2,500 m runway with an elevation change of 25 m or less would meet this criterion.

4.7.2.5 Previous Aircraft Accidents, Existing Corridor Airports

There have been no aircraft accidents reported in the area of Cagayan de Oro (Lumbia) Airport. Five accidents with deaths have been registered in the area of the Iligan (Balo-i) Airport. Given the absence of accidents in the Lumbia area and the topographic restrictions in the vicinity of Balo-i, there is a strong presumption that topography associated problems led to these accidents:

1. February 21, 1964: DC-3 commercial flight (PAL) from Cotabato to Iligan, crash site approximately 15 km south of Marawi City, no survivors.

2. November 1967: DC-3 (C-47 transport), Philippine Air Force, no survivors.

3. May 1983: Cessna 210, Philippine Air Force, no survivors.

4. December 23, 1987: SD-360 commercial flights (PAL) from Cebu to Iligan, no survivors.

5. 1989: Grummann "American Tiger" (private aircraft) of Matling Agricultural Development Corporation of Cotabato, no survivors.

In addition, a S-76 military helicopter suffered minor damage in the Balo-i area, with no casualties.

The closure of the existing Corridor airports and diversion of traffic to Laguindingan would foreseeably eliminate these topography associated accidents. The list of accidents, however, does not represent a trend that would permit a reliable statistical estimation of future accidents. Considering only the commercial aircraft accidents: twenty-three years passed between the two commercial aircraft accidents. Considering only these commercial accidents, there were 37 deaths in the 27 years between 1964-and the present, or 1.37 deaths per year. The new airport, however, would result in some increase in total road access travel distance, since it is further from Cagayan de Oro, where about 70 percent of the passengers originate. Other things constant, the increase in road travel might result in a small increase in the number of deaths as a result of the proposed Laguindingan location.

4.7.2.6 Land Use Restrictions and Planning

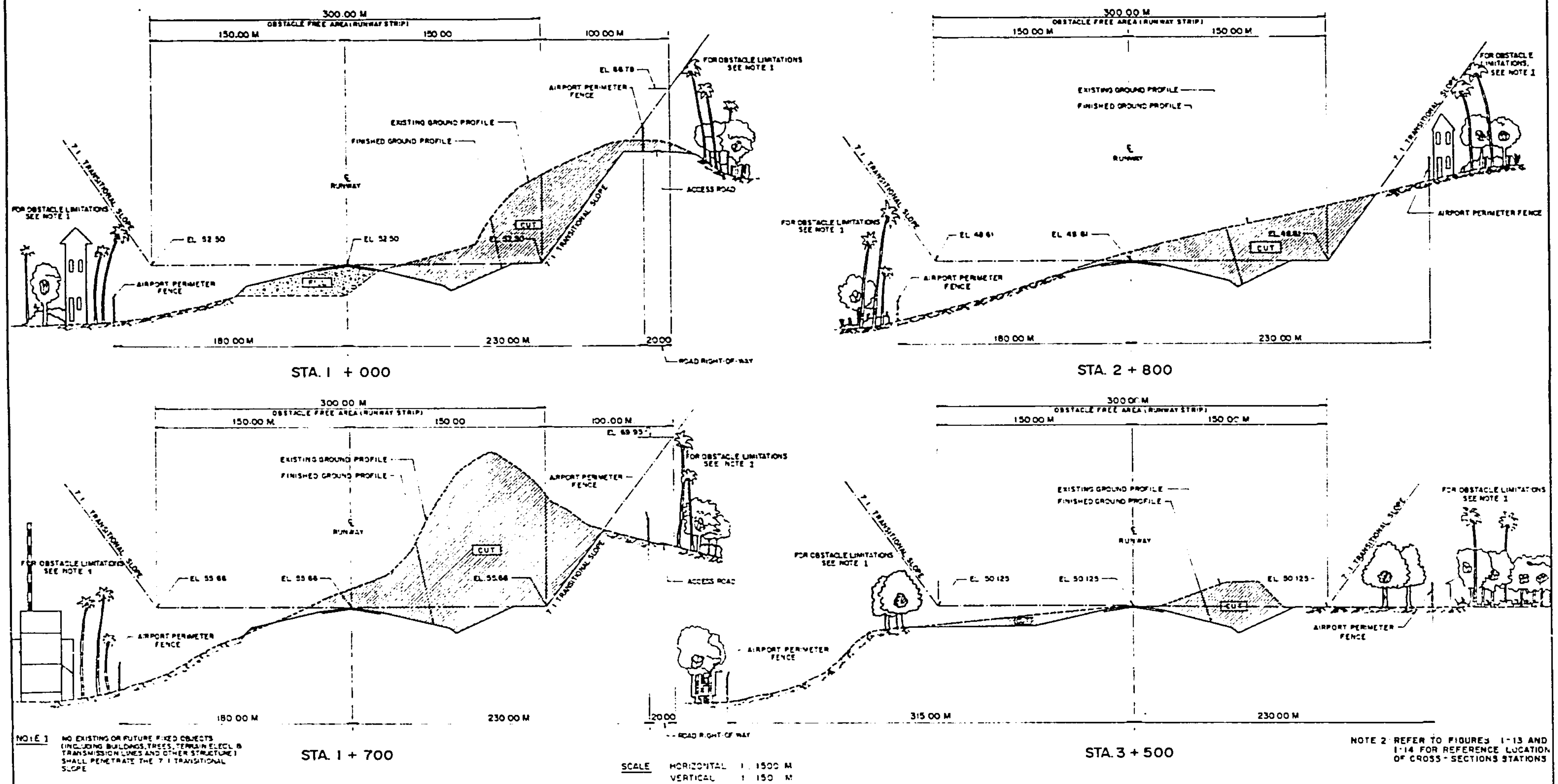
The recommended master planning of areas adjacent to the proposed airport is designed to ensure the capability of both the safety of forecasted air traffic and airport operations as well as the safety of existing residents or induced developments. The primary physical constraints governing land use in the vicinity of the Laguindingan airport will include:

- noise impact restrictions
- height limitations based on obstruction restrictions
- light, glare and emission restrictions

The ICAO recommends a minimum of three zones for land use planning based on projected aircraft noise impacts; summarized as basically no restrictions (no noise impact), some restrictions (moderate noise impact) and most land use restriction (significant noise impact).

Based on forecasted air traffic to the year 2011, noise generation models (Integrated Noise Model, Version 3, USFAA) indicate noise contours in the range of DNL 65 extending approximately 150 m beyond the proposed airport property perimeter (Figure 4-3) and totaling an area of 310 ha, including the designed 167 ha airport area. Compatible land uses within this DNL 65 noise contour impact area include commercial, manufacturing and recreational developments (Table 4-14).

For planning purposes, height limitations will vary according to site specific elevations. For example, Table 4-22 and Figure 4-10 provides transitional slope limitations, the ceiling of which originates at a point 150 m horizontal and perpendicular to the runway centerpoint



PHILIPPINE ASSISTANCE PROGRAM SUPPORT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
CONTRACT NO. 492-0452-C-00-0099-00

LOUIS BERGER INTERNATIONAL, INC.
LOCKWOOD GREENE INT'L · ERNST & YOUNG INT'L · GLOBETROTTERS ENG'G CORP · TRANS-ASIA (PHIL.) INC · CONSULTANT MANAGEMENT SERVICES, INC

ENVIRONMENTAL ASSESSMENT – CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT

OBSTRUCTION LIMITATIONS AND REPRESENTATIVE TRANSITIONAL SLOPES OF FOUR RUNWAY CROSS-SECTIONS

FIGURE 4-10

212

elevation and extends beyond at a 7:1 slope. In addition to height and siting restrictions based on obstruction limitations are restrictions related to operations, including radar and Instrument Landing Systems (ILS) and aeronautical lighting criteria.

Table 4-22
OBJECT HEIGHT LIMITATIONS
(7:1 TRANSITIONAL SLOPE)

DISTANCE OF OBJECT FROM EDGE OF RUNWAY STRIP* (m.)	ALLOWABLE HEIGHT OF THE OBJECT ABOVE RUNWAY CENTERLINE ELEVATION (m)
20	2.86
40	5.71
60	8.57
80	11.43
100	14.28
120	17.14
140	20.00

Source: Consultant estimates

* Runway strip is a defined area whose length extends before the threshold and beyond the end of the runway for a distance of 60 m and whose width extends laterally to a distance of 150 m on each side of the runway centerline.

Light, glare and emission restrictions include uses which may obstruct or confuse normal airport operations, or coastal shipping navigation, are defined under the Civil Air Regulations, Series of 1967, Sections 2.5.1.2 and 2.5.1.3:

- all non-aeronautical lights which due to their intensity, configuration or color might cause or create confusion in the clear interpretation of aeronautical lights should be screened or modified to eliminate such a possibility, in particular lights along each side within 750 m of the runway centerline and a minimum of 4500 from each runway end;

- all lights, aeronautical or non-aeronautical which may cause confusion to mariners or shipping with respect to all angles of the azimuth. Based on available charts, the nearest coastal navigation light is the port of Cagayan de Oro lighthouse. Prior to the design and installation of the airport lighting system, which would foreseeably include the use of a beacon, consultations will be held with respective government agencies, including the Philippine Coast Guard, NAMRIA and port officials.

4.7.2.7 Contingency Plans

Accidents or other hazards during construction would be associated primarily with construction equipment. Training in proper equipment operation and safety procedures would adequately address this risk.

Hazards associated with airport operation would also be considered in the contingency plans. An airport emergency plan would be established for the coordination of the actions to be taken in an emergency occurring at the airport or in its vicinity. Examples of these emergencies are: aircraft emergencies, sabotage including bomb threats, unlawfully seized aircraft, dangerous goods occurrences, building fires and natural disasters. The emergency plan would coordinate the response or participation of all existing agencies which, in the opinion of the appropriate authority, could be of assistance in responding to an emergency. Examples of these agencies within the proposed airport facility include:

- Air traffic control unit
- Rescue and fire fighting services
- Airport administration
- Medical and ambulance services
- Security services and police

Coordinating agencies located outside of the proposed airport site include:

- Fire departments
- Police
- Medical and ambulance services
- Hospitals
- Military and coast guard

For the proposed airport facility, the Crash, Fire and Rescue unit to be provided is based on ICAO criteria initially for Category 6 for B-737 service and subsequently upgraded to Category 8 with A300 service. In addition to CFR facilities, two rescues boats would be provided for sea rescue operation in case of crash landing into the sea.

4.8 POTENTIAL FOR CUMULATIVE EFFECTS WITH OTHER PROJECTS IN THE CORRIDOR

Concurrent projects identify the industrial/agro-industrial potential of the Corridor. Implementation of the proposed airport project, as recommended by Feasibility Study for the Laguindingan site, would serve as an additional incentive to this development particularly through the provision of additional air cargo capacity as provided by the forecasted aircraft

314

movements. As a significant result, the enhanced need to timely implement coherent master planning of the Corridor including water supply and wastewater collection and treatment as detailed in related feasibility studies is further enhanced.

CHAPTER 5
MITIGATIVE MEASURES

CHAPTER 5

MITIGATIVE MEASURES

5.1 SUMMARY OF IDENTIFIED PROJECT IMPACTS

The proposed project will serve to consolidate future air transport requirements of the Corridor and adjoining service area from two existing but constrained airport facilities to a new, unconstrained facility meeting international standards and located within the municipality of Laguindingan. With the noted exception of increased cargo capacity available with A300 aircraft service, and an increment of induced air traffic as a foreseen result of more numerous and convenient flight schedules, the projected traffic forecasts for the proposed Laguindingan facility generally reflect the summed value of forecasted demand on the existing airports rather than the actual generation of new air traffic.

The principal project impacts are thus derived from this transfer of forecasted traffic, the physical construction and subsequent operational activities of the proposed airport on the relatively undeveloped Laguindingan site. To evaluate net environmental impact, this assessment provided a description of the predicted conditions without (Chapter Three) as well as with project implementation (Chapter Four). Based on this comparative analysis, the negative environmental impacts identified for the proposed project include:

- land use, planning and socio-economic impacts involving the dislocation of affected residents and tenant farmers from a coastal agricultural area that is in the legal process of both agrarian reform and zoning conversion to industrial use;

- physical environment impacts including increases in ambient noise levels due to aircraft operations and access road vehicular traffic, heightened demand on domestic water supplies and the carrying capacity for handling wastes, in the form of wastewater, solid and hazardous wastes. The calculated volumes of required earthwork will introduce the potential for increased siltation and runoff into the adjoining coastal waters;

- biological environment impacts described as the physical displacement of marginal terrestrial habitats and induced, secondary stress on coastal marine habitats;

- cumulative impacts that may influence the quality of the environment within the project's vicinity as well as within the general Corridor.

The following sections discuss specific mitigative actions in addition to those described in the previous chapters.

5.2 MITIGATION OF LAND USE AND PLANNING IMPACTS

A concurrent study[1] describes the framework for master planning proposed developments within the Corridor, such as the Laguindingan airport project, in relatively general, macro-scale terms. To fully integrate the proposed airport within the master planning process, early and continuous coordination must be established between the concerned governmental agencies to ensure, for example, adequate consideration for supportive infrastructure and utilities while attempting to avoid conflicting land uses.

The Feasibility Study discusses several alternative institutional structures that might be suitable for building and operating the Laguindingan airport facility, including;

- Traditional public airport construction and administration;
- Public construction, with administration by an independent authority;
- Build, Operate and Transfer (BOT); and
- Operate under contract.

While the Feasibility Study further discusses the relative advantages and disadvantages of each alternative, the primary factor determining the degree of impact mitigation with respect to land use and planning is the stage at which the responsible airport institution becomes locally involved. The existing remoteness and corresponding low level of development and population density within the selected Laguindingan site, in addition to the presence of a large landholding (the 604 ha DCIC property) provides a unique opportunity to apply master planning techniques, similar to the framework and process concurrently being applied throughout the Corridor, to establish adequate land use controls prior to project construction.

In consonance with local zoning regulations and procedures of the municipality of Laguindingan, as well as the provincial- and regional-level agencies, the implementing airport institution will assist in the establishment of land use controls in the peripheral areas of the airport. As a policy, the restrictions would be submitted for public review and would incorporate as minimum standards the physical constraints identified within this assessment, including:

- Height limitations;
- Noise impact restrictions;
- Light, glare and emission restrictions.

---

[1]LBII, 1991. Feasibility Study, Cagayan de Oro-Iligan Industrial Master Plan - Volume I, Preliminary Report.

Various means are available for controlling land use within the vicinity of an airport. The effectiveness of these means and their manner of implementation should be considered for each particular situation. The most common land use controls are:

- planning;
- zoning;
- easement; and
- purchase.

Land use regulatory agencies should be consulted at the earliest possible stage by the responsible airport authority regarding the special requirements of airport operations, to ensure safety and minimize upset. The existing status of the Laguindingan site and the present absence of potentially non-conforming or conflicting land uses implores the implementation of master planning and land use controls as an initial step in the mitigation process. As an example, the possible use of the DCIC property for a cement plant as discussed in Chapter Three, would strongly conflict with emission restrictions as well as possible height limitations of the proposed airport.

5.3 MITIGATION OF SOCIO-ECONOMIC IMPACTS

The selection of the Laguindingan site appears socially sound and feasible. Nonetheless, its acceptability can be further ensured if the anticipated social costs are properly identified and reasonably mitigated prior to and during project implementation. Several steps may be taken to reduce anticipated social costs. Initially, a public information campaign should be designed to discuss among other issues the relative merits of the alternative sites, the rationale for choosing the Laguindingan site, and the short- and long-term consequences for the existing or proposed airports at Lumbia, Balo-i, and Linamon.

An important issue underlying the concerns of some leaders, particularly those from the Lanao provinces, is when the proposed airport in Laguindingan is expected to be operational. Fears about their areas being neglected can be assuaged if more definitive answers about the project's timetable are provided. Possible anxieties about the longer travel time from Cagayan de Oro to Laguindingan (relative to Lumbia) may be reduced if the proposed site's comparative benefits are fully clarified.

While anticipating the benefits of the airport, the municipality of Laguindingan will also need to improve beforehand its absorptive capacity and its readiness to solve the unintended social costs that may accompany modernization, including e.g., inmigration, inefficient public services owing to the increased demand, pollution, and peace and order problems.

For this purpose, education and training programs will be undertaken for the municipal staff and for the larger population as well. Programs for the former may focus on planning, zoning, housing, and related topics, and for the latter on developing marketable skills, managing small scale enterprises, and public participation within the planning process.

As described in Chapter Two, the communities directly affected by the proposed project are predominantly poor; reported incomes are low, public services are limited, and malnutrition levels are high. A major issue in the area is the status of the agricultural lands owned by the Diamond Cement and Industrial Corporation (DCIC) -- whether these are subject to agrarian reform, as maintained by the Department of Agrarian Reform (DAR), or whether they can be converted to industrial use zoning, as requested by DCIC and recently by the municipal government of Laguindingan.

The major socio-economic impact of project implementation will be the dislocation of the families living in the area directly affecting their current means of livelihood, existing lifestyles and community structure, as well as the potential for many of the tenant farmers to eventually acquire land ownership through the land distribution program of DAR. The number of families affected ranges from 220 (the number of households within the airport perimeter) to 380 (the number of households in the 604 ha property owned by DCIC). A few households may also have to be relocated along the alignments of the improved access roads.

Preliminary estimates of relocation costs as well as land acquisition costs are included in the construction cost estimate (Table 1-10) generated by the Feasibility Study and incorporated into the project cost/benefit analysis. Following traditional practice, land acquisition costs are to include the value of improvements, such as agricultural plantings and structural materials of affected buildings, in addition to consideration of the local classification of the land. Recent assessment values provided by the municipality of Laguindingan are included in Table 5-2 with the added note that assessment values tend to be less than current market values.

In addition to financial compensation, mitigation of the project's socio-economic impact will be done through a "Relocation, Resettlement, and Community Development Program," consisting of the following components: (1) Social Preparation; (2) Housing, Site and Services Development; (3) Community Organizing and Development; (4) Socio-economic Development; and (5) Project Management. Specific activities for these components are outlined in Table 5.1.

- Social Preparation will ensure that the communities are fully informed of the proposed project, that there is consensus on terms and agreement of relocation, and that there is enough information on the community for planning purposes.

- Housing, Site and Services Development is geared toward securing an appropriate site, developing the necessary utilities and services, and providing low-cost housing and homelot ownership for the residents.

- Community Organizing and Development is premised on the belief that through an active organization, people can better articulate their concerns, secure the resources they need, design and implement plans, and work together effectively. This component thus includes the development of orientations, values and skills for effective community organizing.

- Socio-economic Development ensures that the residents are equipped with marketable skills, capital and credit, and opportunities for developing micro-enterprises or small-scale income-generating projects, in addition to priority consideration for employment within the proposed project.

- Project Management focuses on monitoring and evaluation of the overall program and on networking with other groups and institutions to help sustain the program.

Distinctive of this program is the orientation that people must participate in the decisions that affect their lives, that they can do so effectively when organized as a group, and that social and economic programs must go hand in hand to ensure sustainable development.

Preliminary meetings indicate that the proposed mitigation program could be undertaken by Ayala Land, Inc., in cooperation with the Ayala Foundation, Inc. subject to favorable resolution of zoning conversion/agrarian reform issue. The latter, through its Socio-Economic Development Division, has extensive experience in implementing programs designed to help disadvantaged groups gain access to more opportunities through an integrated approach to this relocation process. The Ayala Foundation, Inc. has an "Integrated Community Development Program" which helps build the capabilities of relocated communities to identify their own problems and seek long-term solutions to them. This program has been successfully implemented by the Ayala Foundation in association with recent development projects in Molino (Bacoor, Cavite), and in Kasambagan, Cebu.

The transfer of commercial flight operations from the existing Cagayan de Oro and Iligan airports to the proposed Laguindingan facility could conceivably displace airport employees, concessionaires and their staffs. The three to four year detailed design and construction timeframe of the new airport will provide an adequate transition period for the responsible government agencies, including the respective local government units, the Regional Development Councils and the Air Transportation Office, to develop a planning and management framework for future use of the existing airport facilities in consensus with affected employees and concessions, in addition to establishing hiring and concession guidelines for the new airport facility.

Table 5-1
RECOMMENDED RELOCATION, RESETTLEMENT, AND COMMUNITY DEVELOPMENT PROGRAM

I. SOCIAL PREPARATION	
A. Community consultations and dialogue	• discuss specific needs and concern of stakeholders or interest- and support-groups • provide full information on the costs and benefits involved • establish structures for decision-making • agree on terms and conditions • determine short-term and long-term assistance (e.g., basis, amount and mode of compensation; relocation and resettlement assistance)
B. Community appraisal	• conduct census for listing and planning purposes • inventory of skills for possible training and job referrals
II. HOUSING, SITE AND SERVICES DEVELOPMENT	
A. Site selection, planning and development	• set the parameters of the possible sites, conduct on-site ocular visits or field inspections, assess the relative costs and benefit of alternative places, and decide on the area. • plan and design the community landscape and facilities • provide utilities (water, electricity) and access to education, health, and social services, before relocation is made • design appropriate and desired homes
B. Low-cost housing	• determine terms of ownership
III. COMMUNITY ORGANIZING AND DEVELOPMENT	
A. Core group formation and leadership training	• identify community leaders and provide leadership skills training
B. Human relations and group dynamics training	• conduct training programs to provide residents with skills that are economically viable or can be utilized by businesses.
C. Organizational formation and management	• develop organizational skills (e.g., planning, budgeting, auditing) • establish a formal association/cooperative which could help residents secure loans or market their products

Table 5-1 (continued)

IV. SOCIO-ECONOMIC DEVELOPMENT	
A. Market-driven skills training program	• conduct training programs to provide residents with skills that are economically viable or can be utilized by businesses.
B. Micro-enterprise development	• assist families develop and manage small-scale income-generating projects, especially micro-enterprises that would benefit from the presence of an airport
C. Social credit	• extend small loans on easy terms, e.g., no collateral, fast processing, easy repayment and close monitoring
V. PROJECT MANAGEMENT	
A. Monitoring and Evaluation	• check compliance with the quality of public utilities and infrastructure in the relocation area and the community's access to education, health, and social services • determine the progress of efforts to provide security of tenure and establish a viable community organization • determine improvements in socio-economic status and quality of life in general
B. Networking	• develop linkages with government agencies, local government units, non-government which can provide resources and help sustain the program.

223

Table 5-2
ASSESSMENT VALUES (in Pesos) PROVIDED BY THE MUNICIPALITY OF LAGUINDINGAN (1991)

LAND CLASSIFICATION	1st CLASS	2nd CLASS	3rd CLASS	UNITS
Residential Land	60.00	40.00	30.00	per sq.m.
Commercial Land	90.00	70.00	50.00	per sq.m.
Industrial Land	100.00	80.00	60.00	per sq.m.
Agricultural Land, Coconut	10,000.00	8,160.00	6,120.00	per ha.
Agricultural Land, Corn	21,000.00	16,800.00	12,600.00	per ha.
Agricultural Improvement	—	—	—	
Atis	40.00	30.00	20.00	per tree
Avocado	50.00	40.00	30.00	per tree
Abana	150.00	120.00	100.00	per tree
Bamboo	870.00	700.00	520.00	per clump
Banana	40.00	35.00	25.00	per hill
Casoy/Chico	50.00	40.00	30.00	per tree
Coconut Tree	150.00	130.00	80.00	per tree
Falcata/Gmelina	170.00	135.00	100.00	per tree
Ipil-ipil	30.00	20.00	5.00	per tree
Mango (Carabao)	440.00	320.00	200.00	per tree
(Payo)	330.00	220.00	120.00	per tree
(Pico)	650.00	430.00	210.00	per tree
Nangka	110.00	80.00	60.00	per tree
Papaya (home consumption)	30.00	25.00	20.00	per tree
(export)	50.00	40.00	30.00	per tree
Siniguelas	30.00	25.00	20.00	per tree
Starapple	110.00	80.00	60.00	per tree
Tambis	50.00	40.00	30.00	per tree
Tiesa	30.00	25.00	20.00	per tree

TYPE OF BUILDING			
I. Reinforced Concrete	-A.	3,800 to 4,000	per sq.m.
	B.	3,500 to 3,700	per sq.m.
II. Mixed Concrete	-A.	3,200 to 3,400	per sq.m.
	B.	2,900 to 3,000	per sq.m.
	C.	2,600 to 3,000	per sq.m.
	D.	2,300 to 2,500	per sq.m.
III. Strong Materials	-A.	2,000 to 2,200	per sq.m.
	B.	1,700 to 1,900	per sq.m.
	C.	1,400 to 1,600	per sq.m.
	D.	1,000 to 1,300	per sq.m.
	E.	600 to 500	per sq.m.
IV. Temporary Makeshift		200 to 500	per sq.m.

5.4 MITIGATION OF PHYSICAL ENVIRONMENT IMPACTS

5.4.1 Aircraft Noise

Factors governing the impact of aircraft noise exposure on a community or local populace include:

- land and building use;
- type of building construction;
- distance from airport noise source;
- ambient noise levels;
- sound attenuation due to physical or meteorological conditions; and
- sociological considerations.

The primary mitigation identified to limit the impact of aircraft noise are preventive measures of land use control based on predictions of noise level contours such as provided in Figure 4-3. For the year 2011 base case scenario of forecasted air traffic, the predicted setback of residential land use should be approximately 150 m from the airport perimeter fence.

Depending on the level and type of development that is planned for the area, for example tourism along the coast of Tubajon, additional mitigation of aircraft noise may be desired for aesthetic reasons. Recommended mitigation actions include:

- installation of acoustic barriers comprised of earthen berms and planted greenbelts. Care should be made in selecting greenbelt plant species to avoid increasing the avifauna population and bird hazard to aircraft while providing effective sound insulation value;
- adjusting operational procedures to reduce aircraft noise or noise direction on the ground, including the recommended use of shielding engine noise by aligning aircraft towards airport structures during necessary ground tests, or limiting the application of reverse thrusts during landing procedures.
- restrictions to regulate the types of aircraft permitted, flight paths and elevations, volume of aircraft movements or operating hours.

The overwater approaches of the recommended airport site will inherently limit the potential impact of aircraft noise.

225

5.4.2 Vehicular Noise Along Access Roads, Construction Phase

Based on projected volumes of required construction materials (e.g., cement, concrete aggregates) and surplus cut material from preliminary designs of earthwork, a significant flow of construction vehicles and a high level of corresponding noise might be generated along the airport access roads during the construction phase. Pre-construction studies will emphasis economical use of traffic including the feasibility of utilizing barges for local shipping needs, including transhipment of cement from Iligan and surplus cut to identified secondary sites. The shoreline adjoining the existing DCIC wharf provides deep water access ideal for barge operations. Disposal sites for surplus cut material could include the low laying PHIVIDEC Industrial Estate which is across the Macajalar Bay, in Tagoloan, or the coastal site proposed for the Cagayan de Oro wastewater treatment facility in a concurrent study[2]. Additional use of the surplus cut material of approximately 1.5 million cu.m. includes recycled use of soil for agricultural areas of the relocation site, earthen berm acoustic barriers or fill for off-site but related developments in the proximity of the airport.

5.4.3 Vehicular Noise, Operational Phase

Due to the relative distance to the proposed Laguindingan airport facility from both Iligan and Cagayan de Oro, shuttle bus service concessions should be evaluated to accommodate both employee and passenger requirements.

5.4.4 Domestic Water Demands

Adequate water supplies must be identified for the airport project prior to initiating construction. Based on available information described in Chapter Two, the groundwater resources of the project site may be of poor quality and of insufficient quantity to accommodate the additional demands of airport construction and operation. Secondary studies are recommended to further quantify local groundwater quality and supply.

Geo-resistivity studies and exploritory drillings are ongoing in the neighboring municipality of Alubijid as part of the ongoing water supply studies. During the detailed design phase of the proposed airport, similar studies should be extended to the airport vicinity and the municipality of Laguindingan to identify domestic water supplies adequate to serve site and anticipated off-site developments.

Incorporation of rain catchment tanks within the design of airport facility structures is advisable in light of potentially limited local water supplies.

---

[2]LBII, 1991. Feasibility Study of Wastewater Collection, Treatment and Disposal, and Water Supply and Distribution System for Cagayan de Oro.

5.4.5 Increased Siltation During Construction

From a management point of view, construction activities should be concentrated during the more favorable, drier months from November to May (Table 2-12). Due to the sensitive coastal surroundings, stockpiled soil material should be adequately diked and channeled to reduce silt-laden runoff from entering coastal ecosystems. Cut slopes, such as along the improved (widened) access roads will be replanted with native grasses or drought-tolerant groundcover to reduce potential erosion.

5.4.6 Increased Runoff During Operation

To reduce calculated runoff as well as potential erosion, the V-ditches providing linear drainage along the south side of the proposed runway (Figure 4-4) will be turf-lined. A detention pond is included in the preliminary designs (Figure 1-13) to collect a portion of the apron and adjacent taxiway and runway runoffs. In addition, rip-rap treatment should be incorporated within the designed drainageways and runoff ravines to improve retention and infiltration.

5.5 MITIGATION OF BIOLOGICAL ENVIRONMENT IMPACTS

The project impacts identified outside of physical displacement of the remaining marginal terrestrial habitat are secondary in nature, including increased runoff and sediment load (siltation) to the adjoining marine coastal habitats. The planning phase and recommended land use zoning for the airport should recognize as critical the marine habitats identified within this assessment and afford legislated protection as exemplified by municipal resolutions restricting the local harvest of the seaweed, Sargassum.

5.6 MITIGATION OF CUMULATIVE IMPACTS

Introduction of an international standard airport facility in the relatively undeveloped center of a rapidly growing and industrializing corridor will involve cumulative impacts. Concurrently in progress is a master planning study which incorporates the preliminary results of this study. The mitigation of subsequent cumulative impacts is explicitly related to the degree of planning and land use control efforts exerted by the responsible government agencies in-line with the recommendations developed within these respective feasibility studies.

APPENDIX A
METHODOLOGY

Appendix A-1
PERCEPTION SURVEY METHODOLOGY

Methodology

The purpose of the survey was to qualify and quantify the perceptions of the households that may be affected by the proposed project.

Sixty-two (62) households were interviewed from an estimated population of 220 households identified during the topographic survey as living within the perimeter of the planned airport. This sample size has a sampling error of 0.10 and a reliability of 0.95.

Respondents were selected by means of a stratified random sampling technique. First, the area was divided into four strata or quadrants and the proportion of households in each quadrant determined. This was done to reduce if not eliminate any sampling bias based on the distribution of the total population. Third, the respondents in each quadrant were then randomly selected from a list prepared by the barangay captain.

The respondent for each household was to be the household head or his/her spouse. In their absence, adult members of the household could also be interviewed.

Interviews were conducted in the Cebuano language by six public elementary school teachers, using an appropriately constructed interview schedule. Interviews lasted for about twenty minutes, on the average. The survey was conducted on August 9 and 10, 1991.

SAMPLE SURVEY FOR THE
AIRPORT FEASIBILITY STUDY

INTRODUCTION: A study is being made to determine whether part of the barangay would be the best site for an international airport. We are therefore conducting a survey to determine the views and opinions of the people in this area.

RESPONDENT

1.1 What is your name?
Unsa may atong pangalan? ____________

1.2 Sex — Male 1 Female 2

1.3 Where were you born?
Diin man ka matawo? ____________

1.4 How old are you?
Pilay edad na ninyo? — Age (yrs.) ______

1.5 What was the highest level and grade of schooling that you completed?

Level		Grade
None	0	____
Elementary	1	____
High School	2	____
Vocational	3	____
College	4	____

1.6 What is your civil status?

Single	1
Married	2
Widowed	3
Separated/ Divorced	4

1.7 IF MARRIED:
How many living children do you have?

Total	
Male	____
Female	____

1.8 What is your religion?
Unsa may inyong relihiyon?

Roman Catholic	1
Iglesia ni Kristo	2
Protestant	3
Muslim	4
Other	5

1.9 How many persons, including you, live in this household? — No. of HH members: _____

1.10 How many are in each of the following age groups?

Age group	Number
Less than 5 yrs	_____
6 - 10 yrs	_____
11 - 14	_____
15 - 60	_____
60 - 64	_____
65+	_____

2.0 MIGRATION/SETTLEMENT HISTORY

2.1 How many years have you been residing in this barangay? (Pila ka na tuig nga nagpuyo niining lugara?) — No. of years _____

2.2 Did you live somewhere else before this?

No 0 SKIP TO 2.5
Yes 1

2.3 IF YES, Where? _____________________

2.4 Why did you move here? (Ngano man mo nga nagbalhin dinhi?) _____________________

____

2.5 If you were given the choice, would you stay here or move somewhere else?

Stay here 1
Move elsewhere 2

Why? _____________________

____

2.6 At present do you have any plans to move to another place? (May plano ba mo nga mobalhin?)

No 0 SKIP TO 3.1
Yes 1

Why? Ngano ma? _____________________

____

2.7 Where do you intend to move? (Asa man mo nagplano nga mobalhin?) _____________________

3. PERCEPTIONS

3.1 Have you heard of the plan to see if an international airport can be built in this barangay?
(Nakadungog ka na ba sa plano na magtukod ug international airport diri nga barangay?)

0 No 1 Yes

3.2 IF YES: How, or from whom? (Kan kinsa)

____

3.3 Are you in favor of this plan?
(Mouyon ka ba sa kining plano?)

0 No 1 Yes

3.4 Why? Why not? (Ngano man)

____

____

3.5 In your opinion, what things should be taken into account first before the plan is finalized?
(Sa imong opinyon, unsa may mga unang lakang nga buhaton usa madesisyunan kining planoha?)

____

____

3.6 What effects do you think will the building of an airport here have on
(Unsa mang klaseha nga epekto an imong makita sa ngadto-ngadto kung matukod an airport?)

(a) the animal and plant life, and
(sa mga hayop ug tanoman)

____

____

(b) the quality of air, water, and soil
(sa kalidad sa hangin, tubig, ug yuta)

____

____

3.7 What benefits will the airport provide to
(Unsa may mga benepisyo kining airport an mahatag sa

(a) the people in the municipality and the province?
(mga tawo sa nianing munisipyo ug sa tibuok nga probinsya?) ____________________

____

____

(b) you and your household in particular?
(imo ug imong pamilya) ____________________

____

____

3.8 What negative effects will the building of an airport have
(Unsa may mga kadaotan an imong makita niani

(a) on the people of the municipality and province?
(sa mga tawo sa nianing munisipyo ug sa tibuok nga probinsya?) ____________________

____

____

(b) on you and your household in particular?
(sa imo ug imong pamilya?) ____________________

____

____

3.9 If the plan pushes through and your household is among those that will have to be relocated, what kinds of assistance do you feel should be provided to you?
(Kung matuman kining mga plano, ug an imong balay o pamilya maapektuhan para sa relokasyon, unsa may mga butang o tabang na kinanglanan gitahag sa inyo?)

____

____

____

3.10 If it were possible to relocate you to another place, where would you want to be relocated?
(Kung posibleng ibalhin mo sa laing lugar, asa man sad imong gusto?)

____

3.11 Why would you want to be relocated there?
(Ngano man sad nga gusto mo mobalhin didto?)

____

3.12 If your household were to be given financial assistance for the dislocation, how much do you think would be a just and fair amount?
(Kun an imong balay o pamilya bayran tungod sa inyong pagbalhin, sa imong huna-huna pila man an imong pangayuon?)

____

4.0 HOUSING/UTILITIES

4.1 House materials

	GI sheet	Nipa	Cogon	Concrete	Bamboo	Wood	Other
Roof	____	____	____	____	____	____	____
Walls	xxxx	____	____	____	____	____	____
Floor	xxxx	xxxx	xxxx	____	____	____	____

4.2 Tenure of house and lot

	House	Lot
Own	____	____
Free	____	____
Rent/mo.	P____	P____

4.3 What is the floor area of your house (in sq.m.)?
(Pila gilapdan an imong balay?)

Floor area: ____________
(sq.m.)

4.4 How many rooms are there?
(Pila nga kuwarto sa imong balay?)

No. of rooms: ________

4.5 About how old is your house?
(Pila na katuig an imong balay?)

____

4.6 What do you use for lighting and for cooking?

Lighting		Cooking	
Electric	1	Oil	4
LPG	2	Wood	5
Kerosene	3	Charcoal	6

4.7 IF ELECTRIC:
How much is your average electric bill per month?
Pilay inyong kasagarang balayranan sa kuryente kada buwan? ______________________

4.8 What type of toilet do you have?
Unsang klaseha sa kasilyas ang gigamit ninyo dinhi sa balay?

None	0
Inodoro (bubu-an ug tubig)	1
Inodoro (mahimong i-plash)	2
Antipolo (closed pit)	3
Open pit (Na-a sa yuta)	4
Others	5

5.0 HOUSEHOLD, INCOME AND EMPLOYMENT

5.1 How many HH members contribute regularly to the HH income?
(Pila nga ka-miyembro sa pamilya an mohatag permanente sa panggastos sa balay?) ______________

5.2 What is the household's main source of income
(Unsa may inyong panginabuhi gyud?)

Farming	1
Fishing	2
Government employee	3

5.3 What are your household's other sources of income
(Unsa may inyong laen-laen nga pangita?)
____
____
____

5.4 How much in your estimate is the total monthly income your household?
(Sa imong huna-huna, pila may total an inyong kita sa usad na buwan?)

Less P500
500 - 999
1,000 - 1,999
2,000 - 3,999
4,000 - 6,999
7,000 - 9,999
10,000 or more

6.0 COMMUNITY

6.1 What do you think are the main problems of this community?
(Sa imong paghuna-huna, unsa an pinakaunang problema dinhi sa barangay?)
____
____
____

6.2 What is being done to solve them?
(Unsa may gibuha para masolbad kini?)

____

____

6.3 What would you recommend to solve this problem?
(Unsa man sa imong irekomenda para masolbad kini?)

____

____

7.0 FOR FARM HOUSEHOLDS ONLY

7.1	What is your farm area? (Unsa kadako an imong yuta?)	Hectares ________
7.2	What is your main crop (Unsa may imong pinakaprodukto?)	Tobacco 1 Corn 2 Palay 3 Others 4
7.3	How many times did you harvest last year? (Pila ka beses kamo moani sa usa katuig?)	Times harvest ______
7.4	What was your total yield in the last harvest (Pila an imong ani sa kadtong katapusang ani?)	Total yield ________
7.5	How much income did you get from the last harvest (Pila an imong kita sa kadtong katapusang ani?)	P ______________
7.6	What is your tenancy status	Landlord 1 Owner-operator 2 Share tenant 3 Lessee 4 Other
7.7	Do you have any problems with the landowner?	No 0 Yes 1
	IF YES: What are these?	______________ ______________

236

Appendix A-2
Water Quality Sampling and Analysis

A preliminary literature survey was conducted to describe existing water quality of local groundwater supplies and coastal waters based on available information. In coordination with a concurrent environmental assessment of the wastewater collection, treatment and disposal, and water supply and distribution system for Cagayan de Oro (LBII, 1991), groundwater samples were obtained from three locations near the proposed project site (Figure 2-17), including two existing domestic water supply wells and free flowing shoreline spring.

Laboratory testing of water quality was conducted by the Xavier University and the DENR Water Testing Laboratory, Region X. In addition to parameters listed in Table 2-17, tests for heavy metals (mercury, lead, chromium and cadmium) are ongoing. Testing procedures followed the approved methods of analysis listed in Table A-2.

The results of the water sampling at 11 stations within the Macajalar Bay, including a sampling station off Sulauan Point were incomplete at the time of this report preparation. The analysis of the Macajalar Bay water will include similar physical, chemical and biological parameters for comparison to tested groundwater and surface water values.

Table A-2
APPROVED METHOD OF ANALYSIS

PARAMETER	METHOD OF ANALYSIS
1 COLOR	Visual Comparison Method (Platinum Cobalt Scale)
2 TEMPERATURE	Use of Mercury-Filled Thermometer
3 pH	Glass Electrode Method
4 DISSOLVED OXYGEN	Azide Modification (Winkler Method), Membrane Electrode (DO meter)
5 BOD	Azide Modification (Dilution Technique)
6 TOTAL SUSPENDED SOLIDS	Gravimetric Method
7 NITRATE AS OXYGEN	Bruccine Method for Saline Waters, specific Ion Electrode Meter for Fresh Water
8 PHOSPHATE AS PHOSPHORUS	Stannous Chloride Method
9 SURFACTANTS (MBAS)	Methylene Blue Method (Colorimetric)
10 OIL AND GREASE	Gravimetric Method (Petroleum Ether Extraction)
11 PHENOLIC SUBSTANCES	Chloroform Extraction Method
12 ARSENIC	Silver Diethyldithiocarbamate Method (Colorimetric)
13 CADMIUM	Atomic Absorption Spectrophotometry (Wet ashing with concentration HNO_C+ HCl)
14 CHROMIUM	Diphenyl Carbazide Colorimetric Method
15 LEAD	Atomic Absorption Spectrophometry
16 TOTAL MERCURY	Cold Vapor Technique, (Mercury Analyzer, AAS)
17 TOTAL COLIFORMS	Multi-Tube Fermentation Technique or Membrane Filter
18 FECAL COLIFORMS	Multi-Tube Fermentation Technique or Membrane Filter

Note: Other methods found in the Philippine Standard Methods for Air and Water Analysis, the "Standard Methods for the Examination of Water and Waste Waters", published jointly by American Public Health Association (APHA), the American Waterworks Association and the Water Pollution Control Federation of the U.S. or in accordance with such other method of analyses as the DENR may prescribe.

Source: Revised Water Usage and Classification/Water Quality Criteria DENR Administrative Order No. 34 Series of 1990, March 20, 1990.

Appendix A-3
METHODOLOGIES - BIOLOGICAL SURVEY

To document the existent terrestrial habitats and resident species, a floral and fauna survey was conducted for a breadth of six meters and a distance of three kilometers along the delineated and staked centerline of the proposed airport runway, and along the existing alignments of the and proposed airport access roads. The objective was to record the following:

- Habitat types (biotic communities)
- Species observed (plants and vertebrate animals)

  *Life forms (e.g., tree, shrub)
  *Ecological Status or frequency of occurrence (e.g., rare, occasional, abundant
  *Latin binomial or trinomial
  *Vernacular name - local, regional, English, and/or dialectic

- Endangered species (as perceived by local experts)

- Sensitive habitats
- Cultivated plants

A complete list of plants and animals recorded from the biological survey is presented in Appendix D-6.

Prior to field survey of marine habitats, a literature survey was conducted and interviews held with the faculty of the Biology Department of Xavier University who have conducted numerous field studies in the coastal areas off Sulauan Point (Appendix D-7).

Field surveys of the local marine habitats were conducted at low tide, with the aid of local fishermen at cross-sections of the reef flat stretching from shoreline to the reef front "drop off" near Tubajon and Sulauan Point. Utilizing a traditional outriggered banca, skin diving techniques and local informants, the predominant species were identified in the field (Appendix D-8) and referenced to the subjectively defined habitat areas of the reef flat, back reef, reef crest and reef front following standard terminologies. Marine habitats below 10 m depth were not surveyed nor were potential reef areas generally south and east of the proposed site (Figure 2-29).

Based initially on land cover maps (Figures 2-23 and 2-28), wetland areas were identified and surveyed on foot. Additional avifauna lists (Appendix D-9) were obtained from technical reports of recent DENR surveys conducted as part of the 1991 Asian waterfowl census.

Appendix A-4
METHODOLOGIES - ARCHAEOLOGICAL SURVEY

Field archaeological surveys were conducted along a transect, of approximately three km length, which traversed most parts of the proposed runway area. A pocket transit was used to determine location on points (bench marks) with the references marked on the map of the proposed airport site. Starting at the first bench mark (BM1) which is 250 m west of the eastern end of the proposed paved runway on the map, reference points (stations) were made every 500 m extending to the western tip of the proposed runway alignment, covering the total length of more than three kilometers.

Using each station as the arbitrary center of a survey field, the archaeological team scoured the ground surface in search of archaeological materials. The team walked a distance of about 200 m from the center, and worked their way from there, at both sides in each field. In the process the team covered an area of approximately 400 x 400 sq.m. for each station. There were a total of six stations covered, approximating a total survey area of 96 ha.

In addition to the proposed project site, explorations were conducted of a large cave and several rock shelters identified by local informants in the limestone escarpment between the lower and upper terraces near Tubajon. Ocular surveys were also conducted along existing access road alignments and at the site of the Spanish-era watchtower/fort near Sulauan Point.

APPENDIX B
CONTACT LIST

APPENDIX B
CONTACT LIST[1]

Asian Wetlands Bureau

Perla M. Magsalay
National Coordinator
Cebu

Ayala Corporation

Teodoro L. Ferrer
Assistant Vice President
Strategic Planning Group
Makati, Metro Manila

Teresa S. Palma
Division Manager
Strategic Planning Group
Makati, Metro Manila

Mr. Quilab
Caretaker/Officer-in Charge
Diamond Cement and Industrial Corp. (DCIC)
Moog, Laguindingan

Ayala Foundation, Inc.

Elizabeth Cabuguas
Project Manager
Makati, Metro Manila

Glecy C. Cuenco
Office of the Executive Director
Makati, Metro Manila

---

[1]Additional preliminary contacts are included in the attendance lists, Scoping Sessions Report

242

<u>Bureau of Fisheries and Aquatic Resources</u> (BFAR)

Florida Arce
Supervising Aquatic Resources Development Specialist
Research Division
Quezon City

<u>Department of Agrarian Reform</u> (DAR)

Anastacio M. Limbo, Jr.
Regional Director
Region X
Cagayan de Oro

Antonietta R. Borra
Provincial Agrarian Reform Office
Cagayan de Oro

Leonardo S. Cataluña
Municipal Agrarian Reform Office
Laguindingan

<u>Department of Environment and Natural Resources</u> (DENR)

Sixto E. Tolentino, Jr.
Head
EIA Group, Environmental Management Bureau (EMB)
Quezon City

Fe Monge
Technical Staff
EIA Group, (EMB)
Quezon City

Raul Geolleque
Regional Technical Director (OIC)
DENR, Region X
Cagayan de Oro

Marivic Fajardo
Environmental Management Specialist I
DENR, Region X
Cagayan de Oro

Department of Trade and Industry (DTI)

Ninfa U. Along-Albania
Regional Director
Region X
Cagayan de Oro

Mamole A. Pangandaman
Regional Director
Region XII
Iligan

Jaime B. Pa-alisbo
Chief Trade and Industry Development Specialist
Provincial Office, Misamis Oriental
Cagayan de Oro

Department of Transportation and Communication (DOTC)

Felicisimo C. Pangilinan, Jr.
Transport Planner
Air Transport Planning Division
Pasig, Metro Manila

Raphael S. Lavides
Chief
Air Transport Planning Division
Pasig, Metro Manila

Artemio Y. Garcia
Airport Manager
Cagayan de Oro (Lumbia) Airport

Housing and Land Use Regulatory Board (HLURB)

Evangeline B. Agan
Regional Office
Region X
Cagayan de Oro

Philippine Airlines (PAL)
Horace B. Abear
Branch Manager
PAL, Iligan

Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)
Mr. E. de los Angeles
Chief Meteorological Officer
PAGASA Synoptic Weather Station
Cagayan de Oro

PHIVIDEC Industrial Authority
Veronica A. Dato
Advertising/Promotions Officer
Makati, Metro Manila

Misamis Oriental Rural Electric Service Cooperative (MORESCO I)
Jovil Ubay-ubay
Planning and Design Engineer
Cagayan de Oro

Moog Public Elementary School, Teachers
Linda Quilab
Grace Paculba
Irma Estrada
Wilfredo Salupan
Lorenzo Sabillana

Municipality of Laguindingan
Domingo Estrada
Barangay Captain
Barangay Moog

Lourdisa Dagukanan
Barangay Captain
Barangay Tubajon

Lino Sambaan
Municipal Secretary

Gaspar Timba
Fisherman/Farmer
Barangay Tubajon

<u>Municipality of Linamon</u>

Edenita R. Macas
Municipal Planning and Development Council (MPDC)
Linamon, Lanao del Norte

<u>National Museum</u>

Domingo A. Madulid
Curator
Philippine National Museum

<u>Tribal Communities Association of the Philippines, Inc.</u> (TRICAP)

Datu Poncio S. Quina
Director (NCR) and National Coordinator
Quezon City

<u>US Agency for International Development</u> (USAID)

Kevin Allyn Rushing
Environmental and Natural Resources Officer
Office of Rural and Agricultural Development
Manila

Joshua L. Fliegel
Enterprise in Community Development Coordinator
Office of Food for Peace and Voluntary Cooperation
Manila

Jocelyn Daway
Project Management Specialist
Office of Capital Projects
Manila

<u>Wilbur Smith Associates</u> (WSA)

Arnel P. Alvarado
Deputy Project Manager
Philippine Assistance Program Support (PAPS) Project
Makati, Metro Manila

Avril Tollay
Senior Environmental Planner
PAPS Project
Makati, Metro Manila

<u>Xavier University</u> (XU)

Gerarda Abanil
Former Chairperson
Department of Biology
Cagayan de Oro

Fr. Francis Demetrio, S.J.
Curator
Xavier Museum
Cagayan de Oro

Dulce R. Dawang
Chairperson
Marine Biology Department
Cagayan de Oro

Lina C. Kwong
Chairperson
Chemistry Department
Cagayan de Oro

APPENDIX C
REFERENCES

Appendix C
REFERENCES

ASEAN, 1982. The ASEAN Compendium of Climatic Statistics. Published by ASEAN Sub-Committee on Climatology, ASEAN Committee on Science and Technology, Jakarta, Indonesia.

Asian Wetland Bureau, 1988. A Directory of Asian Wetlands. IUCN. Cambridge, England.

Ato, Rey F.E., 1990. A Taxonomic Survey of Some Calcareous Macrobenthic Algae in Selected Intertidal Areas Along Macajalar Bay. Unpublished Report, Department of Biology, Xavier University.

Atrigenio, Michael P., 1988. A Taxonomic Survey of Seagrasses in Macajalar Bay. Unpublished Report, Department of Biology, Xavier University.

Bautista, A., 1991. Field Report on the Investigation of an Archaeological Site in Cagayan de Oro City, Misamis Oriental. MS Thesis, National Museum. Manila.

Brown, W. H., 1950. Useful Plants of the Philippines. Manila Bureau of Printing. Manila, Philippines. 3 Vols.

Bureau of Air Transportation, 1967. Administrative Order No. 5, Part XIV, Civil Air Regulations Governing Construction, Classification and Rating of Aerodromes.

Burton, Linda, 1975. Progress Report No. 1, Exploration of Huluga Sites, Tagwanao Region, Cagayan de Oro, Misamis Oriental. MS Thesis, National Museum. Manila.

Burton, Linda, 1991. Personal Communication.

Cabanilla, I., 1970. Xavier University - National Museum Archaeological Research Cooperation. MS Thesis, National Museum. Manila.

Canter, Larry W., 1977. Environmental Impact Assessment, McGraw Hill, New York.

Cezar, C. J. 1990. Species Diversity of Fishes in Artificial Reefs in Different Stations Along Macajalar Bay. Unpublished Report, Department of Biology, Xavier University.

City of Cagayan de Oro, 1989. Social Economic Profile.

Consing, I. 1990. A Study on the Species Diversity of Fishes in the Coral Reef of Villanueva, Misamis Oriental. Unpublished Report, Department of Biology, Xavier University.

Cortez, Teodora, M., 1990. Spectrophotometric Determination of Mercury Concentration in Decapterus sp Collected from the Fish Landing at Laguindingan, Misamis Oriental. Unpublished Report, Department of Biology, Xavier University.

Cribb, A. B. and J. W. Cribb, 1985. Plant Life of the Great Barrier Reef and Adjacent Shores. University of Queensland Press.

DA, 1991. Fishery Resource Stock Assessment. Technical Report, DA/Misamis Oriental.

DA, 1991. Tuna Stock Assessment in Misamis Oriental. Technical Report, DA/Misamis Oriental.

De las Alas, J. G. and J. A. Sodusta, 1985. A Model for the Wind-driven Circulation of Manila Bay, Nat. and Appl. Sci. Bull., Vol. 38, No. 1.

Demetrio, Francisco (S.J.), 1971. The Huluga Caves and the Prehistory of Cagayan de Oro. Cagayan. A Museum and Archives Publication No. 3. Xavier University.

Demetrio, Francisco (S.J.), 1972. Cagayan. A Museum and Archives Publication No. 9. Xavier University.

DENR, 1991. Mid-winter Brid Counts, Philippines. A Technical Report of the Protected Areas and Wildlife Bureau (PAWB).

DENR, 1991. Regional Community Resource Management Project (RCRMP-X), Feasibility Study/Project Preparation Final Report, Volume V. Associacion Consultants Independente (Philippines), Inc.

Department of Agriculture (DA), 1990. Integrated Management Plan for the Coastal Resources of Panguil Bay. Draft Report.

Department of Environment and Natural Resources (DENR), 1990. Administrative Order No. 34. Revised Water Usage and Classification/Water Quality Criteria Amending Section Nos. 68 and 69 of the 1978 NPCC Rules and Regulations.

Department of Health. National Drinking Water Quality Standards. Bureau of Research and Laboratories, Department of Health, Manila.

Department of Public Works and Highways (DPWH), 1990. Report on Natural Occurring Material Sources. Region X, Northern Mindanao, Bureau of Research and Standards.

Diaz, Jose C. Jr., 1990. A Study of Species Diversity of Holothurians in the Shallow Intertidal Zone of Punta Salauan, Misamis Oriental. Unpublished Report, Department of Biology, Xavier University.

Economic Development Foundation, 1991. Project Feasibility Study, Proposed Phase I Industrial Expansion of PHIVIDEC Industrial Estate, Misamis Oriental.

Fagan, B. M., 1978. Archaeology. A Brief Introduction. University of California, Santa Barbara. Little, Brown and Company, Boston, Toronto.

Federal Aviation Administration, 1970. Airport Drainage. Advisory Circular AC 150/5320 - 5B, Washington , D.C.

Foundation for the Advancement of Science Education, 1983. Guidebook to Grassland Plants: A Resource Material for Biology Teachers. Science Education Center. Quezon, Philippines.

Gonzales, P. and C. Ress, 1988. Birds of the Philippines. Haribon Foundation for the Conservation of Natural Resources, Inc. Manila, Philippines.

Horonjeff, Robert and F.X. McKelvey, 1983. Planning and Design of Airports, Mc Graw-Hill, Third Edition.

Hydrology and Flood Forecast Center, 1981. Rainfall Intensity-Duration-Frequency Data of the Philippines, Vol. 1, First Edition, PAGASA.

ICAO, 1983. Airport Services Manual, 1983, Part 8; Airport Operational Services.

ICAO, 1990. Aerodromes, Annex 14, Volume I, Aerodrome Design and Operations.

Industrial Inspection, Inc., 1991. Final Report, Soil Investigation Survey and Testing, Cagayan de Oro-Iligan Airport Project, Laguindingan, Misamis Oriental. Report prepared for Louis Berger International, Inc.

International Civil Aviation Organization (ICAO), 1985. Airport Planning Manual, Part 2; Land Use and Environmental Control.

Kintanar, Roman L., 1984. Climate of the Philippines, PAGASA, Quezon City.

Lao, Mardonio M., 1980. History of Cagayan de Oro 1622-1901. Bustamante Press and Publishing House. Cagayan de Oro City.

LBII, 1991. Feasibility Study and Master Plan, Rayong U-Taphan International Airport (Thailand). Volume I and II, Final Report.

LBII, 1991. Environmental Assessment, Makar Wharf. Prepared for United States Agency for International Development (USAID) Manila, Philippines.

LBII, 1991. Environmental Assessment, Scoping Sessions Report. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Airport Project. Prepared for USAID, Manila, Philippines.

LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Airport Project. Draft Final Report, Volumes I and II. Prepared for USAID, Manila, Philippines.

LBII, 1991. Feasibility Study and Master Planning, Cagayan de Oro-Iligan Airport Project. Preliminary Report. Prepared for USAID, Manila, Philippines.

LBII, 1991. Feasibility Study of Wastewater Collection, Treatment and Disposal, and Water Supply and Distribution System for Cagayan de Oro. Inception Report. Prepared for USAID, Manila, Philippines.

LBII, 1991. Feasibility Study, Cagayan de Oro-Iligan Industrial Master Plan. Volume I, Preliminary Report. Prepared for USAID, Manila, Philippines.

Louis Berger International, Inc. (LBII), 1989. Philippines National Road Improvement Project. Final Report, prepared for Asian Development Bank, Vols I, II, VIII, IX

Madigan, Francis M. (S.J.), 1963. The Early History of Cagayan de Oro. Philippine Studies, XI (1): 76-130.

Magana, Delia S., 1980 Cagayanon Folklore. An Exploratory Study of its Historical Elements. MA Thesis. Xavier University. Cagayan de Oro City.

Mallorca, Lowell M., 1990. A Study on the Growth Rate of Test Planted Gracilaria coronipifelia in Tubajon, Laguindingan, Misamis Oriental. Unpublished Report, Department of Biology, Xavier University.

Manzano, Ann L., 1988. Species Diversity of Littoral Asteroidea in Five Areas Along Macajalar Bay, Misamis Oriental. Unpublished Report, Department of Biology, Xavier University.

McAndrew, John P., 1978. Andam - Mouswag: A Lesson Learned? Philippine Studies 26, Ateneo de Manila University.

McKeough, J. A. and E. O. Tan, P.T. Escudero and T.A. Rivera, 1973. Hydrobiological Study of Macajalar Bay. Final Report. NSDB Assisted Project No. 2.218.

McKeough, J. A. and F. Yap, 1969. A General Hydrographic and Biological Survey of Macajalar Bay. NSDB Assisted Project No. 2.127.

McKeough, J.A., G.J. Abanil, P.C. Sia, R.M. Lacaroon, N.M. Chaves, M.C. Añasco and L.G. Lim, 1980. Water Pollution and Marine Ecological Studies of Macajalar Bay. Final Technical Report June 1977-May 1979. NSDB Project No. 7709 Ag.

Mervill, E. D. 1912. A Flora of Manila. Manila Bureau of Printing. Manila, Philippines.

Metcalf and Eddy, Inc., 1972. Wastewater Engineering. McGraw-Hill: New York.

Mindanao State University, Naawan, 1990. Annual Report, Volume II.

Montebon, Pierre S.D., 1989. A Study on the Growth Rate of Placoides argentea in Tubajon, Laguindingan, Misamis Oriental. Unpublished Report, Department of Biology, Xavier University.

Municipality of Laguindingan, 1989. Town Plan, 1990-2000.

National Economic and Development Authority (NEDA), 1989. Regional Development Goals, Potential Growth Areas and Alternative Development Strategies for Northern Mindanao (Region X). 1990-2020 Regional Physical Framework Plan.

NEDA, 1990. Socio-Economic Profile; Central Mindanao (Region XII) NEDA, Regional Office XII, Cotabato City.

National Mapping and Resource Information Authority (NAMRIA), 1991. Predicted Tide and Current Tables. Department of Environment and Natural Resources, Philippines.

National Power Corporation, 1989. Environmental Impact Assessment, Agus Hydroelectric Power Plant, Environmental Management Department, EIA Division, NPC. Draft Report.

National Steel Corporation, 1991. Environmental Impact Statement for the FYEP-2, Iligan City. Draft Report.

National Water Resources Council, 1982. Rapid Assessment of Water Supply Sources in the Philippines; Province of Misamis Oriental, Report No. 36, Vol. 62.

National Pollution Control Commission (NPCC), 1978. Rules and Regulations of the National Pollution Control Commission, Official Gazette, No. 23, Vol. 74.

NPCC, 1980. Memorandum Circular No. 002.

Netzorg, Morton J., 1985. The Island of "San Juan" Off the Mindanao Coast. A Cartographic Puzzle. Kinaadman, VII(1):149-194.

Odum, W., 1976. Ecological Guidelines for Tropical Coastal Development. International Union for Conservation of Nature and Natural Resources. Morges, Switzerland.

PAGASA, 1987. Climatological Extremes in the Philippines.

Peralta, J. T., 1968. Preliminary Report on the Cagayan de Oro Seminar and Field School. MS Thesis. National Museum. Manila.

Perennon, Christian, P. Roase and C. Poole, 1990. Asian Waterfowl Census, 1990. Compiled for the International Waterfowl and Wetlands Research Bureau (IWRB) and the Asian Wetland Bureau (AWB).

Philippine Ports Authority, 1991. Batangas Port Development Project. Phase 1. Environmental Impact Statement. Vol. 2. Pacific Consultants International.

Quiaoit, Peter, 1989. A Study on the Fish Population in the Artificial Reefs of Tubajon, Laguindingan, Misamis Oriental. Unpublished Report, Xavier University.

Rabor, D. S., 1977. Philippine Birds and Mammals. U.P. Press. Philippines.

Roa, Willy Ann F., 1989. A Study on the Growth Rate of Test Planted Eucheuma in Tubajon and Sulauan Point, Laguindingan, Misamis Oriental. Unpublished Report, Department of Biology, Xavier University.

Sabanal, Kenneth G., 1988. Productivity Assessment of Enhalus acoroides Based on its Leaf Biomass in the Intertidal Zone of Sulauan Point, Laguindingan, Misamis Oriental. Unpublished Report, Department of Biology, Xavier University.

Science Education Center, 1971. Plants of the Philippines. U.P. Press. Philippines.

Steiner, M. L., 1960. Philippine Ornamental Plants. Carmelo and Bauermann, Inc. Manila, Philippines.

Tandag, Dulce D., 1984. State of Exploitation and Population Dynamics of Skipjack Tuna (Katsunonus pelamis) in Waters off Misamis Oriental. M.S. Thesis, College of Fisheries, University of the Philippines, Diliman.

Ugalde, Ricardo P., 1980. Geological Canvassing and Evaluation of Guano and Phosphate Rock Deposits in the Province of Misamis Oriental. Geological Survey Division. Bureau of Mines and Geo-Sciences.

U.P. Botanical Society, 1977. A Manual on Some Philippine Medicinal Plants. U.P. Press. Philippines.

Viessman, Warren Jr., G.L. Lewis and J.W. Knapp, 1989. Introduction to Hydrology. Third Edition, Harper and Row, New York.

Wilbur Smith Associates, Inc., 1991. Environmental Assessment, General Santos City Air Service Improvement Study. Prepared for USAID, Manila, Philippines. Draft Report.

APPENDIX D
TECHNICAL INFORMATION

Appendix D-1

1ST ENDORSEMENT
JULY 9, 1991

Respectfully forwarded to the Housing and Land Use Regulatory Board the within Resolution No. 40, s-1991 of the Sangguniang Bayan of this town requesting, among others, the conduction of a special zoning survey and the amendment of the town plan of Laguindingan, Misamis Oriental, more particularly at portion of land located at barangays Moog, Tubajon, San Isidro and Liberty, all of this municipality, declared in the name of the Diamond Cement and Industrial Corporation and with a request that same will be granted favorably.

Republic of the Philippines
PROVINCE OF MISAMIS ORIENTAL
Municipality of Laguindingan

OFFICE OF THE SECRETARIAT

EXCERPTS OF THE MINUTES OF THE REGULAR SESSION OF THE SANGGUNIANG BAYAN, THIS MUNICIPALITY, HELD AT THE SESSION HALL ON JULY 5, 1991.

PRESENT:

Hon. Alejandrito O. Paculba,	Vice Mayor, presiding, pro-tempore
Hon. Pedro G. Clarin,	Municipal Kagawad
Hon. Inida S. Jaramillo,	Municipal Kagawad
Hon. Nancy S. Madjos,	Municipal Kagawad
Hon. Dativo C. Bajuyo,	Municipal Kagawad
Hon. Proceso E. Mejila,	Municipal Kagawad
Hon. Livinido S. Ragmac,	Municipal Kagawad
Hon. Pablo Y. Macua,	Municipal Kagawad
Hon. Teodoro N. Consus, Jr.,	Municipal Kagawad, ABC President

ABSENT:

Hon. Orville J. Abellanosa,	Municipal Mayor, at Cebu City

RESOLUTION NO. 40
s-1991

REQUESTING THE CONDUCTION OF A SPECIAL ZONING SURVEY AND THE AMENDMENT OF THE TOWN PLAN OF LAGUINDINGAN, MISAMIS ORIENTAL, MORE PARTICULARLY ANY PORTIONS OF LAND LOCATED AT BARANGAYS MOOG, TUBAJON, SAN ISIDRO AND LIBERTY, ALL OF THIS MUNICIPALITY, DECLARED IN THE NAME OF THE DIAMOND CEMENT AND INDUSTRIAL CORPORATION.

WHEREAS, in order to give the Diamond Cement and Industrial Corporation the authority to exercise the right of ownership over the land they have acquired for more than twenty years it is necessary that portions of land located at barangays Moog, Tubajon, San Isidro and Liberty all of this municipality, (copies of cad, lot, nos. hereto attached) be converted from agricultural to industrial land provided, however, that all requisites required by law be complied with;

WHEREAS, the recent town plan of Laguindingan, Misamis Oriental, conducted in 1990, reflected that said land is agricultural in nature and should therefore be amended to suit with the needs of the present conditions.

Now, therefore, be it

RESOLVED to request the conduction of a special zoning survey and the amendment of the town plan of Laguindingan, Misamis Oriental, more particularly at barangays Moog, Tubajon, San Isidro and Liberty, all of this municipality. Further to forward copies of this resolution be forwarded to the Housing and Land Use Regulatory Board for information and appropriate action.

ADOPTED this 5th day of July, 1991 at Laguindingan, Misamis Oriental, on motion of Kag. Jaramillo severally seconded.

1ST ENDORSEMENT
July 9, 1991

Respectfully forwarded to the Sangguniang Panlalawigan, this province, the within Resolution No. 41, s-1991 of the Sangguniang Bayan of this town requesting, among others, to strongly recommend to the Regional Development Council, the conversion of portion of agricultural land declared in the name of the Diamond Cement and Industrial Corporation located at barangays Moog, Tubajon, San Isidro and Liberty, all of this municipality, into an industrial land and with a request that same will be granted favorably.

Republic of the Philippines
PROVINCE OF MISAMIS ORIENTAL
Municipality of Laguindingan

OFFICE OF THE SECRETARIAT

EXCERPTS OF THE MINUTES OF THE REGULAR SESSION OF THE SANGGUNIANG BAYAN, THIS MUNICIPALITY, HELD AT THE SESSION HALL ON JULY 5, 1991.

PRESENT:

Hon. Alejandrito O. Paculba,	Vice Mayor, presiding, pro-tempore
Hon. Pedro G. Clarin,	Municipal Kagawad
Hon. Inida S. Jaramillo,	Municipal Kagawad
Hon. Nancy S. Madjos,	Municipal Kagawad
Hon. Dativo C. Bajuyo,	Municipal Kagawad
Hon. Proceso E. Mejila,	Municipal Kagawad
Hon. Livinido S. Ragmac,	Municipal Kagawad
Hon. Pablo Y. Macua,	Municipal Kagawad
Hon. Teodoro N. Consus, Jr.,	Municipal Kagawad, ABC President

ABSENT:

Hon. Orville J. Abellanosa,	Municipal Mayor, at Cebu City

RESOLUTION NO. 41
s-1991

REQUESTING THE SANGGUNIANG PANLALAWIGAN, THIS PROVINCE, TO STRONGLY RECOMMEND TO THE REGIONAL DEVELOPMENT COUNCIL, REGION X, CAGAYAN DE ORO CITY, THE CONVERSION OF PORTIONS OF AGRICULTURAL LAND LOCATED AT BARANGAYS MOOG, TUBAJON, SAN ISIDRO AND LIBERTY, ALL OF THIS MUNICIPALITY, DECLARED IN THE NAME OF THE DIAMOND CEMENT AND INDUSTRIAL CORPORATION, INTO INDUSTRIAL ZONE.

WHEREAS, consistent with the national policy to promote countryside development and to give the Diamond Cement and Industrial Corporation the authority to exercise the right of ownership, aside from the benefits which will be accorded to the residency, over the land they have purchase more than twenty (20) years ago it is but necessary that portion of agricultural land located at barangays Moog, Tubajon, San Isidro and Liberty, all of this municipality, and declared in the name of the above-mentioned corporation, be converted to industrial;

WHEREAS, it can be recalled due to the failure of the Corporation to industrialize the area above-mentioned right on schedule previous land owners were privileged to till the land without giving shares to its owner as a sign of goodwill. Hence, it is also normal to occupants therein to waive in favor to the rightful owner.

Now, therefore:

BE IT RESOLVED as it is hereby resolved to request the Sangguniang Panlalawigan, this province, to strongly recommend to the Regional Development Council, the conversion of agricultural land located at barangays Moog, Tubajon, San Isidro and Liberty, all of this municipality and declared in the name of the Diamond Cement and Industrial Corporation, into industrial. Provided that conditions stipulated in Resolution No. 62, dated August 23, 1990 (copies of which is hereto attached) will be complied with. FURTHER to let copies of this resolution be forwarded to the Sangguniang Panlalawigan, this province, for information and appropriate action.

ADOPTED this 5th day of July, 1991 at Laguindingan, Misamis Oriental, on motion of Kag. Jaramillo severally seconded.

1ST ENDORSEMENT
July 9, 1991

Respectfully forwarded to the Secretary Department of Environment and Natural Resources, Manila, the within Resolution No. 42, s-1991, of the Sangguniang Bayan of this town requesting, among others, the issuance of a certification that portion of agricultural land located at barangays Moog, Tubajon, San Isidro and Liberty, all of this municipality, and declared in the name of the Diamond Cement and Industrial Corporation, is ecologically balance and materially sound and is free and safe from the hazards of pollution once industrialized and with a request that same will be granted favorably.

Republic of the Philippines
PROVINCE OF MISAMIS ORIENTAL
Municipality of Laguindingan

OFFICE OF THE SECRETARIAT

EXCERPTS OF THE MINUTES OF THE REGULAR SESSION OF THE SANGGUNIANG BAYAN, THIS MUNICIPALITY, HELD AT THE SESSION HALL ON JULY 5, 1991.

PRESENT:

Hon. Alejandrito O. Paculba,	Vice Mayor, presiding, pro-tempore
Hon. Pedro G. Clarin,	Municipal Kagawad
Hon. Inida S. Jaramillo,	Municipal Kagawad
Hon. Nancy S. Madjos,	Municipal Kagawad
Hon. Dativo C. Bajuyo,	Municipal Kagawad
Hon. Proceso E. Mejila,	Municipal Kagawad
Hon. Livinido S. Ragmac,	Municipal Kagawad
Hon. Pablo Y. Macua,	Municipal Kagawad
Hon. Teodoro N. Consus, Jr.,	Municipal Kagawad, ABC President

ABSENT:

Hon. Orville J. Abellanosa,	Municipal Mayor, at Cebu City

RESOLUTION NO. 42
s-1991

REQUESTING THE ISSUANCE OF A CERTIFICATION STATING, AMONG OTHERS, THAT PORTION OF AGRICULTURAL LAND LOCATED AT BARANGAYS MOOG, TUBAJON, SAN ISIDRO AND LIBERTY, AND OF THIS MUNICIPALITY, AND DECLARED IN THE NAME OF THE DIAMOND CEMENT AND INDUSTRIAL CORPORATION, IS ECOLOGICALLY SOUND AND ONCE INDUSTRIALIZED WILL BE SAFE FROM THE HAZARDS OF POLLUTION.

WHEREAS, one of the requisites required by law in the conversion of agricultural to industrial land is to determine whether the area subject to industrialization is a certification stating among others that the place is safe and free from the hazards of pollution;

Now, therefore:

BE IT RESOLVED as it is hereby resolved to request the issuance of a certification stating, among others, that portions of land located at barangays Moog, Tubajon, San Isidro and Liberty, all of this municipality declared in the name of the Diamond Cement and Industrial Corporation, is ecologically balance and materially sound and, if, industrialized will be safe from the hazards of pollution.

Let copies of this resolution be forwarded to the Department of Environment and Natural Resources for information and favorable action.

ADOPTED this 5th day of July, 1991 at Laguindingan, Misamis Oriental, on motion of Kag. Jeramillo and severally seconded.

Appendix D-2
PERCEPTION SURVEY RESPONDENT PROFILE

The survey respondents may be described in modal terms as male (66 percent), 45 years of age, Catholic (94 percent), and married (98 percent), with four living children.

Most of the respondents (69 percent) were born in the area and have lived there since birth. Some had moved to their current place of residence from another barangay (5 percent), while others had come from a different municipality (26 percent). Most had moved to the area because of marriage (27 percent) or because farmwork was available there (32 percent).

Asked whether they preferred to stay or to move elsewhere, 89 percent said they would rather stay, primarily because their source of livelihood was in the area. The same number said they had no current plans of moving elsewhere. The few (11 percent) who had plans of moving said they might be dislocated by the proposed airport.

Although the majority of the respondents (89 percent) own their house, 55 percent of them do not own the land. Half of their houses have galvanized iron roofs and either concrete or wooden walls, while another half are made of nipa or other light materials. The typical house has a floor area of less than 40 sq.m., has two rooms, and is about 10 years old or less. Most households have a closed pit for a toilet, use wood for cooking, and kerosene for lighting. Households with electricity (45 percent) spend an average (median) of ₱27 a month for their electric bill.

Table D-2
PROFILE OF PERCEPTION SURVEY RESPONDENTS

ITEM/CATEGORY	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
1. Sex		
Male	41	66
Female	21	34
2. Place of Birth		
Same barangay	43	69
Different barangay	3	5
Different municipality	16	26
3. Age		
20 - 29	6	10
30 - 39	15	24
40 - 49	16	26
50 - 59	10	16
60 - 69	8	13
70 +	7	11
4. Education		
None	2	3
Some elementary	45	73
Some high school	11	18
Some college	4	6
5. Civil Status		
Single	1	2
Married	61	98
6. No. of living children		
1 - 3	21	34
4 - 6	24	39
7 - 9	12	20
10 +	4	7

Table D-2 (continued)

ITEM/CATEGORY	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
7. Religion		
Roman Catholic	58	94
New Life Assembly	3	5
Assembly of God	1	2
8. No. of household members		
2 - 4	24	39
5 - 7	28	45
8 - 10	10	16
9. Age of household members		
5 years and under	27	8
6 - 10	46	14
11 - 14	40	12
15 - 60	200	60
60 - 64	11	3
65 +	11	3
	(335)	
10. Years of residence in barangay		
Median	36.00	
Mean	36.32	
Standard Deviation	15.01	
11. Whether Respondent previously lived elsewhere		
No	40	64
Yes	22	35

Table D-2 (continued)

ITEM/CATEGORY	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
12. Where Respondent previously lived		
Different barangay, same municipality	7	32
Different municipality	15	68
13. Why Respondent moved to current residence		
Due to marriage	6	27
Farmwork available here	7	32
Purchased land here	2	9
Other responses	7	32
14. Whether Respondent would prefer to stay or move elsewhere		
Stay	55	89
Move elsewhere	7	11
15. Why Respondent would move elsewhere		
Farmwork available elsewhere	3	43
Other responses	3	43
No answer	1	14
16. Why Respondent would rather stay		
No answer	22	40
Farmwork/livelihood here	22	40
Place is all right	5	9
Not easy to transfer elsewhere	2	4
Other responses	4	7
17. Whether Respondent has plans of moving elsewhere in the future		
No	55	89
Yes	7	11

Table D-2 (continued)

ITEM/CATEGORY	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
18. Why Respondent plans to move?		
Will be dislocated by proposed airport	7	100
19. Where Respondent intends to move		
Same barangay and municipality	6	86
Different municipality	1	14
20. House materials		
Galvanized iron roof, concrete walls	4	6
Galvanized iron roof, wooden walls	27	44
Nipa roof, wooden walls	23	37
Nipa roof, other materials	5	8
Others	3	5
21. Tenure		
Own house and lot	21	34
Own house, free lease lot	34	55
Free lease house and lot	7	11
22. Floor area (sq m)		
< = 20 sq m	9	15
21 - 40	22	37
41 - 60	18	31
61 - 80	3	5
81 +	7	12
23. No. of rooms		
1 - 2	26	42
3 - 4	26	42
5 - 6	10	16

Table D-2 (continued)

ITEM/CATEGORY	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
24. Age of house		
5 years and less	20	33
6 - 10	11	18
11 - 15	9	15
16 - 20	4	7
21 - 30	5	8
31 - 40	6	10
41 +	5	8
25. What Respondent uses for lighting		
Electric	28	45
Kerosene	34	55
26. What Respondent uses for cooking food		
Wood	62	100
27. Average electric bill for month		
₱ 25 and above	12	43
26 - 40	13	46
41 +	3	10
28. Type of toilet		
Water-sealed	15	24
Closed-pit	44	71
Open pit	2	3
Flush toilet	1	2

Appendix D-3

Republic of the Philippines
DEPARTMENT OF AGRARIAN REFORM
Provincial Agrarian Reform Office
Osmeña St., Cagayan de Oro City

1st Indorsement
May 22, 1991

Respectfully indorse to Director Anastacio M. Limbo, Jr., DAR Regional Office, Cagayan de Oro City the herein Resolution to the Petition for Conversion filed by Diamond Cement and Industrial Corporation with the information that the same had been investigated at the provincial level and finds said petition to be devoid of merit, hence, denied.

ANTONIETTA R. BORRA, MNSA
PARO

Republic of the Philippines
DEPARTMENT OF AGRARIAN REFORM
Municipal Agrarian Reform Office
Laguindingan, Misamis Oriental

IN RE: PETITION FOR CONVERSION PURSUANT TO DAR ADM. ORDER NO. 15, SERIES OF 1988

DAR CASE NO. 89-001

DIAMOND CEMENT AND INDUSTRIAL CORPORATION, Petitioner

X--X

A petition has been filed by Diamond Cement and Industrial Corporation thru its Attorney-in-fact for conversion of all its agricultural lands situated at Moloc-boloc, Alubijid, Misamis Oriental; Moog, Kibaghot and Tubajon all part of the municipality of Laguindingan, Misamis Oriental to Industrial lands.

Upon receipt of the petition the corresponding notices has been issued by this office and had it posted in the Municipal Hall of Alubijid, Misamis Oriental, Laguindingan, Misamis Oriental and in all public places, buildings in all the barangays where the land is located in accordance with the rules and guidelines issued by the Department of Agrarian Reform for the purpose of informing all the farmer-tillers who are occupying the land which is the subject matter of this petition.

Subsequently thereafter an opposition to the petition of reconversion was filed by some of the farmers who are occupying the land and properly identified by this office as farmer beneficiaries of the land in question.

Issued having been join, this office conducted an inquiry/investigation to determine the truth and falsity of all the allegations in the petition and in the answer.

Actual inspection was made by the undersign with some of the personnel of this office of all the lands covered by the petition coupled with interviews of some of the oppositors to the petition.

Based on the actual inspection and interviews made by this office to some of the oppositor who are actually occupying the said land the following facts crop up and uncontroverted:

1. That all lands covered by the petition are all suited for agriculture;

2. That all the lands covered by the petition are all occupied by the oppositors who are actually tilling the said land, planted it with corn, tobacco and coconut where the present occupants/oppositors derives sufficient income to support their respective families and they have been occupying the land for over thirty years;

3. That 90% of all the occupants of the land in question are former owners of the land in question and that they sold the land to Diamond Cement and Industrial corporation in 1964, they being convince by Diamond Cement and Industrial Corporation thru its personnel that the land they are selling be used in the establishment of a cement factory with a promise that all the occupants as well as their children who are of age will be given preference for a job in the said cement factory, which promise remains a promise up to the present;

4. That the oppositors were properly identified by this office as farmer-beneficiaries of the land in question;

5. That prior to this new dispensation the oppositors/actual tillers on the land in question has even filed with the DAR requesting the said office help them the repurchase the land which they are occupying for a reasonable price for the said lands own by DCIC was not used by them in accordance with its promise to construct and established a cement factory in the land in question;

6. That all the farmer beneficiaries/oppositors in the instant petition express their eagerness and willingness to acquire the lands they are occupying for them to enjoy the benefits of the Comprehensive Agrarian Reform Program of the government and as a matter of fact they express their willingness to start payment for their amortizations in accordance with the provision of law for they have already reserve certain sum of money out of their income from land in question.

It must be noted that the forgoing petition was filed by the petitioner on July 6, 1989 but however before to this date this office has already conducted acts for the acquisition of the said land in question by identifying the farmer beneficiaries and has already notified the different BARC requesting their assistance by identifying the land to be covered as will as a written notice to Diamond Cement and Industrial Corporation.

That as a matter of fact as of October 13, 1988 the Department of Agrarian Reform thru the Provincial Agrarian Reform Officer has officially sent a communication address to the petitioner to its central office in Makati, Metro Manila notifying them that the land in question will be required by the government for redistribution to the qualified farmer pursuant to RA 6657. On December 28, 1988, DCIC thru its corporate Secretary and General Counsel Renato L. de la Fuente in a communication address to Atty. Samson G. Cayetuna, PARO of Misamis Oriental expressing there consent and offer the amount which is acceptable to them which is

₱30,000.00 per hectare aside from the fact that they have manifested that they were not exercising their right of retention.

With this information, this office started the ball-rolling for the acquisition of the said landholding of DCIC under the coverage of RA 6657 for it is apparent that the DCIC has express its willingness to sell to the government its land which is the subject matter of the petition.

Surprisingly, DCIC backtracks to its former position to sell the said land and instead filed the present petition for conversion alleging among other things that the said land is not under the coverage of the Comprehensive Agrarian Reform Law and that their lands is fast becoming a site for urban and industrial development.

Taking into consideration all the issues of the instant case, the allegations in the petition, the opposition, result of the field investigation conducted by this office and all evidences consisting of communications from Diamond Cement and Industrial Corporation now on file and on records, be denied on the following grounds to wit:

a. That the land in question is suited for agriculture;

b. That the land subject matter of this petition are all occupied by all the oppositors, occupant/actual tiller which are farmer beneficiaries and have already been properly identified by this office.

c. That by the acts of the petitioner in giving a price on the land in question for ₱30,000.00 per hectare is already an admission for their desire to sell the said land to the government therefore the principle of estoped applies to the petitioners.

d. That the said land is not suitable for conversion from agricultural land to industrial land and to date the municipality of Laguindingan, Misamis Oriental is not becoming a site for urban and industrial development more so with the land subject matter of this petition.

e. That the acts of petitioner in filing the instant petition is done solely for the purpose in evading the provision of the Comprehensive Agrarian Reform Law.

WHEREFORE, in view of the foregoing and for reasons stated above, this office is left with no other alternatives but to deny the petition.

Laguindingan, Misamis Oriental

September 12th, 1989.

LEONARDO S. CATALUÑA
Mun. Agrarian Reform Officer
Laguindingan, Misamis Or.

Copy furnished:

- Petitioner
- Provincial Agrarian Reform Officer
  Cagayan de Oro City
- Regional Director
  DAR, Carmen, Cagayan de Oro City

RESOLUTION

FOR: ANTONIETTA R. BORRA, MNSA PARO

FROM: PROVINCIAL INVESTIGATING COMMITTEE FOR DCIC

DATE: MAY 21, 1991

RE: RESOLUTION TO THE PETITION FOR CONVERSION FILED BY THE DIAMOND CEMENT AND INDUSTRIAL CORPORATION

STATEMENT OF THE PROBLEM:

This is a petition for conversion filed by Diamond Cement and Industrial Corporation (DCIC) concerning their property situated at barangays Molocboloc of Alubijid; Kibaghot, Moog, Tubajon, and Liberty of Laguindingan within the province of Misamis Oriental and subject of Compulsory Land Acquisition scheme under Section 7 of RA 6657.

DESCRIPTION OF THE AREA:

Land subject of this petition for conversion is owned by Diamond Cement and Industrial Corporation (DCIC), a corporation duly organized and registered with the Securities and Exchange Commission with principal office at Makati, Metro Manila. Among its properties is an agricultural land containing an area of SIX HUNDRED TWO hectares more or less and straddles the municipalities of Alubijid and Laguindingan.

Subject property covered by this petition for conversion was planted with corn, tobacco, cotton and coconut which a number farmers derived sufficient income to support their dependents who would be affected and deprived of a living in the event conversion would be given due course.

CHRONOLOGY OF EVENTS:

Oct. 13, 1988 - the Department of Agrarian Reform thru the Provincial Agrarian Reform Officer sent an official communication to the petitioner's main business office notifying them that the land in question is slated for acquisition and distribution to qualified farmer beneficiaries pursuant to Sec. 7 of RA 6657.

Dec. 28, 1988 - DCIC thru its Corporate Secretary and general counsel gave their consent and made the offer of ₱30,000.00 per hectare.

Immediately after the offer was made the DAR thru its Municipal Agrarian Reform Office started the undertakings and came up with the list of identified potential beneficiaries and all other acts necessary for the completion of the Compulsory Land Acquisition Folder, iist of potential farmer beneficiaries is here to attached as Annex "A" of this resolution.

July 6, 1989 - DCIC backtracks from its former stand to sell the property and instead filed a petition for conversion which was later on withdrawn for undefined purpose.

Sept. 5, 1989 - Opposition to petition for conversion was filed by the farmers of five aforecited barangays who would be affected in case DAR submits itself into the trap employed by DCIC.

Apr. 16, 1991 - Petition to convert subject property was formally submitted to the MARO (Municipal Agrarian Reform Office) of Laguindingan.

May 2, 1991 - Letter of Indorsement was subsequently made by MARO of Laguindingan affirming the stand of MARO Cataluña denying the petition for conversion.

ACTUAL SITUATION AS OF PRESENT DATE:

When the committee tasked to investigate and conduct ocular inspection, the following information were obtained and gathered:

a. Subject property was still the main source of living to all the farmers living and cultivating the area, in fact, the farmers cultivating the area are now all set in preparation for the wet season.

b. That the allegation of the petitioner that the property is no longer viable based on the allege certification from the Department of Agriculture is a blatant lie and devoid the truly, the truth being that:

b-1 The property still remain very much productive.

b-2 That for over thirty years now the property still remain the bread and butter of the more than Four Hundred Fifty farmers and their dependents who depended so much on farming for their existence.

b-3 That because of the agricultural feasibility of the area, DCIC has established a Coco Buying station right at the Company's compound at Moog.

b-4 That as proof of sound agricultural feasibility, tobacco seedbeds are the common sight in preparation for the planting season.

c. Contrary to the allegation of DCIC in their petition dated April 16, 1991, marked as Annex "E" that subject property ceased to be agriculturally feasible is a clear erosion of the fact, the truth being that, up to this minute there is no, as yet certification from the Department of Agriculture that the land subject of this petition has ceased to be agriculturally productive.

d. That to approve the petition for conversion would be to displace, dislocate, deprive some four hundred and fifty farmers and undetermined numbers of dependents.

RECOMMENDATION:

With the issues of this instant petition all bind together, the allegations in the petition, the opposition, and the result of the field investigations, this body holds and finds the foregoing petition be denied for the following reasons, to wit:

A. Subject property is still agriculturally feasible, in fact subject property is up to the present the only source of a living of some Four Hundred and Fifty farmers and their beneficiaries/dependents.

B. The allegations of the petitioner as contained in their petition for conversion under sub-par. e of par. 5 and sub-par. 6.1 of par. 6 are devoid of truth, the truth being that:

b-1 under the sub-par. e of par. 5- petitioner concealed the true facts of the existence of the farmers cultivating the area, the truth of the matter is that because of the existence of these farmers, referred to under Annex "A", petitioner has established a buying station at the company's compound at Moog to ensure that all coco products will not be sold to outside market.

b-2 under the sub6.1 of par. 6- certification attached as Annex "E" in their petition did not bear the approval of the Housing and Land Use Regulatory Board (HLURB) of locational clearance from the aforecited agency when the intended use is for industrial purposes.

WHEREFORE, in view of the foregoing reasons above-cited, this body strongly recommends DENIAL to the petition for conversion filed by Diamond Cement and industrial Corporation.

Submitted by:

INVESTIGATING COMMITTEE
for DCIC:

FRANKLIN T. FABE
Chairman
Legal Services Division

ANTONIO F. QUISUMBING
Member
SARPO - SSD

FRANCIS PADILLA
Agricultural Engineer
Operation Division

APPENDIX D-4

"Short Notes on the Geo-Hazard Potential of the Cagayan-Iligan Corridor"[1]

J.A. Manzano, Jr.; P.C. Salise; L.S.J. Manzano; J. Sierra
Department of Environment and Natural Resources - Region X
Mines and Geo-Sciences Development Service

The Philippines which lie within the western margin of the Circum-Pacific Belt or the "Ring of Fire" have a very complex geology. The vulnerability of the country to various geologic hazards is due to the presence of active and potentially active fractures or faults, active volcanoes, subduction zones, and trenches. The most important structure is the very active Philippine Fault, a left-lateral strike-slip fault extending from north to south, cutting through the whole length of the Philippine Mobile Belt.

The Cagayan-Iligan Corridor which is situated within the mobile belt or the unstable physiographic province is not exempted from various geologic hazards and disaster which might ensue in the near future. It is also located 80 km west of the active Philippine fault. Fractures or faults which are oriented Northwest-Southeast and are almost parallel to the major faults are present in areas within the corridor. Recent findings of the geological survey team of MGDS-DENR-X revealed the presence of a gravity fault with a displacement of almost a meter cutting through young unconsolidated sediments within the Alubijid area. This unconsolidated medium gravel and coarse sand unit is underlain by well-bedded tuff deposit which is also very extensive in the area. In 1969, an earthquake with its epicenter east of Naawan and having a magnitude of 5.1 on the Richter Scale could have triggered the displacement of the sediments along this fault line.

Going towards the coastal areas of Alubijid, coralline limestone is widely distributed. Based on field relationships and attitudes of the rock units in the area, this limestone is the youngest, probably late Pleistocene to Holocene. The area proposed or envisioned for the construction of an airport is underlain by this rock type. It occurs as an uplifted marine terrace, karstic, generally porous, and poorly bedded. It is rich in mollusks, coral, algae, and forams. Spaces in between cavities are filled up with highly oxidized reddish brown soil. Occasionally it is also interbedded with tuff layers.

Aside from fractures criss-crossing the area of consideration, there are on Mindanao or nearby also five active volcanoes and 16 dormant ones. The most active is Mt. Hibok-hibok on Camiguin Island whose evolution and volcanic activity has yet to be studied in detail.

Tuff or consolidated volcanic ash deposit is widely distributed in western Misamis Oriental, specifically from Alubijid to Opol. It was observed to underlie Quaternary fluvial and marine

---

[1]Reference text for public comments presented by authors during the August 8, 1991 Scoping Session, Environmental Assessment, Feasibility Study of Wastewater Collection, Treatment and Disposal, and Water Supply and Distribution System for Cagayan de Oro City.

sediments, while younger members are interbedded with the most recent ones. Tuff deposit of similar physical characteristic was also observed in the coastal areas of Bohol. Absolute dating by Potassium Argon (KAr) or Uranium Thorium (UTh) and chemical analysis of this volcanic ash could help establish the characteristic eruptive history and future activity of the surrounding active volcanoes.

Other prominent and important features in the corridor are the terrace deposits. There are four levels of terrace deposits which suggest that the area probably had been uplifted four times during the Quaternary.

Major drainage systems in the area must to be given special attention as to dam construction. Based on the regional map of Cagayan de Oro and its vicinity and through aerial photograph interpretation, Cagayan River and Tagoloan River are probably fault-controlled.

Losses due to geologic and hydrologic hazards can be mitigated. A variety of actions for loss reduction measures can be implemented. These include avoidance, stabilization, protection, warning, land use planning, and engineering design. For some types of hazards, the development of new and better measures is needed, for others the application of present state of the art procedures to mitigate the losses will suffice. What is of paramount importance in any hazard mitigation is the recognition by the decision-makers and planners that the hazards do exist and that they can be mitigated.

APPENDIX D-5

I. Title: Geo-Environmental Hazard Inventory of Cagayan de Oro Metropolis[1]

II. Location: Cagayan de Oro and Vicinities

III. Proponent/Implementing Agency: Mines and Geo-Sciences Development Service (MGDS), DENR, Region X with Technical Support from Mines and Geo-Sciences Bureau (MGB), Central Office

IV. Objectives:

A. General

A.1 To enhance land-use planning and development in preparation for future socio-economic growth with proper consideration of the environment.

B. Specific

B.1 To alleviate the impact of some natural hazards present in the area through comprehensive rural and urban land-use and ecological planning based on understanding of the various field of geological sciences and their implications to resource use and development.

B.2 To revitalize geologic data on non-consolidated deposits and groundwater with provision of thematic geological maps.

B.3 To provide engineering and environmental geological information for the enhancement and protection of the Metropolis.

B.4 To publish technical reports concerning the results of B.1 to B.3 with recommendations of the project regarding the potentials of the areas concerned.

V. Rationale:

To sustain the dramatic increase of the lowland area populace, it requires enhancement of land-use planning for its socio-economic growth. Lowland settlements and industrial sites are being expanded and high-rise building/structure are increasing in number

[1] Project/Study proposal endorsed to Misamis Oriental Vice-Governor J. Miguel C. de Jesus on July 26, 1991. Copy provided by Office of the Regional Executive Director. DENR, Region X.

without proper consideration of the general environment resulting in the rise in the problem of lack of water supply, environmental degradation such as flooding, groundwater and surface water pollution and in some cases ground subsidence and slope instability in nearby hilly areas. Geologic processes as well as principles of socio-economics are essential inputs for land-use planning and applied environmental geological studies have to be undertaken to determine the causes and mitigations of hazards.

The said metropolis is within the northern part of Mindanao. Although the metropolis is about 100 kms west of the active Philippine Fault, it is, however, dissected by fractures and splays of the said active major fault. These "branches" might serve as channelways for propagation of seismic waves which might cause tremendous destruction on lives and properties, similar to the one that affected Dagupan City during the July 16, 1990 catastrophe. The occurrence that this natural hazard might affect the metropolis is not remote. During a recent survey within Alubijid town, about 25 kms west of the city, a north-northeast trending fault was found to have affected recent sediments underlying the area which indicates that the structure is active. The January 17, 1969 tremor, having a magnitude of 5.1, whose epicenter was located east of Naawan, could be related to the trace of the said fault.

Volcanic eruption also poses a great threat to the metropolis. At least five known active volcanoes, including the eruptive Mt. Hibuk-hibok might affect the area. This excludes the 16 inactive or dormant volcanoes that bound the area. This excludes the 16 inactive or dormant volcanoes that bound the area. The recent eruption of Mt. Pinatubo, which became the center of attention for the year 1991, and the subsequent hazards such as mudflows (lahars), pyroclastic flows, and ashfall, that ensued thereafter, have caused tremendous damage to properties, amounting to at least 2 billion pesos, and have claimed, at the moment 355 lives.

Coastal flooding, rain and rivering flooding, like the one that hit Barangay Agusan of this city last 1988, have affected this low-lying metropolis. Saltwater intrusion or subsidence is likely to happen when there is an over exploitation of groundwater reservoirs where groundwater level have been lowered severely.

Considering the above premises and facts, the area must be studied thoroughly of its hazard potential. With regards to the existence of geologic hazards adequate identification of these "critical" areas should be made in order to pursue sound policy making with respect to site planning and building code implementation. Development objectives envisioned should cater to environmental and geological information that would help in the development and mitigation of hazard effects.

Rapid urbanization and the increase in population of hazardous areas are matters of growing concern. Land-use planning and control are key factors for the orderly and safe growth and establishment of human settlements. Disaster prevention should logically be based on the knowledge of geologic hazards present and the disaster which may ensue.

There are two fundamental alternatives of disaster prevention and mitigation, to steer development away from hazardous areas towards safer grounds and to observe structural building measures aimed at resisting or deflecting the impact of geological phenomena.

Geology plays an important role in the implementation of these hazard mitigations and other activities where the enhancement of socio-economic growth is the prime concern. The geology and subsurface condition of lowland human settlement areas is an essential element in planning and managing its development. The wise use of geologic information can help improve the quality of life of lowland dwellers, but only if decision makers do recognize its importance.

VI. Descriptions of Activities and Outputs.

A. Major Activities

A.1 Research - includes also acquisition of aerial photographs and satellite imageries.
A.2 Aerial photo/LANDSAT imagery interpretation.
A.3 Semi-detailed geological investigation - involves lithological, structural, stratigraphic geophysical and hydrogeological surveys.
A.4 Detailed geological investigation of pinpointed/selected sites with hand-auger and/or truckmounted analysis.
A.5 Laboratory analysis
A.6 Processing and interpretation of data.
A.7 Preparation of environmental geological maps and figures.
A.8 Preparation of progress and internal technical report.
A.9 Dissemination of information and recommendations through seminars/lectures from time to time.
A.10 Preparation/publication of summarized and final reports for public and private sectors use and submission of project outputs.

B. Outputs

B.1 For Activities A.1 to A.7

B.1.1 Quaternary Geology map
B.1.2 Slope Map
B.1.3 Soil Map
B.1.4 Land Use Map
B.1.5 Hazard Zonation Map
B.1.6 Structural Map
B.1.7 Engineering Geology Map
B.1.8 Engineering Geomorphology Map
B.1.9 Hydrogeology Map
B.1.10 Groundwater Quality Map

B.2 For Activities A.8 to A.10

B.2.1 Published internal and technical reports concerning the results and recommendations of the project for technical and non-technical end-users.

The present technical capabilities of MGDS, DENR Region X will be supported by the expertise of the technical resource specialists of the Mines and Geo-Sciences Bureau MGB).

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
OFFICE OF THE REGIONAL EXECUTIVE DIRECTOR
CAGAYAN DE ORO CITY, REGION X

July 10, 1991

REGIONAL SPECIAL ORDER
NUMBER 91-200 :
Series of 1991

SUBJECT : CREATION OF "DENR TASK FORCE CAGAYAN DE ORO' RE: GEO-HAZARD ASSESSMENT OF CAGAYAN DE ORO AND VICINITIES.

In the interest of the service and in order to assist planners and policy makers of Local Government Units (LGUs) in its proposed Metropolitization Plan of Cagayan de Oro, the "DENR Task Force Cagayan de Oro" is hereby created. The composition and functions of the Task Force are as follows:

a. Project Team

Project Coordinator	- Juanito A. Manzano, Jr.
Deputy Coordinator	- Engr. Paul C. Salise
Members	- Liza Soccoro J. Manzano
	Jean L. Sierra
Support	- Shirley C. Garciano

b. Functions of the "DENR TASK FORCE CAGAYAN DE ORO":

1. Conducts Initial Geo-Hazard Inventory of Cagayan de Oro and its vicinities.

2. Coordinates with Local Government Units (LGUs), Disaster Councils and their Chief Executive regarding urban and industrial site plans.

3. Provides technical support, specifically on geo-environmental aspects, in the Metropolitization Plan.

4. Perform such other functions as may be assigned by the DENR Regional Executive Committee.

All expenses incurred in the performance of these assignments are chargeable against regular funds, subject to usual accounting and auditing procedures.

This Order takes effect immediately.

JOSE R. GAPAS
Regional Executive Director

Appendix D-6
LIST OF FLORA IN THE VICINITY OF SULAUAN POINT, LAGUINDINGAN

SPECIES (COMMON NAME)	SCIENTIFIC NAME	LIFE FORM	HABITAT	RELATIVE ABUNDANCE
Family Acanthaceae				
Sputnik, Ampion	Andrographis paniculata Nees.	under-shrub	clay-coralline	abundant
Shrimp Plant	Drejerella guttata Brem.	under-shrub	clay-coralline	rare
Water Bomb	Ruellia repens L.	erect herb	clay-coralline	occasional
Family Amaranthaceae				
Apug-apug, Sim-sim	Aerua lanata (L.) Juss.	decumbent herb	clay-coralline	occasional
Kudyapa, Colitis	Amaranthus viridis L.	erect herb	clay-coralline	occasional
Bukingan, Bachelor's Button	Gomphrena globosa L.	erect herb	clay-coralline	rare
Family Amaryllidaceae				
Summer-Lily	Hymenocallis rotundata	erect herb	clay-coralline	rare
Aurora, Fairy-lily	Zephyranthes rosea Lindl.	erect herb	clay-coralline	rare
Family Anaacardiaceae				
Mango	Mangifera indica L.	tree	clay-coralline	rare
Cireguelas, Seneguelas	Spondias purpurea L.	tree	clay-coralline	occasional
Family Anonaceae				
Abana, Guayabano	Annona muricata L.	tree	clay-coralline	rare
Anonas	Anona sp.	tree	clay-coralline	rare
Atis, Sugar Apple	Anona squamosa L.	tree	clay-coralline	abundant
Family Apocynaceae				
Adelfa	Nerium indicum Mill	shrub	clay-coralline	rare
Calachuchi	Plumeria acutifolia Poir.	tree	clay-coralline	rare
Tungao, Tuwad	Tabernaemontana pandacaqui Poir.	shrub	clay-coralline	abundant
Family Araceae				
	Raphidophora sp.	vine	coral rubble	occasional
Family Asclepiadaceae				
Wax Plant	Hoya sp.	woody vine	epiphyte	rare
Family Bignoniaceae				
	Tabebuia pentaphylla L.	tree	clay-coralline	rare
Family Cannaceae				
Saging-saging	Canna indica L.	herb	clay-coralline	rare
Family Capparidaceae				
	Cleome gynandra L.	erect herb	clay-coralline	rare
Family Caricaceae				
Papaya	Carica papaya L.	tree	clay-coralline	rare
Family Commelinaceae				
	Vaccaria pyramidata Medic.	erect herb	clay-coralline	rare
	Commelina sp.	erect herb	clay-coralline	abundant

BEST AVAILABLE DOCUMENT

Appendix D-6

LIST OF FLORA IN THE VICINITY OF SULAUAN POINT, LAGUINDINGAN

SPECIES (COMMON NAME)	SCIENTIFIC NAME	LIFE FORM	HABITAT	RELATIVE ABUNDANCE
Family Compositae/Asteraceae				
Blumea	Blumea laciniata Roxb.	erect herb	clay-coralline	occasional
Dahlia-like	Chromolaena odorata L.	erect herb	clay-coralline	occasional
	Eclipta alba Hassk.	erect herb	clay-coralline	occasional
Gabon-gabon	Synedrella nodiflora (L.) Gaertn.	decumbent herb	clay-coralline	abundant
Wild daisy	Tridax procumbens L.	decumbent herb	clay-coralline	abundant
Gapas-gapas	Vernonia cinerea (L.) Less.	erect herb	clay-coralline	occasional
Hagonoy	Wedelia sp.	under shrub	clay-coralline	abundant
Family Convolvulaceae				
Camote	Ipomoea batatas (L.) Poir.	creeping herb	clay-coralline	rare
	Ipomoea digitata L.	vine	clay-coralline	abundant
Mote-mote	Ipomoea sp.	vine	clay-coralline	abundant
Family Crassulaceae				
Angelica	Bryophyllum pinnatum (Lam.) Kurz.	succulent herb	clay-coralline	rare
Family Cucurbitaceae				
Melon-like	Cucumis sp.	vine	clay-coralline	rare
Cabaling, Wild Amargoso	Momordica sp.	vine	clay-coralline	occasional
Family Cyperaceae				
Panyo-panyo, Tabulog	Cyperus iria L.	erect herb	clay-coralline	abundant
Family Euphorbiaceae				
Bugos, Maraotong	Acalypha indica L.	erect herb	clay-coralline	occasional
San Francisco	Codiaeum variegatum (L.) Blume.	shrub	clay-coralline	rare
Poinsettia-poinsettia	Euphorbia heterophylla L.	erect herb	clay-coralline	occasional
Gatas-gatas, Tawa-tawa	Euphorbia hirta L.	decumbent herb	clay-coralline	abundant
Tuba-tuba	Jatropha curcas L.	shrub	clay-coralline	rare
Tubang Morado	Jatropha sp.	shrub	clay-coralline	occasional
Cassava	Manihot utilissima Pohl.	shrub	clay-coralline	abundant
Makikitot	Phyllanthus thymifolia L.	creeping herb	clay-coralline	occasional
Hantalikod, Iba-iba, Sambag-sambag	Phyllanthus urinaria L.	erect herb	clay-coralline	abundant
Tangan-tangan, Castor Oil Plant	Ricinus communis L.	shrub	clay-coralline	rare
Family Gramineae/Poaceae				
Para Grass	Brachiaria sp.	erect herb	clay-coralline	abundant
Alfalfa	Chloris barbata L.	erect herb	clay-coralline	rare
Bremuda Grass	Cynodon dactylon (L.) Pers.	creeping herb	clay-coralline	occasional
Balili	Digitaria sanguinalis L.	erect herb	clay-coralline	occasional
	Dinochloa sp.	creeping herb	clay-coralline	abundant
Barnyard Grass	Echinochloa sp.	herb	clay-coralline	occasional
Palag-tiki	Eluesine indica L.	herb	clay-coralline	occasional

BEST AVAILABLE DOCUMENT

289

Appendix D-6
LIST OF FLORA IN THE VICINITY OF SULAUAN POINT, LAGUINDINGAN

SPECIES (COMMON NAME)	SCIENTIFIC NAME	LIFE FORM	HABITAT	RELATIVE ABUNDANCE
Lagit-lit	Eragrostis mangalorica Hochst.	herb	clay-coralline	occasional
	Eragrostis sp.	herb	clay-coralline	occasional
	Ischaemum sp.	herb	clay-coralline	abundant
Bugas-bugas	Panicum flavidum Retz.	herb	clay-coralline	occasional
Kawat-kawat	Paspalum conjugatum Berg.	decumbent herb	clay-coralline	abundant
Bugang	Saccharum spontaneum L.	herb	clay-coralline	occasional
Mahjong Grass	Setaria sp.	spreading herb	clay-coralline	abundant
Corn, Maize	Zea mays L.	erect herb	clay-coralline	very abundant
Family Labiatae/Lamiaceae Cogong-cogong	Hyptis sp.	under-shrub	clay-coralline	abundant
Kadlom Baho	Hyptis suaveolens (L.) Poir.	erect herb	clay-coralline	occasional
Family Lauraceae Buhok-buhok, Salimpukot	Cassytha filiformis L.	vine	epiphyte	occasional
Avocado	Persea americana Mill.	tree	clay-coralline	rare
Family Legumosae/Fabaceae	Alusicarpus bupleurifolius L.	decumbent herb	clay-coralline	rare
Banig-usa	Alusicarpus nummularifolius L.	herb	clay-coralline	occasional
	Alusicarpus sp.	shrub	clay-coralline	abundant
Mani-mani	Arachis sp.	erect herb	clay-coralline	abundant
Kadyos, Tabyos	Cajanus cajan (L.) Merr.	shrub	clay-coralline	rare
Kudzu	Centrosema pubescens Benth.	vine	clay-coralline	abundant
	Clitorea sp.	vine	clay-coralline	occasional
	Crotalaria incana L.	herb	clay-coralline	occasional
Kagaykay	Desmodium capitatum Burm.	under-shrub	clay-coralline	rare
Dap-dap	Erythrina fusca Lour.	tree	clay-coralline	rare
Kakawate, Madre De Cacao	Glyricidia sepium Stend.	tree	clay-coralline	rare
Kamungay-kamungay	Indigofera sp.	shrub	clay-coralline	abundant
Ipil-ipil	Leucaena glauca	tree	clay-coralline	occasional
	Leucaccra leucocephala L.	tree	clay-coralline	rare
Makahiya	Mimosa sp.	spreading herb	clay-coralline	occasional
Mongos, Mung Bean	Phaseolus radiatus L.	under-shrub	clay-coralline	occasional
Camachile	Pithecelobium dulce Roxb.	tree	clay-coralline	rare
String Beans	Vigna sesquipedalis L.	vine	clay-coralline	rare
Family Liliaceae Sabila	Aloe vera (L.) Webb	succulent herb	clay-coralline	rare
Family Malpighiaceae Bagnit	Tristellateia australasiae Rich.	shrub	coral rubble	occasional

BEST AVAILABLE DOCUMENT

Appendix D-6
LIST OF FLORA IN THE VICINITY OF SULAUAN POINT, LAGUINDINGAN

SPECIES (COMMON NAME)	SCIENTIFIC NAME	LIFE FORM	HABITAT	RELATIVE ABUNDANCE
Family Malvaceae				
Malbas	Abutilon indicum L.	shrub	clay-coralline	occasional
Gumamela	Hibiscus rosa-sinensis L.	shrub	clay-coralline	rare
	Sida sp.	under-shrub	clay-coralline	occasional
Aum	Thespesia lampas Cav.	tree	clay-coralline	rare
Daupang, Cocklebur	Urena lobata L.	shrub	clay-coralline	occasional
Family Moraceae				
Jackfruit	Artocapus heterophyllus Lmk.	tree	clay-coralline	rare
Family Moringaceae				
Kamungay, Horse-radish Tree	Moringa oleifera Lam.	tree	clay-coralline	rare
Family Musaceae				
Banana	Musa paradisiaca L.	herb	clay-coralline	occasional
Family Myrtaceae				
Banana	Psidium guajava L.	tree	clay-coralline	rare
Family Nyctaginaceae				
Bougainvillea	Bougainvillea spectabilis Willd.	shrub	clay-coralline	rare
Colis, Carrot Tree	Pisonia alba Spanoghe.	tree	clay-coralline	rare
Family Orchidaceae				
Mariposa	Phyalaenopsis amabilis Blume.	herb	epiphyte	rare
Family Oxalidaceae				
	Biophytum sensitivum (L.) DC.	erect herb	clay-coralline	rare
Family Palmae/Arecaceae				
Coconut, Lubi	Cocos nucifera L.	tree	clay-coralline	rare
Buli	Corypha elata Roxbv.	tree	clay-coralline	rare
Palm, Pata De Gallo	Rhapis excelsa Thumb.	shrub	clay-coralline	rare
Family Pandanaceae				
Pandan Tsina	Pandanus odoratissimus L.	shrub	clay-coralline	rare
Family Passifloraceae				
Dulce Maria	Passiflora foetida L.	vine	epiphyte	rare
Family Polypodiaceae				
Boston Fern	Nephrolepis exaltata	herb	clay-coralline	rare
Family Potulacaceae				
Olasiman, Purslane	Potulaca oleracea L.	creeping herb	clay-coralline	abundant
Fine-leaf Olasiman	Portulaca sp.	creeping herb	clay-coralline	occasional
Family Rosaceae				
Rose, Rosas	Rosa philippinensis Merr.	under-shrub	clay-coralline	rare
Family Rubiaceae				
	Borreria articularis N.F. Williams	erect herb	clay-coralline	rare

BEST AVAILABLE DOCUMENT

Appendix D-6

LIST OF FLORA IN THE VICINITY OF SULAUAN POINT, LAGUINDINGAN

SPECIES (COMMON NAME)	SCIENTIFIC NAME	LIFE FORM	HABITAT	RELATIVE ABUNDANCE
Santan	Ixora coccinea L.	under shrub	clay-coralline	rare
Bangkoro	Morinda sp.	tree	clay-coralline	rare
Family Rutaceae				
Pomelo	Citrus decumana Murr.	tree	clay-coralline	rare
Kalamansi	Citrus mitis Blanco.	shrub	clay-coralline	rare
Family Scrophulariaceae				
Silhigon, Escoba	Lindenbergia philippensis (Cham.) Benth.	shrub	clay-coralline	rare
Family Solanaceae				
Sili, Pepper	Capsicum frutescens L.	erect herb	clay-coralline	rare
Tobacco, Tobako	Nicotiana tabacum L.	erect herb	clay-coralline	very abundant
Wild Eggplant	Solanm torvum Sw.	erect herb	clay-coralline	rare
Is-is, Sagusahis	Solanum verbascifolium L.	shrub	clay-coralline	rare
Family Sterculiaceae				
Cacao	Theobroma cacao L.	tree	clay-coralline	rare
Family Tiliaceae				
Tugabang, Saluyot	Corchorus olitorius Lam.	under-shrub	clay-coralline	abundant
Family Verbenaceae				
Pagoda Plant	Clerodendron paniculatum L.	under-shrub	clay-coralline	rare
Bleeding Heart	Clerodendron thomsonae Balfour.	under-shrub	clay-coralline	rare
Utot-uto, Kanding-kanding	Lantana camara L.	shrub	clay-coralline	occasional
Kandila-kandilaan, Trumfo De Elepante	Stachytarpheta jamaicensis (L.) Vahl.	under-shrub	clay-coralline	abundant

LIST OF FAUNA IN THE VICINITY OF SULAUAN POINT, LAGUINDINGAN

SPECIES (COMMON NAME)	SCIENTIFIC NAME	HABITAT	RELATIVE ABUNDANCE
Tams, Olive-backed Sunbird	Jugularis jugularis subsp. jugularis	field/thickets	rare
Tikarol, White-collared Kingfisher	Halcyon chloris subsp. collaris scopoli	field/thickets	rare
Uwak, Large-billed Crow	Corvus macrorhyncus subsp. philippinus Bon.	field/thickets	rare
Taglola, Yellow-vented Bulbul	Pycnonotus goiavier subsp. goiavier scopoli	thickets	occasional
Tukmo, Philippine Turtle-dove	Streptopelia bitorquata subsp. dusumeiri tem.	clay-coralline	rare
Baktak, Toad	Bufo marinus	wet grassland	occasional

BEST AVAILABLE DOCUMENT

292

APPENDIX D-7

MARINE ORGANISMS IDENTIFIED IN PAST STUDIES AT SULAUAN POINT, LAGUINDINGAN

Seagrass (Atrigenio, 1988)

Halophila minor
H. ovalis
Halodule pinifolia
H. uninervis
Cymodocea serrulata
Thalassia hemprichii
Enhalus acoriodes

Calcareous Macrobenthic Algae (Ato, 1988)

Padian sp
Halimeda opuntia
Amphiroa fragilissima
Amphiroa spp
Cheilosporum sp
Lithothamniom sp
Mastophora rosea
Calaxaura cylindrica

Holothurians, sea cucumbers (Diaz, 1990)

Synapta maculata
Opheodesoma glabra
Stichopus variegatus
Holothuria scabra
H. nobilis
H. albiventer
H. rigida

Asteroidea, starfish (Manzano, 1988)

Archaster typicus
Protoreaster nodosus
Protoreaster sp
Pentaceropsis tyloderma
Culcita novae - guineae
Nardoa tuberculata
Linckia laevigata
Acanthaster planci
Pentaceros sp

Shellfish, clams (Montebon, 1989)

Phacoides argentea

Fish (Quiaoit, 1989)

Siganus sp	*rabbitfish*
Acanthuris	*surgeonfish*
Abudefduf	*damselfish*
Dascyllus	*damselfish*
Balistapus	*triggerfish*
Elagatis	*rainbow runner*
Anisochaetodon	*butterflyfish*
Amphipron	*clownfish*
Lutjanus	*snapper*
Dasson	*blenny*
Caranx	*trevallis*
Pterois	*blenny*
Epinephelus	*lionfish*
Parupeneus	*grouper*
Zanclus	*goatfish*
Scarus	*moorish idol*
Caesio	*parrotfish*

Appendix D-8
PREDOMINANT SPECIES IDENTIFIED DURING MARINE SURVEYS OF TUBAJON AND SULAUAN POINT, LAGUINDINGAN

Macrobenthic Algae

Turbinaria ornata
Padina australis
Codium edule
Enteromorpha intestinalis
Sargassum cristaefolium
Caulerpa racemosa
Hormophysa triquetra

Mangroves, mangrove fern

Acrostichum
Rhizophora
Avicennia
Sonneratia

Scleractinian, hard corals

Porites
Hydnophora
Millepora
Fungia
Galaxea
Lobophyllia
Pocillopora
Pavona

Alcyonaceans, soft corals

Simularia
Hobophytum
Sarcophytum

Appendix D-9
ASIAN WATERFOWL CENSUS
January, 1991 Surveys

SPECIES	ALUBIJID WETLAND AREA	OPOL WETLAND AREA
HERONS AND EGRETS		
1. Little Egret Egretta garzetta	104	76
2. Striated Heron Butorides striatus	2	
3. Chinese Pond Heron Ardeola bacchus		2
4. Yellow Bittern Ixobrychus sinensis	1	
SHOREBIRDS-WADERS		
5. Asiatic Golden Plover Pluvialis fulva	25	50
6. Little Ringed Plover Charadrius dubius	44	33
7. Mongolian Plover Charadrius mongolus	83	26
8. Greater Sand Plover Charadrius leschenaultii	18	38
9. Eurasian Curlew Numenius arguata	6	
10. Redshank Tringa totanus	17	
11. Marsh Sandpiper Tringa stagnatilis	55	3
12. Greenshank Tringa nebularia	6	
13. Common Sandpiper Actitis hypoleucos	15	17
14. Grey-tailed Tattler Heteroscelus brevipes	3	2
15. Great Knot Calidris tenuirostris	4	
16. Red-necked Stint Calidris ruficollis	132	131
GULLS, TERNS AND SKIMMERS		
17. Little Tern Sterna albifrons	1	
ADDITIONAL SPECIES		
18. White-collared kingfisher Halcyon chloris	3	9
19. Barn swallow Hirundo rustico	6	200
20. Pacific swallow Hirundo tahitica	4	158
21. Yellow bellied warbler		1
22. Brahming kite Haliastum indus	3	3
23. Philippine coucal	2	
24. Tailor bird	2	
1991 CENSUS TOTAL	536	749

Source: DENR, 1991
Note : Species are listed by number of individuals observed during a one day survey period.

396

Appendix D-10
REPUBLIC OF THE PHILIPPINES
Department of Agrarian Reform

September 5, 1991

MEMORANDUM

T O	:	The Municipal Agrarian Reform Officer Alubijid, Misamis Oriental
F R O M	:	The Director, Bureau of Land Development (BLD)
SUBJECT	:	**Additional Requirements on Conversion Request Pursuant to Administrative Order Nos. 15, and 1 and 8, Series of 1988 and 1990**

Name of Petitioner	:	DIAMOND CEMENT AND IND'L. CORP. Rep. by Atty. Saturnino Galleon
TCT No.	:	
Location	:	Alubijid, Misamis Oriental
Area	:	93.7140 hectares
Proposed Use/Conversion	:	Industrial

Upon evaluation of the reports and documents submitted in connection with the above-noted petition for conversion from agricultural to non-agricultural uses, it was found that some of the requirements or documents have not been complied with or submitted as required under Administrative Order No. 15, and 1, and 8, Series of 1988 and 1990. In view thereof, you are hereby requested to comply with or cause compliance with the following requirements:

1. Certification from the HLURB Deputized zoning Administrator of the city/municipality concerned together with his/her Deputization paper of Regional HLURB Officer that the land is within the proper zone of the town/city or the proposed use conforms with the approved Land Use Plan, <u>specifying HLURB resolution and date of approval</u>;

2. Proof of payment of disturbance compensation (acknowledgement receipt by the tenant/farmworker attested by BARC or Barangay Chairman and MARO) or Undertaking to pay disturbance compensation (agreement signed by the tenant/farmworker and applicant embodying undertaking of the applicant to pay

disturbance compensation in kind, e.g., award of homelots or grant of priority in employment, etc.);

3. Certification from the Department of Agriculture Regional Director concerned that the land ceases to be economically viable and sound for agricultural purposes or certification from the Deputized Zoning Administrator of the HLURB that the locality has become highly urbanized;

4. Certification from Department of Environment and Natural Resources Regional Executive Director concerned that the proposed conversion is ecologically sound or Environmental Compliance Certificate (ECC);

5. Certification from the MARO concurred by the BARC or Barangay Chairman that the Notice of Intent to Convert the Land has been posted;

6. MARO certification that the land has not been applied under VOS, VLT, Stock Distribution Option, not covered by Notice of Compulsory Acquisition;

7. Proof of Financial and Organizational Capability to develop the land as determined by the HLURB;

8. Certified Xerox Copy of OCT/TCTs

9. Study showing viability as well as economic and social benefits of the project; and

10. PARO to submit explicit recommendation either for the denial or approval of the request for conversion.

RENATO G. PELAYO

Copy furnished:

1. Diamond Cement and Industrial Corp.
   593 J. R. Borja Street Extension
   Cagayan de oro City

2. Regional Director, DAR Region X
   Cagayan de Oro City

3. Provincial Agrarian Reform Officer
   Misamis Oriental

Appendix D-11
ENVIRONMENTAL MANAGEMENT BUREAU
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

PROJECT DESCRIPTION FOR LAND CONVERSION FROM AGRICULTURAL LAND TO OTHER USES

1. Name and Address of Project Proponent

State the name of the person or entity who/which plans to undertake the project. The address and telephone number of the above should also be included to facilitate communications between Environmental Management Bureau (EMB) and all concerned.

2. Purpose of the Project

Describe briefly the goals and objectives of the project.

3. Location of the Project

Indicate the exact location of the project site in a 1:10,000 scale topographic map or 1:10,000 cadastral survey plan. Indicate on the map or plan the nomenclature of claims, leases, concessions,etc.

4. Description of Environmental Setting

A description of the existing environmental conditions in the proposed site should accompany the map submitted. Emphasis should be given to the following:

a. nearby surface waterbodies (quality, uses, classifications, etc.);

b. important ecological systems (mangrove areas, forestlands, etc.);

c. land uses (agricultural, human settlement, industrial, etc.); and

d. existing environmental or pollution problems, if any (incidence or air and water pollution, soil erosion, etc.).

5. Sources of Environmental Impacts

Identify all possible sources of environmental impacts (e.g., stripping, sit clearing, earth movement) and the extent or magnitude of the impacts.

6. Environmental Management Measures

   Identify all measures to be undertaken by the proponents to minimize adverse environmental impacts described in item #5.

7. Signature of Project Proponent or Person Preparing the Project Description

8. Supporting Documents

   The following documents should be submitted together with the Project Description:

   a. Certified xerox copy of the Original Copy of Title (OCT)/Transfer Certificate of Title and/or other documents establishing ownership;

   b. A certification from Department of Agriculture that the agricultural land being applied for has no working and serviceable irrigation facilities, and has ceased to be economically feasible and sound for agricultural purposes; and

   c. A certification from Housing and Land Use Regulatory Board (HLURB) Deputized Zoning Administrator of the city/municipality concerned or in the absence thereof, the regional HLURB Officer that the area or locality has become highly urbanized and will have greater economic value for commercial, industrial or residential purposes, and that the proposed use of the land conforms with approved land use plan.

Notes: All documents should be submitted in Five (5) copies. The original copy should be notarized.

This outline was prepared by Environmental Impact Assessment Section of Environmental Management Bureau (EMB), Department of Environment and Natural Resources (DENR) and is provided free to all applicants.

Appendix D-12
PROCEDURAL REQUIREMENTS IN REPLANNING/REZONING OF TOWN PLAN ZONING ORDINANCES

- Sangguniang Bayan (municipal council) resolution authorizing the proposed change;
- The resolution shall be submitted to Housing and Land Use Regulatory Board (HLRB) Regional Office for approval/disapproval;
- The Municipal Planning and Development Council (MPDC) together with local sectoral experts shall make necessary changes (when resolution is approved). The HLRB Regional Office may extend technical assistance upon request by the municipal Mayor;
- Changes in the sectoral plans shall be subjected to review by the Municipal Development Council;
- Conduct a public hearing on the proposed amendments;
- The proposed amendments shall be submitted to the interagency Regional Group for review whether said changes adhere to and are in conformity with the provincial and regional plans. The composition of the interagency group includes the different Regional Directors, or representatives of NEDA, HLRB, DENR, DILG, DTI, DA, DAR, and the Provincial Development Coordinator;
- Endorsement of the Sangguniang Panlalawigan (provincial council) and Regional Development Council;
- HLRB approves and ratifies the proposed amendments or changes.

Source: HLRB Regional Office, Region X, 1991

Appendix D-13

RUNOFF CALCULATIONS

The runway alignment at the proposed Laguindingan Airport is oriented in an east/west direction, perpendicular to the natural slope which is towards the north. The construction of the runway as well as access road across this slope will intercept the runoff flowing in the existing intermittent watercourses, requiring drainage culverts to be constructed underneath the runway. As designed, storm runoff and drainage flows of the proposed facility will discharge into the existing watercourse ravines.

A total of three watercourse ravines that cross the proposed runway alignment would be provided with drainage culverts underneath the runway. The individual catchment area of these watercourses is shown in the Catchment Area Plan, Figure 4-5.

The calculation of catchment runoff was derived[1] from the rational expression,

$$Q = CiA$$

where:

Q	=	runoff from given drainage basin, (cu.m./sec)
C	=	runoff coefficient
i	=	rainfall intensity for the time of concentration of runoff, mm/hr
A	=	drainage area/(sq.m.)

The runoff rate is variable from storm to storm and varies even during a single period of precipitation. The coefficient of runoff depends on antecedent storm conditions, slope and type of surface, and extent of drainage area.

Construction of an airport at the Laguindingan site would create drainage basins consisting of several types of surfaces with specific infiltration characteristics. The weighted runoff coefficient would be computed using the following expression:

$$C = \frac{A_1C_1 + A_2C_2 + A_3C_3}{A_1 + A_2 + A_3}$$

The FAA has compiled a range of different runoff coefficients for use in computation of runoff in airports (Table D-13).

---

[1]FAA, 1970. Airport Drainage. Advisory Circular AC 150/5320-5B. Washington, D.C.

Table D-13
CALCULATED RUNOFF COEFFICIENTS

TYPE OF SURFACE	RUNOFF COEFFICIENT, C
For all watertight surfaces	.75 to .95
For asphalt runway pavements	.80 to .95
For concrete runway pavements	.70 to .90
For gravel or macadam pavements	.35 to .70
For impervious soils (heavy)*	.40 to .65
For impervious soils, with turf*	.30 to .55
For slightly pervious soil*	.15 to .40
For slightly pervious soils, with turf*	.10 to .30
For moderately pervious soils*	.05 to .20
For moderately pervious soils, with turf*	.00 to .10

* For slopes from one to two percent.
Source: FAA, 1970. Airport Drainage.

Based on 27 years of records from the PAGASA synoptic weather station in Cagayan de Oro, the Rainfall Intensity-Duration Frequency Curve was plotted for different return periods as shown in Figure D-13. The FAA recommends that for civil airport facilities the drainage system should be designed for a storm whose probability of occurrence is once in 5 years.

Runoff at the site would be affected by concrete and asphalt paving of the landing areas and construction of terminal facilities. These improvements would tend to increase the concentration of runoff by reducing the area of previous surfaces for percolation of water into the ground, thus, generally increasing the amount of runoff.

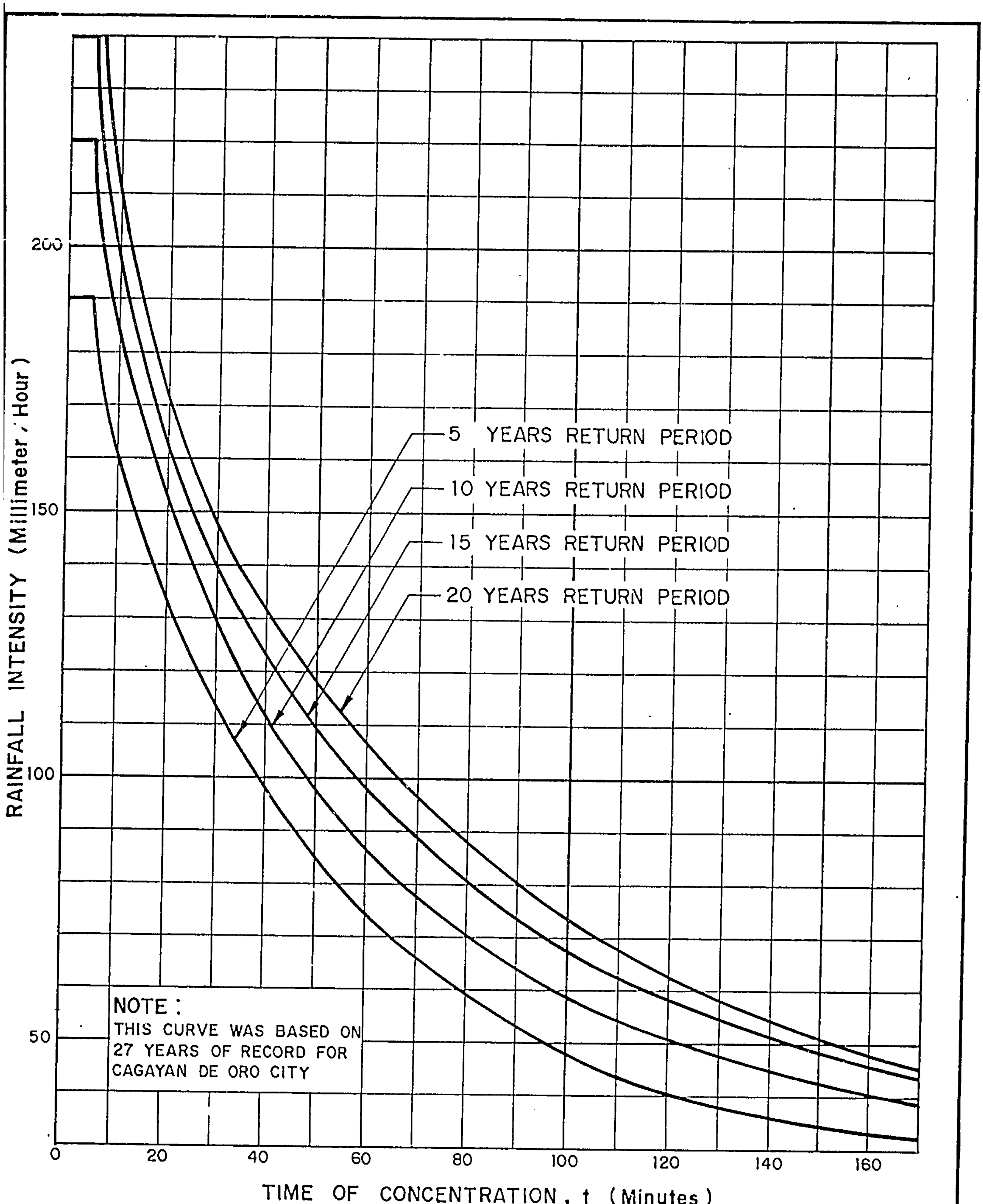
The amount of runoff that is added to the drainage system due to improvements at the site was calculated for each designed culvert based on the respective catchment area (Figure 4-5).

- Runoff calculations for Culvert No.1, for existing conditions:

  Catchment area, A = 2,163,511 sq. m. = 2.163 sq. km.
  Assumed runoff coefficient, C = 0.55
  Distance of the watercourse from the most remote point to the inlet = 2,950 m
  Slope of watercourse, S = $\frac{130 - 40}{2,950}$ = 3.05%

  Solving for time of concentration, T,

302



PHILIPPINE ASSISTANCE PROGRAM SUPPORT UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT CONTRACT NO.: 492 - 0452 - C - 00 - 0099 - 00	ENVIRONMENTAL ASSESSMENT CAGAYAN DE ORO - ILIGAN AIRPORT PROJECT	FIGURE D - 13
LOUIS BERGER INTERNATIONAL, INC. • LOCKWOOD GREENE INT'L. • TRANS-ASIA (PHIL.) INC. • ERNST & YOUNG INT'L. • CONSULTANT MANAGEMENT • GLOBETROTTERS ENG'G. CORP. SERVICES INC.	RAINFALL INTENSITY - DURATION FREQUENCY CURVE	

$$T = \frac{3.25\ (1.1-0.55)\ \sqrt{2,950}}{\sqrt[3]{3.05}} = 67.16\ \ minutes$$

From the Rainfall Intensity - Duration Frequency Curve shown in Figure D-13, the value of rainfall intensity, i = 68 mm/hr (considering 5-year return period)

Solving for runoff, Q,

$$Q = CiA = \frac{0.55\ x\ 68\ x\ 2,163,511}{3,600\ x\ 1,000} = 22.48\ cu.m./\mathrm{sec.}$$

- Runoff calculations for Culvert No. 1, with proposed airport improvements and provision for potential catchment area development.

Airport area to be paved with concrete	=	14,513 sq. m.
Airport area to be paved with asphalt	=	4,838 sq. m.
Unpaved area	=	2,144,160 sq. m.
Total catchment area	=	2,163,511 sq. m.

Solving for weighted runoff coefficient, C, using an average runoff coefficient of 0.65 for unpaved areas. A higher runoff coefficient is applied based on an assumption that subsequent development may also occur elsewhere in the catchment area as an indirect result of the airport and access road construction.

$$C = \frac{14,513\ (.90) + 4,838\ (.95) + 2,144,160\ (0.65)}{2,163,511} = 0.652$$

Solving for time of concentration, T,

$$T = \frac{3.25\ (1.1-0.652)\ \sqrt{2,950}}{\sqrt[3]{3.05}} = 54.70\ \ minutes$$

From the Rainfall Intensity - Duration Frequency Curve, for time of concentration, T = 54.70 minutes; i = 81 mm/hr.

Solving for runoff, Q,

$$Q = \frac{0.652 \times 81 \times 2,163,511}{3,600 \times 1,000} = 31.70 \ cu.m./\text{sec.}$$

Additional runoff to Culvert No. 1 due to anticipated improvements = 31.70 - 22.48 = 9.22 cu.m./sec.

- Runoff calculations for Culvert No. 2, for existing conditions.

Catchment area, A = 886,486 sq m = 0.886 sq. km.
Assumed runoff coefficient, C = 0.55
Distance of watercourse from the most remote point to the inlet = 1,200 m.
Slope of watercourse, $S = \frac{80 - 45}{1,200} = 2.92\%$

Solving for time of concentration, T,

$$T = \frac{3.25\ (1.1-0.55)\ \sqrt{1,200}}{\sqrt[3]{2.92}} = 43.44 \ minutes$$

From the Rainfall Intensity - Duration Frequency Curve, the value of rainfall intensity, i = 92 mm/hr.

Solving for runoff, Q,

$$Q = \frac{0.55 \times 92 \times 886,846}{3,600 \times 1,000} = 12.47 \ cu.m./\text{sec.}$$

- Runoff calculations for Culvert No.2, with airport improvements and provision for potential catchment area development.

Airport area to be paved with concrete	=	31,932 sq. m.
Airport area to be paved with asphalt	=	11,858 sq. m.
Unpaved area	=	842,696 sq. m.
Total catchment area	=	886,486 sq. m.

306

Solving for weighted runoff coefficient, C, using an average runoff coefficient of 0.65 for unpaved areas.

$$C = \frac{31{,}932\ (.90)\ +\ 11{,}858\ (.95)\ +\ 842{,}696\ (.65)}{886{,}486} = 0.66$$

Solving for time of concentration, T,

$$T = \frac{3.25\ (1.1-0.66)\ \sqrt{1{,}200}}{\sqrt[3]{2.92}} = \frac{1.80\ (.44)\ (62.74)}{1.43} = 34.75\ \ minutes$$

From the Rainfall Intensity - Duration Frequency Curve, the value of rainfall intensity, i = 104 mm/hr.

Solving for run-off, Q,

$$Q = \frac{0.66\ x\ 104\ x\ 886{,}846}{3{,}600\ x\ 1{,}000} = 16.91\ \ cu.m./\mathrm{sec.}$$

Additional runoff to Culvert No. 2 due to anticipated improvements
= 16.91 - 12.47 = 4.44 cu.m./sec.

- Runoff calculations for Culvert No. 3, existing conditions.

Catchment area, A	=	356,300 sq. m.	=	0.356 sq. km.
Distance, D,	=	1,400 m		
Slope of watercourse, S	=	$\frac{80 - 40}{1{,}400}$	=	2.86%
Runoff coefficient, C	=	0.55		

Solving for time of concentration, T,

$$T = \frac{3.25\ (1.1-0.55)\ \sqrt{1{,}400}}{\sqrt[3]{2.86}} = 47.24\ \ minutes$$

APPENDIX E
SUMMARY OF PUBLIC RECOMMENDATIONS

Appendix E-1
Summary of Scoping Sessions

The Scoping Sessions Report for the Environmental Assessment was submitted on August 5, 1991, and details the presentation and public review by 120 attendees of the proposed project at the preliminary study phase. In summary of this report for the three separately conducted scoping sessions, the public comments and recommendations include:

- Quezon City (Metro Manila), July 15, 1991

  Questions were raised about the loss of agricultural land and whether proper compensation would be made to those presently farming in the area of the existing as well as the proposed new airport. Concern was expressed for the consideration of cultural communities in the vicinity of the alternative sites. The issue of archeological investigations was raised. It was pointed out that any new roads constructed would require the same sort of assessment as for the airport site itself. Questions on funding centered on who would pay if adverse impacts required mitigation. Most of the informal discussions among various groups of participants and LBII personnel dealt with technical aspects of the airport feasibility studies.

- Iligan (Lanao del Norte, Region XII), July 17, 1991

  Most comments and questions from the meeting participants focused on their desire to have an improved airport in their immediate vicinity. Almost without exception, the government representatives present at the meeting expressed the desire to continue the development of the partially constructed airport at Linamon. One person made an effort to address environmental concerns by pointing out that the initial environmental reconnaissance had not identified any issues other than those few outlined in the Background Paper. Some concern was raised about safety and noise factors.

- Cagayan de Oro (Misamis Oriental, Region X), July 18, 1991

  As with the Iligan scoping session, the participants in Cagayan de Oro remarked extensively on the question of whether a new airport will be constructed or the existing one improved. Several favored improving Lumbia Airport. They pointed out that people from the interior of Mindanao, specifically those from Bukidnon Province, would have farther to drive if a new facility was located in Laguindingan.

- SUBMISSIONS SUBSEQUENT TO THE SCOPING SESSIONS

  One written submission has been received subsequent to the scoping sessions. It included the significant point that the EA/EIS for an airport project, especially if a new airport site is selected, must address in detail certain technical aspects of particular significance in relation to airport siting. These include air quality and noise modeling, land use planning, hazardous material handling, and secondary transportation impact modeling.

APPENDIX E-2
FAXED MEMORANDUM
from USAID/WASHINGTON

To:	Molly Kux Asia/DR/TR	**Date:**	September 19, 1991
From:	Jim Tarrant Asia/DR/TR		
Subject:	**Comment and Review of Scoping Sessions Report of Feasibility Study and Master Planning, Cagayan de Oro-Iligan Airport Project**		

I recommend approval of this scoping report, which also includes a summary proposed field investigation methodology and EA table of contents, subject to a few changes.

Three scoping sessions were held: in Manila, Iligan City and Cagayan de Oro. Compared to the large number of NGO's invited, only a very few showed up for the scoping sessions, which is very unfortunate since this is their main opportunity for direct input into the assessment and design process. most of the NGOs invited were for the Manila meeting. Most of the attendees at the local sessions appeared to be mayors and other politicians. The biggest grievances appeared to be in Iligan City which argued passionately for their airport (Linamon) as opposed to the site to be investigated (Laguindingan).

The scoping sessions report raised a few questions which I would suggest need clarification.

1. Is A.I.D. (or the PAPS Project) financing just a new airport or new airport and capital improvements to one or more existing airports? Are the proposed or planned capital improvements to the existing airports intended to enable the ATO to land more aircraft and/or larger aircraft? If so, won't these improvements possibly create significant secondary impacts (increased noise, accident risks, ground transport and service facility demands) which ought to be investigated?

2. In the proposed Table of Contents, I would recommend the following additions:

    a) a summary matrix table of project impacts, by category (physical, socio-economic, etc.), proposed mitigations and monitoring (where necessary) to be placed at the end of the executive summary, I felt this was a very handy reference in the GSC Airport EA done by Wilbur Smith and would be a useful monitoring reference for the Mission and Bureau as well.

b) an Environmental Action Plan such as was done by LBII for the Makar Wharf EA and the GSC Airport, which identifies the sequence of steps and actions to address the mitigations proposed in the EA and, to the extent possible identifies which agency should do them. This would be of direct potential utility to the Mission and Bureau as well.

APPENDIX F
LIST OF PREPARERS

Appendix F
LIST OF PREPARERS

ROGELIO N. CONCEPCION, SOIL SPECIALIST

Dr. Concepcion holds a masters and a Ph.D. in Agronomy from Cornell University and specializes in soils and land use studies for rural development. His most recent work has included poverty alleviation projects for impoverished uplands, feasibility studies for the Regional Community Resource Management Project and Agro-Ecological mapping techniques.

JORGE DE LAS ALAS, AIR QUALITY AND OCEANOGRAPHY SPECIALIST

Dr. De Las Alas is a Professor and Chairman of the Department of Meteorology and Oceanography at the University of the Philippines, Diliman. He obtained his master's and doctorate degrees in Meteorology from McGill University, Canada. He has participated in a wide variety of studies ranging from environmental impact assessment on mining, geothermal, and road projects as well as specialized studies on Manila Bay monitoring and beach stability studies.

MICHAEL ROSS, ENVIRONMENTAL SPECIALIST

A resident of the Philippines for over ten years, Michael Ross holds a B.A in Aquatic Biology from the University of California, Santa Barbara, and has completed extensive research on the coral reefs and related coastal resources throughout the country. His publications span a range from coral taxonomy and community structure, to coral fisheries and environmental assessment of development impact on coastal zones. In a management role, he has implemented projects as varied as the Small Island Community Development Project (USAID - A. Soriano Foundation funded; Cuyo, Palawan) to operation of the privately-owned Bohol Beach Club, in Bohol. Recent environmental assessment assignments include the Rural Infrastructure Fund (RIF) Project and the Makar Wharf Project of the Philippine Assistance Program Support (PAPS) program, both USAID-funded.

ROBERT SALAZAR, ANTHROPOLOGIST/SOCIOLOGIST

Robert Anthony C. Salazar is an associated professor of De La Salle University and Director of the Research Center. He obtained his A.B. Psychology (cum laude) and M.S. Applied Sociology-Anthropology degrees from the Ateneo de Manila University, and his Ph.D. in Anthropology from the Ohio State University, U.S.A. As Director of the Research Center, he directs and supervises research, planning and evaluation of projects and programs for development. He has extensive experience conducting social soundness analysis, impact evaluation and project monitoring and evaluation in many types of development projects. He is also a member of the Environmental Assessment Review Committee of Environmental Management Bureau, DENR.

PAUL D. SÖRENSEN, ENVIRONMENTAL ASSESSMENT COORDINATOR

Dr. Sörensen is an Associate Professor of Biological Sciences, Northern Illinois University, DeKalb, Illinois. He received his Ph.D. in Plant Taxonomy at the University of Iowa, following which he served three years as Assistant Curator of the Arnold Arboretum of Harvard University. His research specialization and publications are on taxonomic revisions of Latin American plant genera. Since its founding in 1974, he has been Vice-President and Principal Ecologist of ENCAP, Inc., Environmental Consultants and Planners, based in Dekalb, Illinois. He also serves on the Technical Advisory Committee for Plants of the Illinois Endangered Species Protection Board.

FLORAL AND FAUNAL SURVEY

GERARDA J. ABANIL, BIOLOGIST

Mrs. Abanil is the former Chair of Biology, Xavier University, Cagayan de Oro. She has earned three master's degrees in Education, the Teaching of Biology, and in Biology (as a subject), the last from the University of the Philippines, Quezon City. Her varied research includes studies on chemical bonding, ecology of marine organisms, pollution ecology, toxicology, and field biology. Her role in the EA was to assemble a team of local biologists to conduct a faunal and floral survey in the vicinity of the proposed airport at Laguindingan.

ARCHAEOLOGICAL SURVEY

EUSEBIO Z. DIZON, SUPERVISING ARCHAEOLOGIST

Dr. Dizon has been connected with the National Museum since 1977. In 1980, he went on study leave to the University of Pennsylvania, Philadelphia, PA. U.S.A., obtaining a M.Sc. degree in 1983 and a Ph.D. in 1988, in Anthropology, major in Archaeology. He has conducted archaeological fieldwork in India, U.S.A. and extensively in the Philippines. He is also the present head of the Underwater Section in the Archaeology Division of the National Museum.

MAHARLIKA CUEVAS, SENIOR ARCHAEOLOGIST

Mr. Cuevas is a Researcher II of the National Museum presently assigned to the Underwater Section of the Archaeological Division. Since he joined the Museum in 1977, he has undertaken archaeological explorations and excavations in various sites throughout the Philippines. He has served as technical staff in training courses in archaeology conducted in the Philippines and has attended training courses in underwater archaeology held in Thailand in addition to participating in workshops and seminars on archaeology with venues in Southeast Asia.

MELCHOR L. AGUILERA, JR., CULTURAL RESOURCES SPECIALIST

Mr. Aguilera holds a B.S. in Geology and has been trained in the field of Archaeology. Connected since 1978 with the National Museum of the Philippines, his research specialization is geo-archaeology and includes exploration and excavation in Japan, Thailand and in various sites throughout the Philippines. He recently participated in the environmental impact assessments for the Rural Infrastructure Fund (RIF) Project and the Aurora Roads Infrastructure Development Project (ARIDP), both USAID-funded.

APPENDIX G
ENVIRONMENTAL ACTION PLAN

APPENDIX G
ENVIRONMENTAL ACTION PLAN

The following plan outlines concise steps and implementation timeframes for recommended mitigation of the environmental impacts identified for the proposed airport project. The environmental action plan is intended to provide specific guidelines to subsequent stages of the project, including detailed design, construction and operation, as well as to serve as a monitoring tool to funding and regulatory agencies. The emphasis of this action plan is preventive in nature.

For the purpose of establishing an economic and traffic forecast setting, the Feasibility Study assumed a construction starting point of January, 1993 as shown in the General Construction Schedule (Table 1-8). Acknowledging the inherent flexibility of the project's construction schedule, for the purpose of this assessment, the environmental action plan is referenced to the January, 1993 start of construction (Figure G-1).

G.1 PRECONSTRUCTION

At the time of the project approval for detailed design and construction management, it is assumed within the environmental action plan that the responsible airport authority will be identified and will henceforth function as the project proponent and action plan implementor.

It is further assumed that this environmental assessment, in a finalized form acceptable to the respective funding and regulatory agencies will be incorporated within the contract documents prepared for the detailed design, construction management and operational phases of the project.

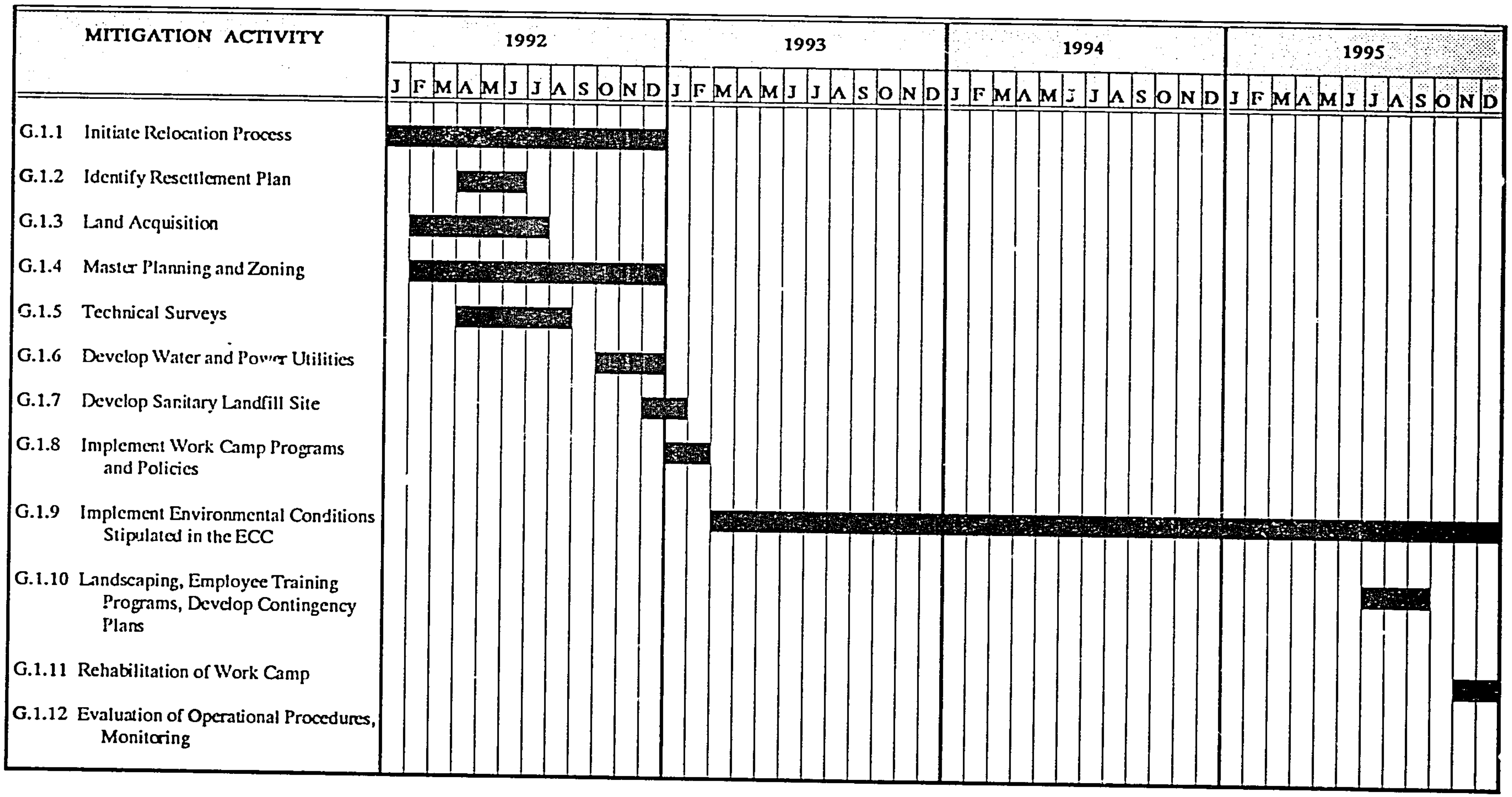
G.1.1 January to December, 1992

The initial relocation process is estimated, based on recent experiences of the Ayala Foundation, to extend over a one year period. The relocation process should be started as early as possible to allow an adequate allowance of time for public participation, program formulation and feedback mechanisms to operate. The recommended relocation, resettlement and community development program is outline in Table 5-1. As a preliminary step in this recommended program a site specific census would be conducted to formally identify affected households and properties to establish baselines for further program activities and funding requirements (e.g., number of beneficiaries, land classifications and improvements, types of existing structures).

As detailed in Table 5-1 and Section 5.3, the orientation of the recommended relocation program explicitly emphasizes public participation, review and evaluation towards developing the consensus of program objectives. With respect to this orientation, a representative group of

317

Figure G–1
ENVIRONMENTAL ACTION PLAN



affected residents should be identified and popularly recognized to facilitate consecutive planning decisions involving the relocation process, including the appropriate siting of a resettlement site, the necessity of a resettlement facilities or provision for employment opportunities within the project activities. The responsible airport authority will coordinate with the municipal and barangay-level governments in establishing the representative resident group.

G.1.2 September to November, 1992

Based on results of the identification process directly involving affected and concerned community members, the consensus will determine the requirement of a formal resettlement site or equivalent compensation in financial terms. If a resettlement facility is deemed required, the public review process will also determine, within reason, the siting, basic infrastructure, required utilities and housing arrangements to be implemented during this three-month period. To develop a sense of community as well as to provide additional means of livelihood, beneficiaries of the proposed resettlement area should be actively involved/employed in the development of the resettlement site. Labor contributions to development of the resettlement facility could foreseeably be applied towards amortizations of individual house and lot costs.

G.1.3 February to July, 1992

Land acquisitions should be completed as soon as mutually agreeable compensation rates and land classifications schemes are locally established to avoid unnecessary appreciation due to land speculation.

G.1.4 February to December, 1992

Existing issues involving land distribution under the Comprehensive Agrarian Reform Program (CARP) and zoning conversion to industrial use as contested by the Diamond Cement and Industrial Corp. (DCIC) should be resolved in an expeditated manner. Subsequently, a local master plan of the proposed airport vicinity should be proposed, incorporating the recognized physical constraints of airport operations (height, noise, light and emission restrictions), and ratified under applicable municipal, provincial and regional-level procedures.

G.1.5 April to August, 1992

To define geological hazards associated with the identified Alubijid Fault and local occurrence of solutional cavities, as well as the need to identify sufficient groundwater supplies, an integrated geo-technical, seismic, groundwater and geo-resistivity survey will be conducted throughout the project site vicinity. The geo-technical survey will be coordinated with the Region X Office of DENR, and their project described in Appendices D-4 and D-5. Secondary water quality testing will be conducted during this period to verify results obtain during this assessment. Meteorological studies would also be initiated at the site during this period.

G.1.6 October to December, 1992

Based on the results of the proceeding groundwater and geo-resistivity surveys, the identified water sources will be developed to supply the project site and the resettlement area. Following installation of water and power utilities, the relocation of all resident beneficiaries to the resettlement site will be implemented, to include supportive livelihood and training programs.

G.1.7 December, 1992 to January, 1993

A sanitary landfill site identified during the previous master planning stage will be developed to initially accommodate construction-phase generated wastes and subsequently, operational phase solid wastes.

G.1.8 January to February, 1993

With establishment of the construction work camp, temporary sanitation facilities will be constructed. Procedures will be established for handling construction-generated hazardous wastes, such as petroleum-based products. Informational programs will be conducted for all contractors and employees to identify sensitive environmental issues and to limit secondary environmental impacts. Specific programs will address the standard application of erosion control practices, the protection of groundwater resources from hazardous spills and disciplinary activities to minimize the disruption to natural resources in the area, such as clamming in the seagrass reef flats.

G.1.9 March, 1993 to December, 1995

Management-based, employee-oriented programs will be implemented based on the conditions of the Environmental Compliance Certificate (ECC) provided by the Environmental Management Bureau (EMB) of the Department of Environment and Natural Resource, in addition to provisions stipulated by USAID and subsequent funding agencies.

G.1.10 July to September, 1995

Coinciding with the normal rainy season, landscaping will be installed including greenbelt acoustic barriers as required, particularly near the existing Moog Elementary School. Selected greenbelt species and sitings will follow height restrictions such as the transitional slopes, as well as to not attract additional avifauna, to limit potential bird hazards to aircraft operation.

Training programs would be initiated for operational personnel and management regarding storage and handling procedures for hazardous materials, including aviation fuel. In addition to daily operating procedures and disposal practices, emergency plans will be developed involving inter-agency levels of organization as described in Section 4.7.2.7 and tested through regular drills. Safety and upset drills will include on-site as well as off-site emergency scenarios such as a fuel tanker accident along the national highway or access roads, or a crash landing at sea.

G.1.11 **November to December, 1995**

During the abandonment of the work camp, all solid wastes and temporary structures, including sanitation facilities, will be removed. The work camp site will be cleared and rehabilitated as required to meet to planned utilization of the area.

G.1.12 **January, 1996 onward**

Regular evaluation of adapted operational procedures and organizational structures will be conducted and updated as needed. Local public review and recommendation will be solicited and incorporated to maintain a high level of community relations.

With the onset of flight operations, noise monitoring will be conducted to test initial predictions of noise impacts. A groundwater testing program would be maintained for domestic water supply wells in the vicinity to document possible groundwater infiltration by hazardous materials.