社会開発調査部報告書

No. 52

JAPAN INTERNATIONAL COOPERATION AGENCY

JAPANESE INTERNATIONAL COOPERATION AGENCY

MUSIC HISTORY AND THE WORKS OF THE NATIONAL COMPOSERS

THE STUDY ON FLOOD CONTROL

FOR JAMUNA AND PARARIA AREA

IN

THE REPUBLIC OF INDONESIA

FINAL REPORT

(SUMMARY)

NOVEMBER 1997

パシフィックコンサルタンツインターナショナル株式会社

JAPAN INTERNATIONAL COOPERATION AGENCY

DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
MINISTRY OF PUBLIC WORKS, THE REPUBLIC OF INDONESIA

THE STUDY ON FLOOD CONTROL FOR AMBON AND PASAHARI AREA IN THE REPUBLIC OF INDONESIA

FINAL REPORT (SUMMARY)

NOVEMBER 1997

YACHIYO ENGINEERING CO., LTD.
yec

Exchange Rate

Master Plan and Conceptual Plan :
1US$=¥115=Rp.2,300 (as of November 1, 1996)

Priority Project :
1US$=¥120=Rp.2,928 (as of September 1, 1997)

PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct a master plan study and feasibility study on flood control for Ambon and Pasahari Area and entrusted the study to the Japan International Cooperation Agency (JICA).

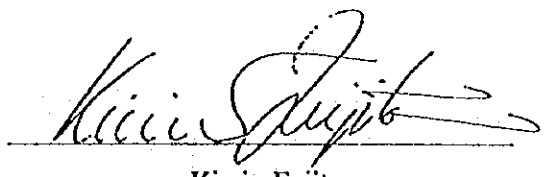
JICA sent to Indonesia a study team headed by Mr. Masatomo Watanabe, Yachiyo Engineering Co. ,Ltd., three times between October 1996 and November 1997.

The team held discussions with the officials concerned of the Government of Indonesia and conducted field surveys in the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the team.

November 1997



Kimio Fujita
President
Japan International Cooperation Agency

November, 1997

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. Fujita,

LETTER OF TRANSMITTAL

We are pleased to submit to you the final report of the Study on Flood Control for Ambon and Pasahari Area in the Republic of Indonesia. The report contains plans of flood control and city water development projects, as well as the advice and suggestions of the authorities concerned of the Government of Japan and your Agency. Also included are comments made by the Directorate General of Water Resources Development, Ministry of Public Works, Republic of Indonesia, through technical discussions on the draft reports which were held in Jakarta and Ambon, Indonesia.

The report consists of the master plan and feasibility study for flood control and city water development in the central area of Ambon City, as well as the conceptual flood control plan for the Pasahari area. In the Ambon area, structural flood control measures such as river improvement, a diversion channel and small scale multi-purpose dams for the five (5) rivers, and non-structural flood control measures for the river basin management, were proposed targeting the year 2015 and 30-year return period design scale. In the planning, negative socio-economic impact (resettlement and land acquisition) and effects on the natural environment were minimized as much as possible. In addition city water development using small scale multi-purpose dams was planned, based on the future water demand, in conjunction with flood control project. In the Pasahari area, river dike systems with wide river width and low dikes targeting the year 2015 and 20-year return period design scale, were proposed as the most suitable flood control measures, based on the current and future conditions of socio-economy and land use.

In view of the urgent necessity for flood control measures and water resources development as well as river environment improvement in the central area of Ambon City, and of the need for the infrastructure development of Ambon as the capital of Maluku Province, we recommend that the Government of Indonesia implements the priority projects proposed in the report as a top priority.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and Ministry of Construction. We also wish to express our deep gratitude to the Directorate General of Water Resources Development, Ministry of Public Works, Republic of Indonesia for the close cooperation and assistance extended to us during our investigation and study.

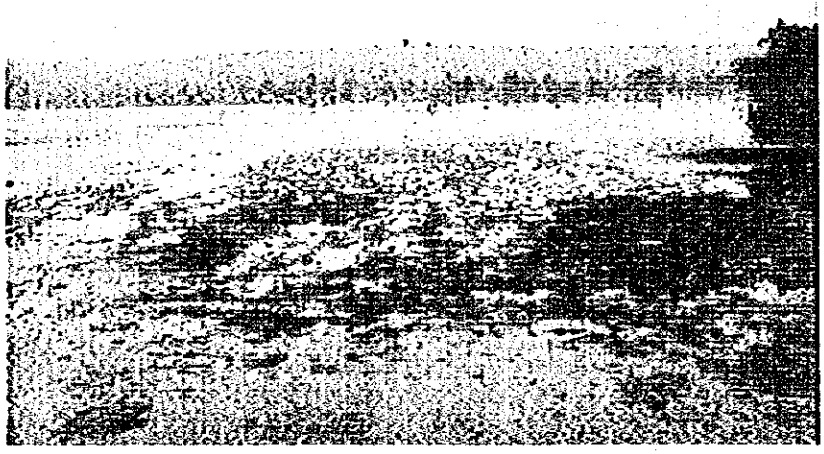
Very truly yours,

渡邊正知

Masatomo Watanabe
Team Leader
The Study on Flood Control for Ambon and
Pasahari Area in the Republic of Indonesia

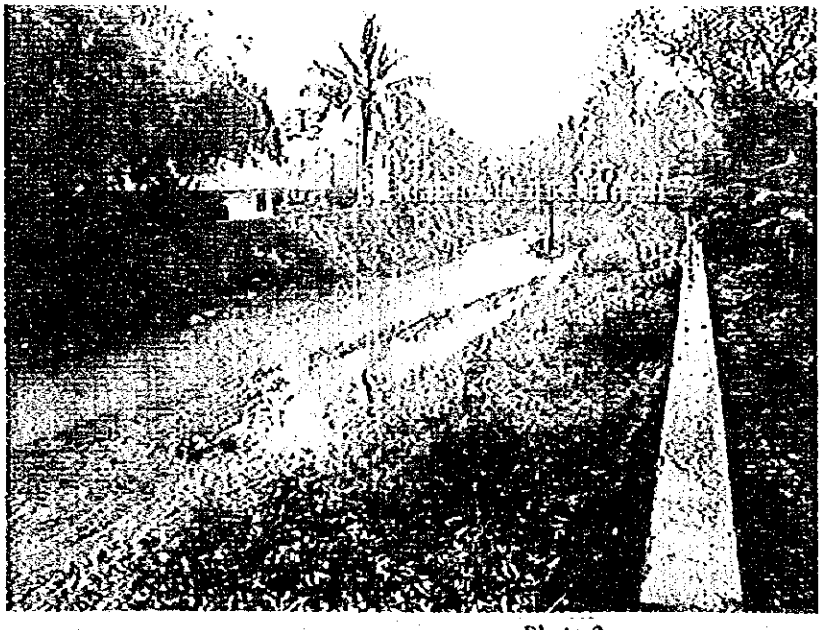
Study Area of Ambon (From the South-east, Martha Christina Tijahahu)

Study Area of Ambon (From the South-west)



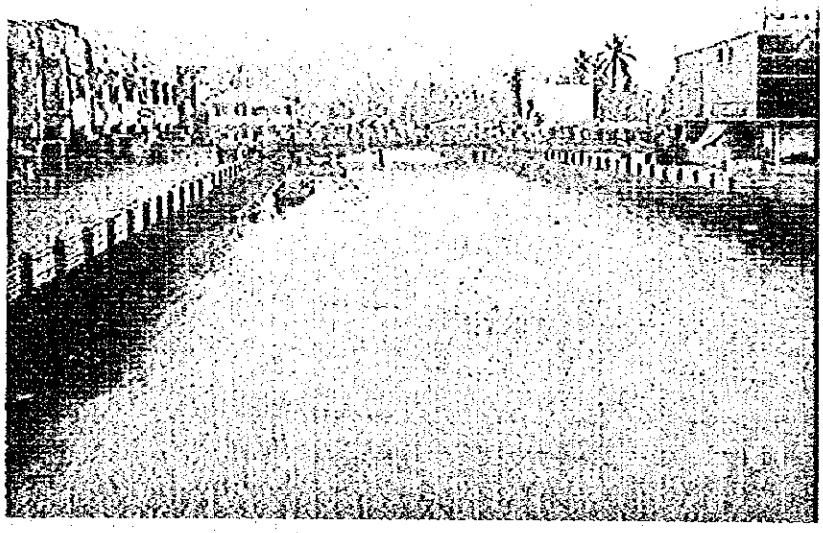
Ruhu River Mouth
Much Sedimentation

Ruhu River
Downstream View from
the Left Side at 0k650

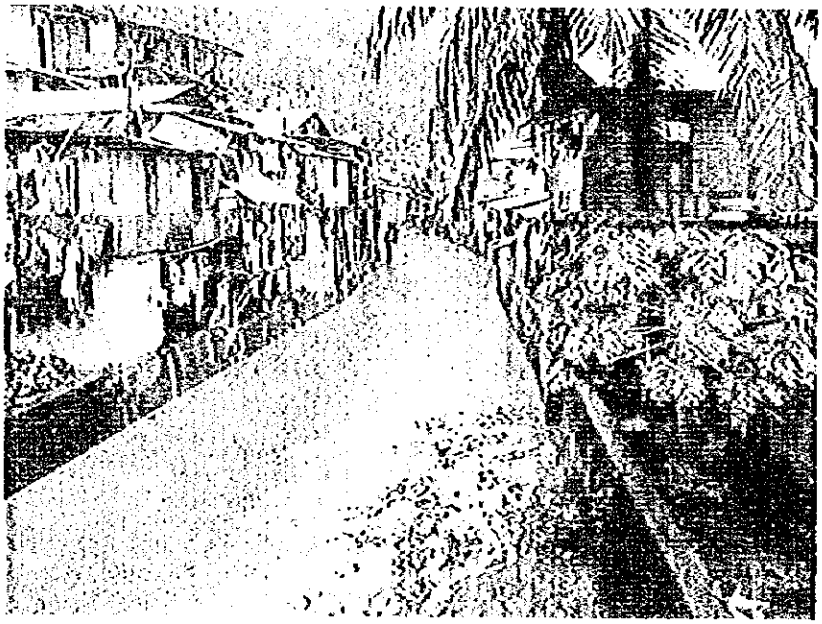


Ruhu River
Downstream View from
the Right Side at 1k400

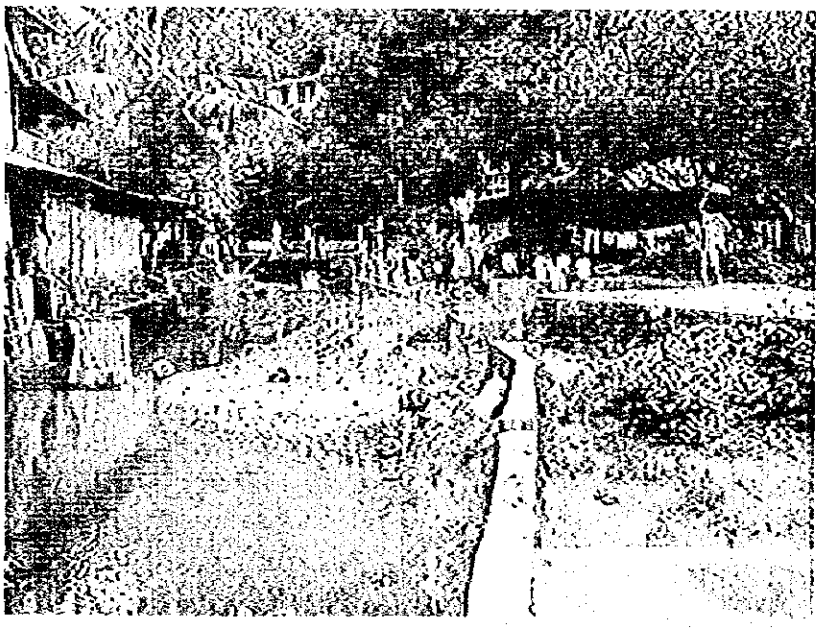
Photo-2



Batu Merah River
Upstream View from the River Mouth Bridge

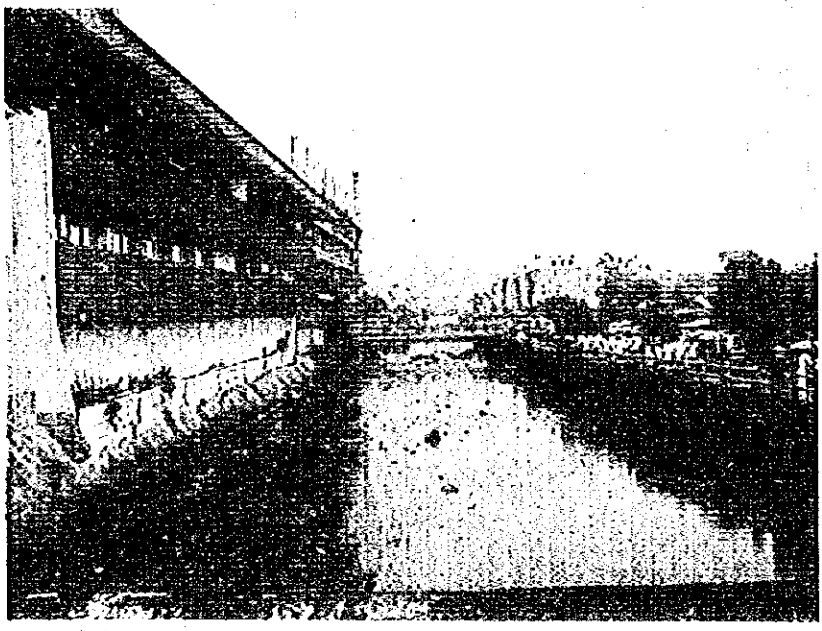


Batu Merah River
Upstream View from the Bridge at 0k250
Closely Located Houses along the River

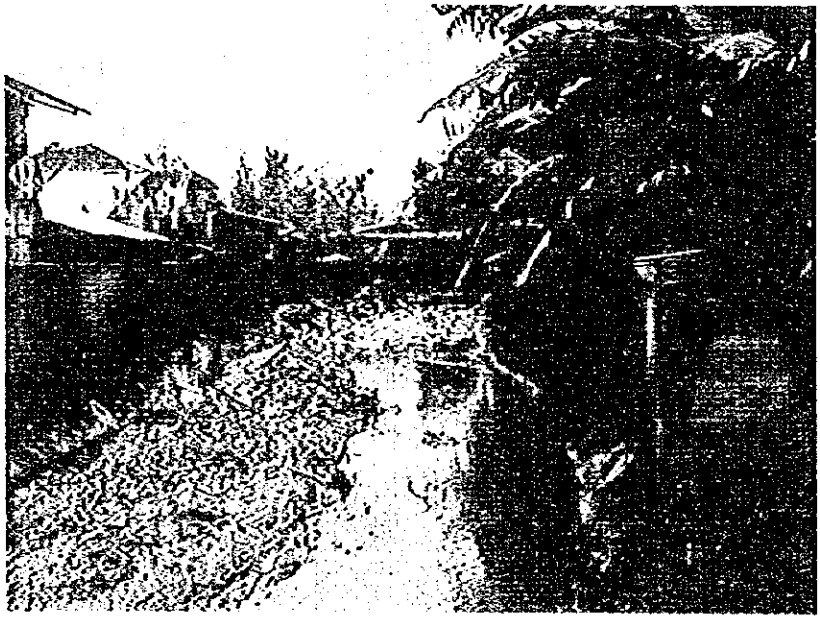


Batu Merah River
Downstream View from 1k450
Inlet Site of Diversion

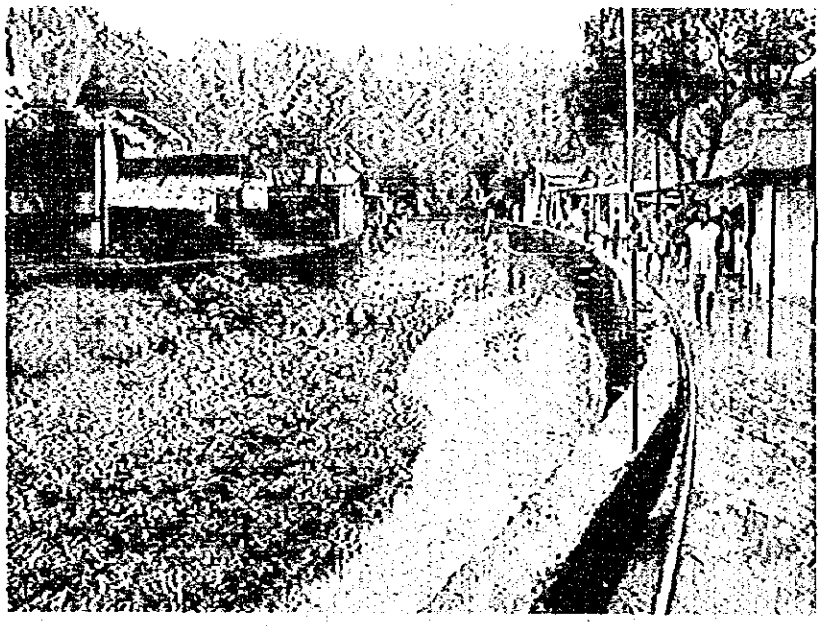
Photo-3



Tomu River
Downstream View from the Bridge at 0k420
Left Building is "PU"



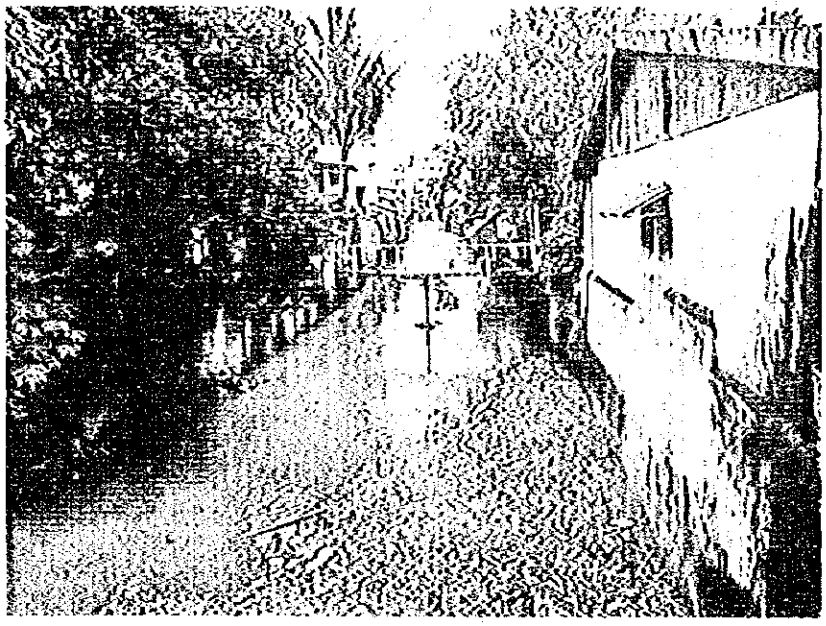
Tomu River
Downstream View from 0k900
Houses are closely located and the river is narrow and meandering.



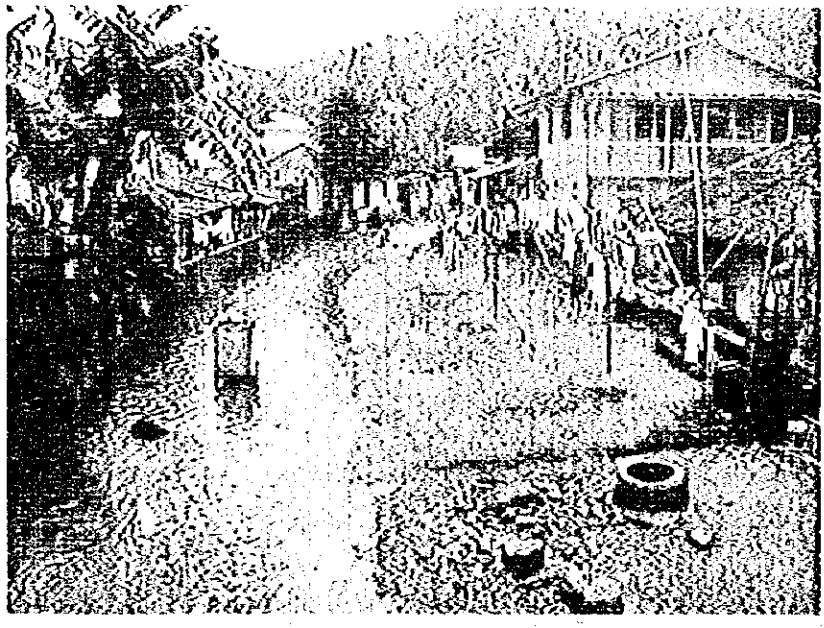
Tomu River
Upstream View from 1k900

Photo-4

Batu Gajah River Mouth
Downstream View from 0k100

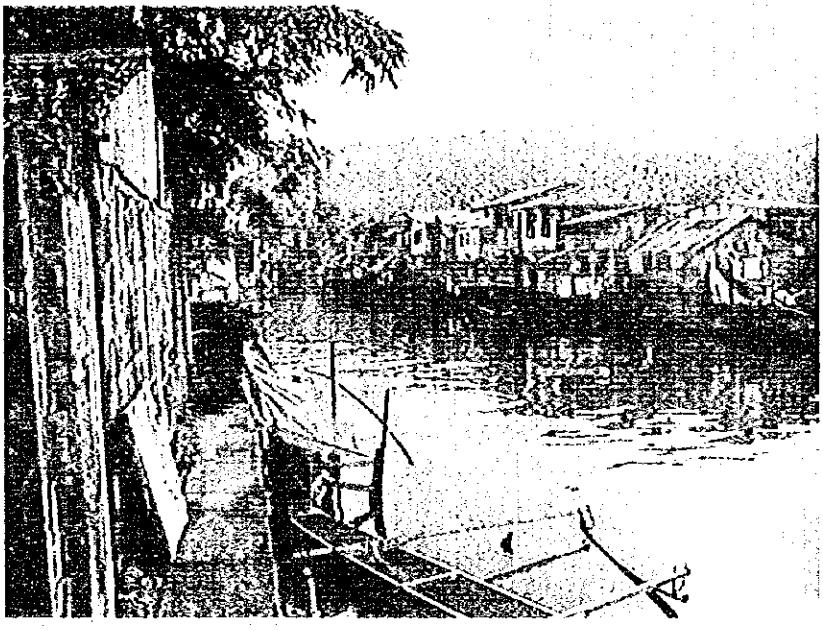


Batu Gajah River
Downstream View from the Bridge at 0k750



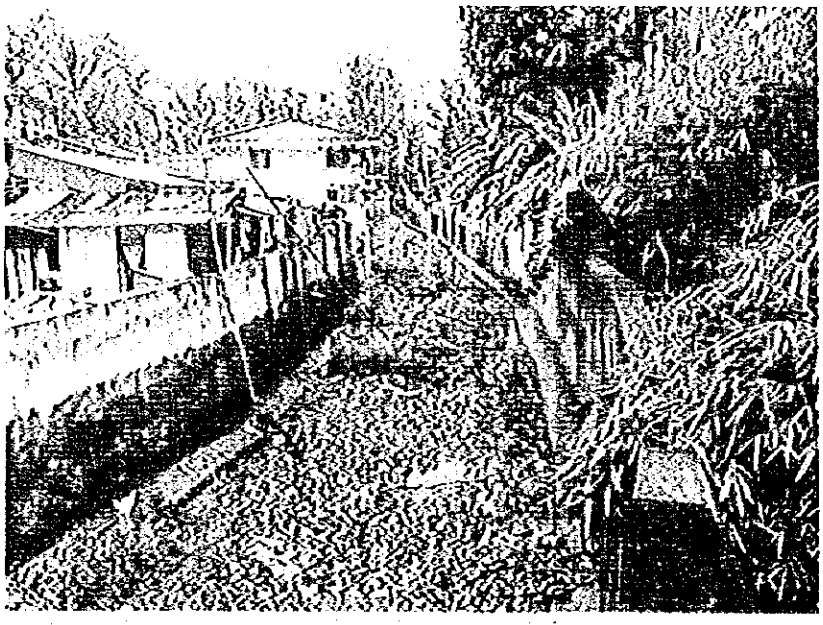
Batu Gajah River
Upstream View from the Bridge at 1k388

Photo-5



Batu Gantung River
Upstream View from the River Mouth
Some parts of Houses are located in the river.

Batu Gantung River
Upstream View from the Bridge at 0k400
The steep slope of Batu Gantung River basin is seen.

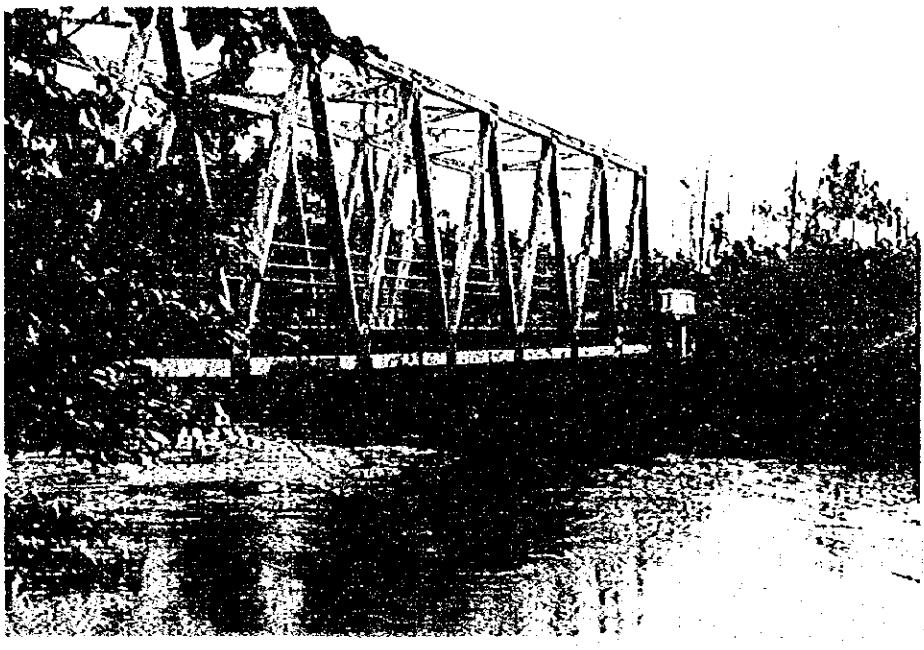


Batu Gantung River
Downstream View from 1k150
This section is the narrowest in Batu Gantung River.

Photo-6

Samal River
View upstream from
Irrigation Free Intake
(Normal Flow)

Samal River
View upstream from
Irrigation Free Intake
(Flood Flow)



Samal River
Samal Road Bridge
(Flood Flow)

Kobi River
View upstream from
New Free Intake
(Under Construction)

Kobi River
View downstream at
Existing Free Intake
(Gabion Protection)

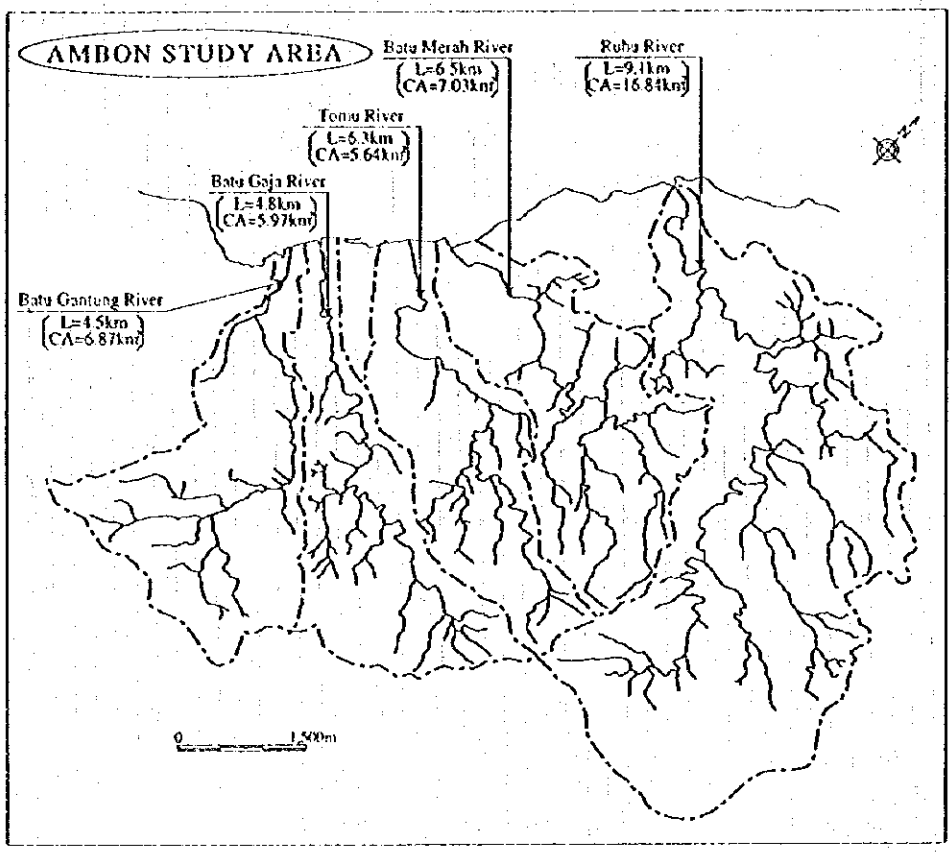
Kobi River
View upstream from
Kobi Road Bridge
(Flood Flow)

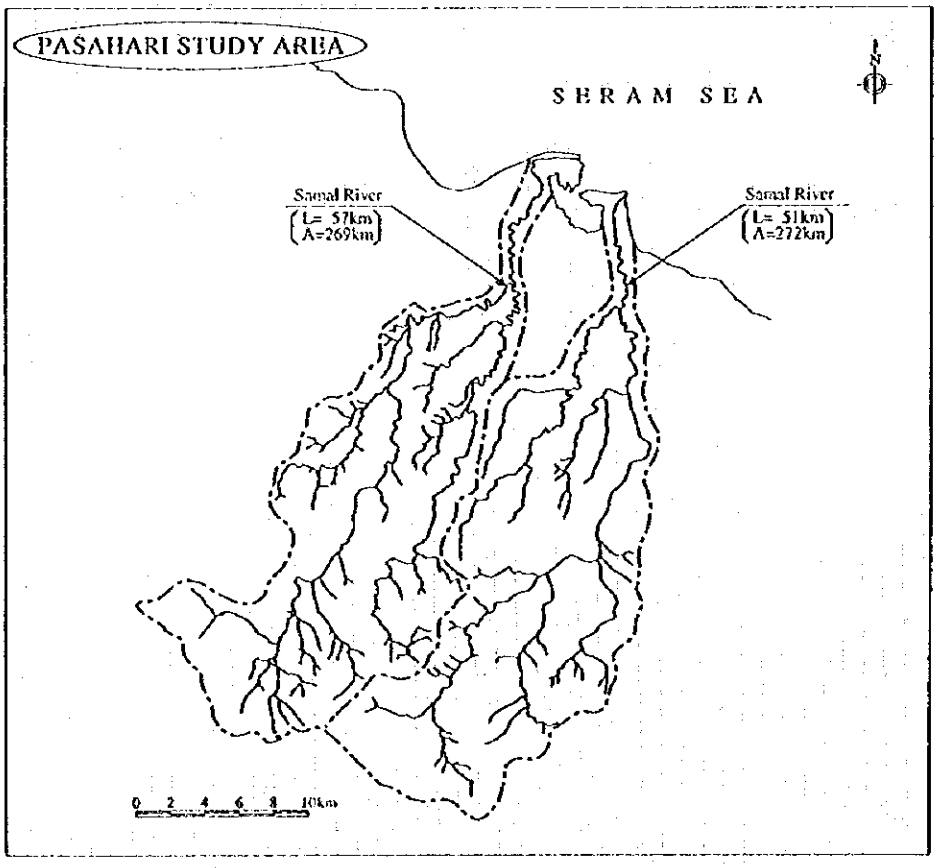
The Republic of Indonesia
Location of Ambon Island and Seram Island

Study Area
[Ambon Central Area / Pasahari Area]

Map of the Study Area (1/2)

(i)





Map of the Study Area (2/2)

List of Study Reports

SUMMARY

MAIN REPORT

SUPPORTING REPORT

Master Plan and Feasibility Study for Ambon Area

Part-A Socio-economy and Land Use
Part-B Topography and Geology
Part-C Meteorology and Hydrology
Part-D Flood Control Plan
Part-E Water Utilization Plan
Part-F Facility Design and Cost Estimate
Part-G Environment
Part-H Economic Evaluation
Part-I Implementation Program
Part-J Topographic Survey

Conceptual Plan for Pasahari Area

Part-K Socio-economy and Land Use
Part-L Topography and Geology
Part-M Meteorology and Hydrology
Part-N Flood Control Plan and Design
Part-O Environment
Part-P Economic Evaluation
Part-Q Topographic Survey

DATA BOOK

DataBook-A Meteorological and Hydrological Data for Ambon Area
DataBook-B Meteorological and Hydrological Data for Pasahari Area

SYNOPSIS

The Study on Flood Control for Ambon and Pasahari Area in the Republic of Indonesia

Study Period: October 1996 - November 1997
Recipient Agency: Directorate General of Water Resources Development, Ministry of Public Works

1 BACKGROUND OF THE STUDY

Ambon City, the capital of Maluku Province, is blessed with a good natural port and has been the social and economic center of the region ever since the days of colonial rule by the Netherlands. The population of Ambon City, which currently stands at 305,000 as of 1996, is forecast to rise to 420,000 by the end of 2015 with a population growth rate of 1.7 % based on the recent census. However, despite being such an important commercial center, the center of the city is flooded and damaged every year by the five main rivers. In addition, current water supply in the central Ambon area is not sufficient with a supply coverage of only 28 % and there will be a shortfall in supply of 9,500 m^3/day by the year 2015 and 24,000 m^3/day by the year 2030. Ambon needs to reinforce the infrastructure to support future growth in line with the central government policy to develop the eastern region of Indonesia.

Further more, at the strong request of the Indonesia side, it was decided to examine a conceptual flood control plan in the Pasahari area on the island of Seram next to Ambon. This area is one of the highest potential irrigation areas in Maluku Province but is also vulnerable to flood damage.

2 OBJECTIVES OF THE STUDY

The objectives of the study can be summarized into the following three points:

1) Formulation of a flood control master plan and city water development plan for the urban city area of Ambon
2) Implementation of a feasibility study into priority projects raised within the master plan that require particularly urgent attention
3) Preparation of a conceptual flood control plan for the Pasahari area on Seram Island

3 FLOOD CONTROL FOR AMBON AREA

3-1 Outline of the Project

(1) Basic Policy

Based on the basin characteristics and river conditions, the basic policy for flood control and city water development are set as follows:

1) Structural measures and non-structural measures for flood control and sediment control are planned with a planning scale of 30-year return period, targeting the year 2015.
2) Structural measures include river improvement works, dams, diversion channels and check dams. Non-structural flood control measures are measures other than structural flood control measures to mitigate flood disasters and include various methods for flood runoff suppression, for flood proofing and for facilitation of flood control activities.
3) Plans for water development for future domestic use through multi-purpose dams are proposed with a planning scale of 10-year return period. Target water supply coverage is set as 80 % by 2015 and 100 % by 2030.
4) Special attention is paid to possible negative social and environmental impacts to identify optimum projects.

(2) Proposed Projects (Structural Flood Control Measures)

The proposed projects for flood control and water resources development in Ambon Area are shown in Table-1. All projects with the exception of Ruhu multi-purpose dam were selected as priority projects.

Table-1 Proposed Projects in Ambon Area *1

River		Ruhu	Batu Merah	Tomu	Batu Gajah	Batu Gantung
Construction Cost	Rp.million	6,214	27,708	18,492	71,080	47,179
Land Acq. & Comp. Cost	Rp.million	287	2,335	1,252	7,334	6,026
Land Acquisition	Area	615 m^2	4,250 m^2	1,781 m^2	192,958 m^2	149,291 m^2
Resettlement	Household	5	33	10	69	27
River Improvement Work	Type *2	E, H, W	E, H, C, W	E, H, C, W	E, H, C, W	E, H, C, W
	Length	1,600 m	1,500 m	2,700 m	2,200 m	1,450 m
Multi-purpose Dam	Type	Rock Fill	-	-	Rock Fill	Rock Fill
	Height	44.7 m	-	-	50.0 m	36.6 m
	N.D.D. *3	16,000m^3/d			8,000m^3/d	2,500m^3/d
Diversion Channel	Type	-	Tunnel	-	-	-
	Length	-	900 m	-	-	-
Check Dam	Type	Masonry	-	Masonry	Masonry	Masonry
	Height	3.8 m	-	4.9 m	6.1 m	3.5 m
Land Reclamation (as Disposal Site)	Cost	Construction Cost : Rp. 6,608 million				
	Ave.Depth	3.0 m				
	Area	6.56 ha				

*1 Ruhu multi-purpose dam is not included in the Priority Projects but is included in the Master Plan.
*2 E : Excavation, H : Flood Wall Heightening, C : Three-sided Concrete Channel, W : River Widening
*3 N.D.D. : Newly Developed Discharge

(3) Non-structural Flood Control Measures

The targets and methods of non-structural flood control measures are proposed as shown in Table-2.

Table-2 Non-structural Flood Control Measures for Ambon Area

Objectives	Methods	
Suppression of Flood Runoff	- Land Use Regulation	- Off-site Storage
	- Vegetation Improvement	- Lowland Infiltration
Improvement of Flood Proof Function	- Land Use Regulation	- Flood Proof Facilities
Facilitation of Flood Disaster Prevention Activity	- Management Organization	- Flood Fighting System
	- Flood Forecast & Warning System	- River Management Zone
		- Public Awareness
	- Flood Risk Map	- Human Resource Development

(4) Project Cost

The project cost for the priority projects is estimated to be Rp. 302,049 million (equivalent to ¥ 12,379 million) using unit prices as of September 1997 (US$ 1 = Rp.2,928 = ¥ 120). Of the total project cost, Rp. 23,732 million is the cost of land acquisition and compensation.

3-2 Implementation Program

The responsible agency for project implementation will be the Ambon Flood Control Project Office which will be newly established at the project site under DGWRD. The Indonesian government wish to implement this project using finance from an OECF loan (Overseas Economic Cooperation Fund). The overall implementation schedule is shown in Table-3.

Table-3 Implementation Schedule

Fiscal Year	(1) 1998/99	(2) 1999/00	(3) 2000/01	(4) 2001/02	(5) 2002/03	(6) 2003/04	(7) 2004/05	(8) 2005/06	(9) 2006/07	(10) 2007/08
1 Loan Procedure										
2 Procurement										
a Consulting Services										
b Construction Work										
3 Consulting Services										
a Survey & Design										
b Tendering										
c Const. Supervision										
4 Construction										
5 Land Acquisition										

3-3 Project Evaluation

(1) Environmental Impact Assessment

Initial environmental examination was conducted and negative impacts were identified on 12 environmental elements. Of these twelve, resettlement, solid waste and groundwater were considered to be significant impacts when the proposed projects are implemented. On this basis, environmental impact assessment (EIA) for the priority projects was conducted and the impacts were carefully analyzed and conclusions were drawn as follows:

1) **Resettlement** : The projects will be planned and designed based on the policy of least negative impact as well as continuous care for the resettled households.
2) **Solid Waste** : Through land reclamation, existing landfills and construction material reuse, solid waste disposal will not be a significant problem during project construction.
3) **Groundwater** : Construction of the multi-purpose dams, the diversion tunnel and the three-sided concrete channel could cause negative impacts on groundwater. Facilities will be planned and designed taking into account measures such as leakage prevention, recharge of groundwater, alternative water resources and so on.

(2) Economic Evaluation

The entire project is assessed to be feasible, attaining an internal rate of return (IRR) of 16.4 % using a discount rate of 10 %. The projects for each river were also assessed to be feasible showing individual IRR of between 10.5 and 28.1 %.

Table-4 Results of Economic Analysis for Priority Project

Case	Economic Cost (Rp. Million)	NPV at 10% (Rp. Million)	B/C at 10%	IRR	Remarks
Ruhu River	7,768	26,154	5.3	28.1%	5-year return Period
Batu Merah River	34,635	98,256	4.7	25.8%	30-year return Period
Tomu River	23,115	36,474	3.0	19.9%	
Batu Gajah River	92,980	37,262	1.4	13.1%	
Batu Gantung River	63,104	3,619	1.1	10.5%	
Entire Project	221,602	168,756	2.2	16.4%	

3-4 Recommendations

1) Urgent implementation of the priority projects.
2) Implementation of the non-structural measures in line with the structural measures.
3) Careful and appropriate countermeasures to land acquisition and resettlement.
4) River environment management.
5) Formulation of water distribution plan by the local government.
6) Continuous effort to collect hydrometric data.

4 FLOOD CONTROL FOR PASAHARI AREA

4-1 Outline of the Project

Based on the social, economic and river conditions, the basic policy of flood control measures are set as follows:

1) Design scale of 20-year return period and target year of 2015.
2) Low cost river improvement works.
3) River dikes planned widely surrounding the current river course.
4) Multi-purpose dikes with road function.
5) Staged construction to be prioritized.

Based on these policies, conceptual flood control plans were proposed for Samal and Kobi rivers as shown in Table-5. The project cost is estimated to be as follows:

Samal River Project : Rp. 20,077 million Kobi River Project : Rp. 22,190 million

Table-5 Conceptual Flood Control Plan for Pasahari Area

River	Planned Gradient	Planned River Length (km)	Design Discharge (m^3/sec)	Dike Height (m)	Planned River Width (m)	Land Acquisition Area (ha)
Samal River	1/200-1/5600	16.6	1,550-2,450	2.00	350-2,850	26.52
Tributary Musi River	1/220-1/270	5.5	900	2.00	260-340	15.98
Kobi River	1/180-1/4900	16.6	1,900-2,650	2.00-2.50	540-1,500	29.98
Tributary Tinupa River	1/230-1/520	6.5	750	2.00	220-410	11.39

4-2 Project Evaluation

(1) Initial Environmental Examination

Possible negative impacts were identified during project construction on 6 environmental elements as follows: 1) Resettlement, 2) Economic Activity, 3) Traffic and Living Activity, 4) Solid Waste, 5) Coastal Area and 6) Water Pollution. However, no negative impact is anticipated during operation stage following completion of construction.

(2) Economic Evaluation

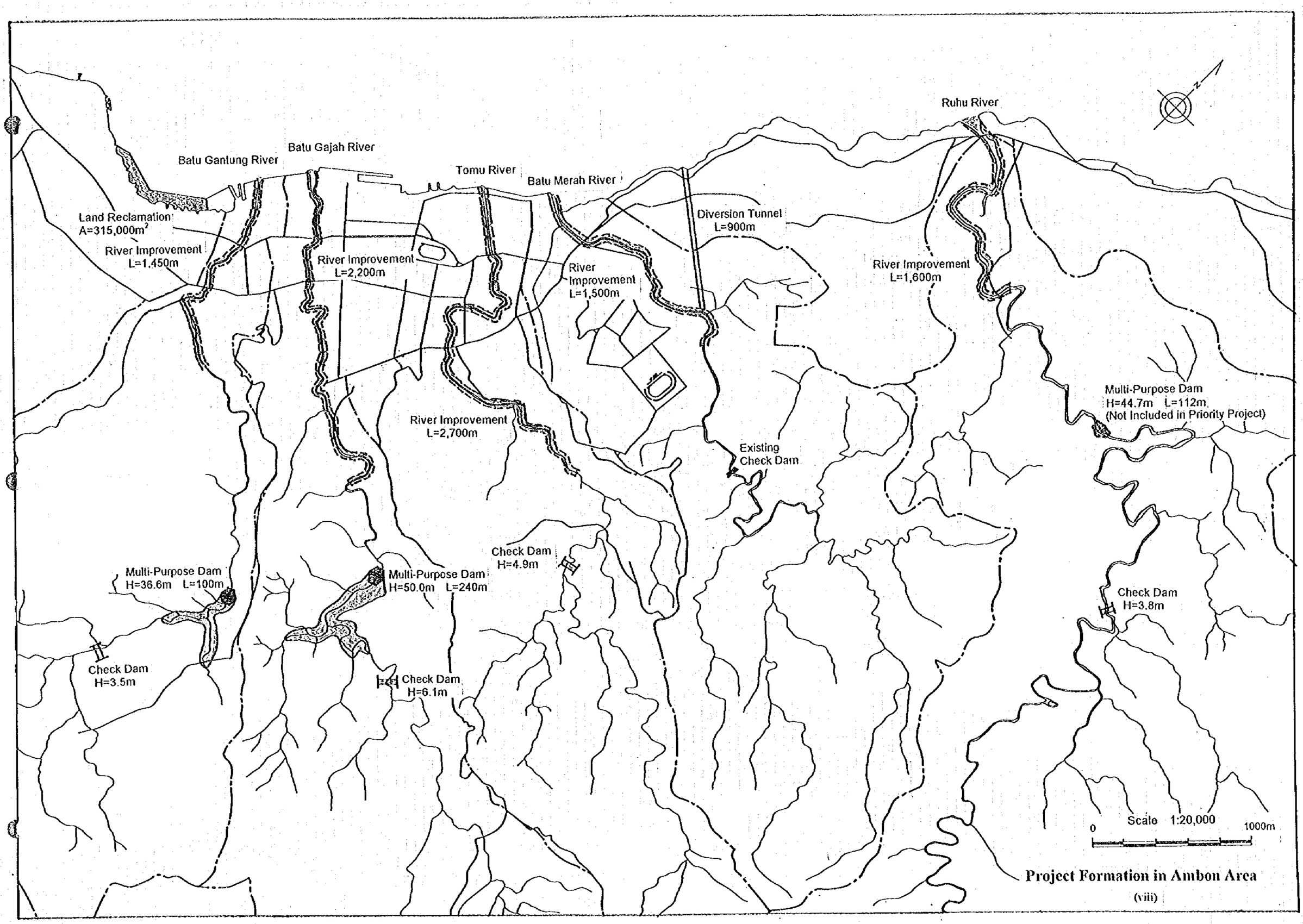
Since an IRR of 16.0 % using a discount rate of 10 % will be achieved for the Samal River flood control project, it is judged to be economically feasible. However, economic feasibility of the Kobi River flood control project is marginal with an IRR of 8.2 %. It should be noted that flood control facilities in Kobi River could also be used as roads which would have additional impact on the local economy, although benefits are difficult to quantify due to lack of traffic data.

Table-6 Results of Economic Analysis

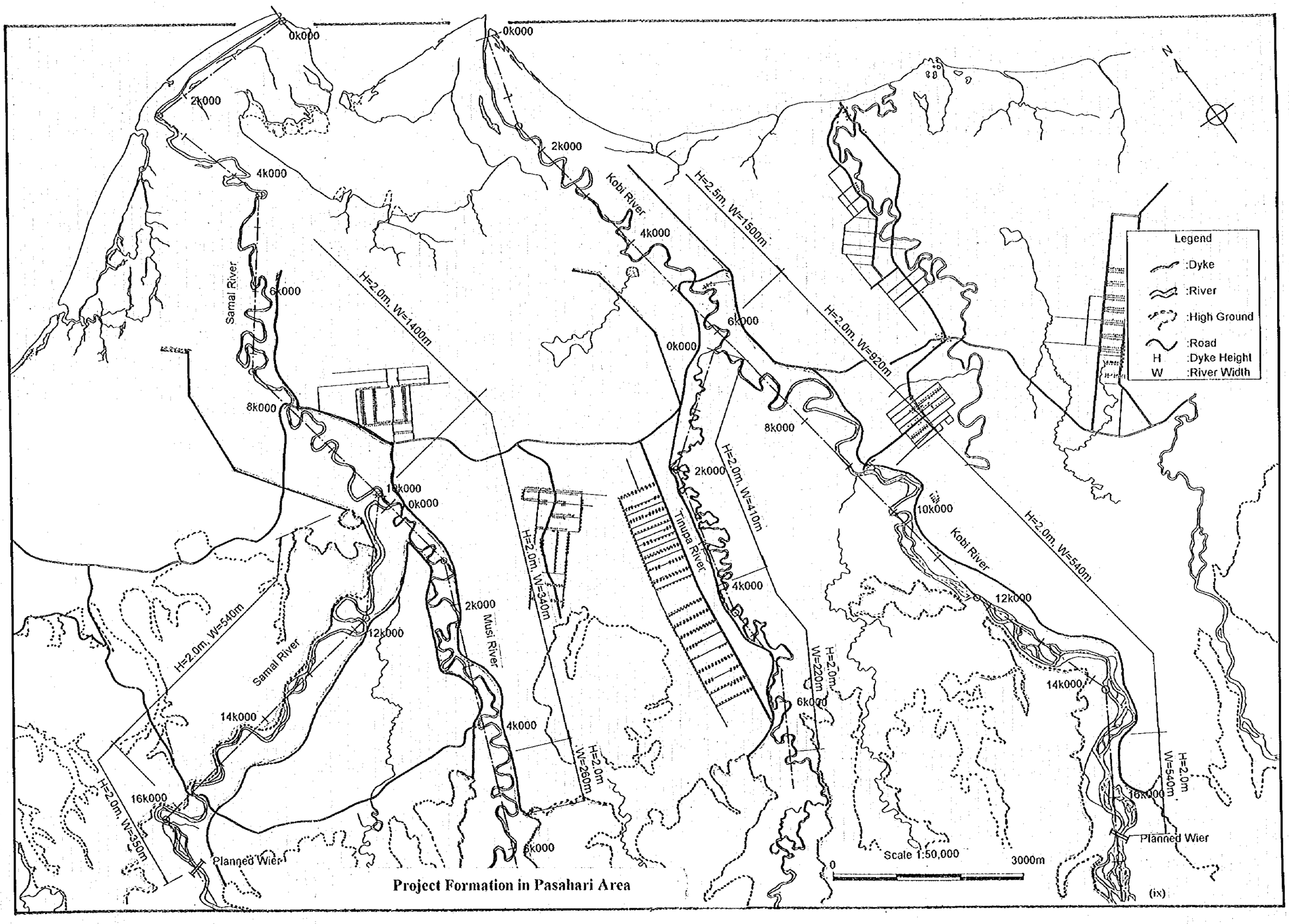
Project	Economic Cost (Rp. Million)	NPV at 10% (Rp. Million)	B/C at 10%	IRR
Samal River Project	17,065	7,885	1.88	16.0 %
Kobi River Project	18,862	-2,122	0.79	8.2 %

4-3 Recommendations

1) Further stages of flood control planning in line with irrigation projects.
2) Continuous effort to collect hydrometric data.
3) Land use regulation for the wide river area.



Project Formation in Ambon Area



Project Formation in Pasahari Area

FINAL REPORT
(SUMMARY)

TABLE OF CONTENTS

List of Tables and Figures

List of Abbreviations

AMDAL	:	Analisa Mengenai Dampak Lingkungan (Environment Impact Assessement)
ANDAL	:	Analisa Dampak Lingkungan (Environmental Impact Analysis)
ABLN	:	Administrasi Bantuan Luar Negeri (Foreign Aid Administration)
BAPPENAS	:	Badan Perencanaan Pembanngunan Nasional (National Development Planning Board)
BAPPEDA	:	Badan Perencanaan Pembangunan Daerah (Regional Development Planning Board)
BAPEDAL	:	Badan Pengendalian Dampak Lingkungan (Environmental Impact Agency)
BMG	:	Badan Meteorology dan Geofisika (Meteorology and Geophysical Agency)
BPP	:	Bina Program Pengairan (Directorate Of Planning and Programming)
BPN	:	Badan Pertanahan Nasional (National Land Agency)
BUPATI	:	Kepala Daerah Tingkat II, Kepala Kabupaten (Head Of Regency)
BPS	:	Biro Pusat Statistik (Central Bureau For Statistics)
CAMAT	:	Kepala Kecamatan (Head Of Subdistrict)
DATI I / DATI II	:	Daerah Tingkat I (Provincial Level) / Daerah Tingkat II (Municipal Level)
DPU (Dep. PU)	:	Departement Pekerjaan Umum (Ministry Of Public Works)
DITJEN	:	Direktorat Jenderal (Directorate General)
DITJEN BINA MARGA	:	Direktorat Jenderal Bina Marga (Directorate General Of Highways = DGHW)
DITJEN CIPTA KARYA	:	Direktorat Jenderal Cipta Karya (Directorate General Of Human Settlements = DGHS)
DITJEN PENGAIRAN	:	Direktorat Jenderal Pengairan (Directorate General of Water Resources Development = DGWRD)
DIRJEN	:	Direktur Jenderal (Director General)
DPR	:	Dewan Perwakilan Rakyat (House of Representatives = Parliament)
DRM	:	Daftar Rekanan Mampu (List Of Capable Contractors)
EIRR	:	(Economic Internal Rate Of Return)
EKUIN	:	Ekonomi, Keuangan dan Industri (Economy, Finance and Industry)
GBHN	:	Garis Besar Haluan Negara (National Policy Guidelines)
GOI	:	(Government Of Indonesia)
GOJ	:	(Government Of Japan)
HAKI	:	Himpunan Ahli Konstruksi Indonesia (Indonesian Contractors Association)
IAI	:	Ikatan Arsitek Indonesia (Indonesia Architects Association)
IWT	:	Indonesia Wilayah Timur (Eastern Region of Indonesia)
IKK	:	Ibu Kota Kecamatan (Sub-District Capital)
INKINDO	:	Ikatan Nasional Konsultan Indonesia (Indonesian Consultants Association)
INPRES	:	Instruksi Presiden (Presidential Instruction)
IDT	:	Inpres Desa Tertinggal (Presidential Instruction for Underdeveloped Village)
IPEDA	:	Iuran Pembangunan Daerah (Regional Development Tax)
IUDP	:	(Integrated Urban Infrastructure Development Programme = P3KT)
JICA	:	(Japan International Cooperation Agency)
KA-ANDAL	:	Kerangka Acuan Analisa Dampak Lingkungan (Terms of Reference for Environmental Impact Assessment)
KANWIL	:	Kantor Wilayah (Regional Office of the Ministry at Provincial Level)
KAKANWIL	:	Kepala Kantor Wilayah (Head of the Regional Office)

KADIN	:	Kepala Dinas (Head of Provincial Office)
KASUBDINAS	:	Kepala Sub-Dinas (Head of Sub-Agency / Provincial Office)
KASUBDIT	:	Kepala Sub-Direktorat (Head of Sub-Directorate)
KDPU	:	Kepala Dinas Pekerjaan Umum (Head of Provincial Public Works Office)
KEPMEN	:	Keputusan Mentri (Ministerial Decree)
KEPPRES	:	Keputusan Presiden (Presidential Decree)
KK	:	Kepala Keluarga (Head of Family / Household)
KODYA	:	Kotamadya (Municipality)
KABUPATEN	:	District or Regency, Division of Province, same level as Municipality
KECAMATAN	:	Sub-division of Kabupaten or Municipality
KELURAHAN	:	Sub-division of Kecamatan, the same level as Village (Desa)
LIPI	:	Lembaga Ilmu Pengetahuan Indonesia (Indonesian Institute of Science)
LKMD	:	Lembaga Ketahanan Masyarakat Desa (Village Community Residence Institution)
LSM	:	Lembaga Swadaya Masyarakat (Non Governmental Organization = NGO)
LURAH	:	Kepala Desa / Kepala Kelurahan (Village Head)
MCK	:	Mandi Cuci Kakus (Communal Unit for Bathing, Washing and Lavatory)
MPR	:	Majelis Permusyawaratan Rakyat (People Consultative Assembly = Congress)
OECF	:	(The Overseas Economic Cooperation Fund)
P2KT	:	Program Pembangunan Kota Terpadu (Integrated Urban Dev. Program)
P3KT	:	Program Pembangunan Prasarana Kota Terpadu (Integrated Urban Infrastructure Development Program = IUIDP)
PEMDA	:	Pemerintah Daerah (Local / Regional Government)
PDAM	:	Perusahaan Daerah Air Minum (Local Government Water Enterprise)
PIL		Penyajian Informasi Lingkungan (Prelim. Environmental Information)
PELITA	:	Pembangunan Lima Tahun (Five Year National Development)
PERDA	:	Peraturan daerah (Local Government Regulation)
PIMPRO	:	Penimpin Proyek (Project Manager)
PPN	:	Pajak Pertambahan Nilai (Value Added Tax = VAT)
PPSAPB	:	Proyek Pengelolaan Sumber Air & Pengendalian Banjir (Water Resources Management & Flood Control Project)
PU	:	Pekerjaan Umum (Public Works)
PUSDIKLAT	:	Pusat Pendidikan & Latihan (Education & Training Center)
PUSLITBANG	:	Pusat Penelitian & Pengembangan (Research & Development Center)
RDTRK	:	Rencana Detail Tata Ruang Kota (Detailed Urban Plan)
REPELITA	:	Rencana Pembangunan Lima Tahun (Five-Year National Dev. Plan)
RKL	:	Rencana Pengelolaan Lingkungan (Environmental Management Plan)
RPL	:	Rencana Pemantauan Lingkungan (Environmental Monitoring Plan)
SEL	:	Studi Evaluasi Lingkungan (Environmental Evaluation Study)
SUBBAG	:	Sub-Bagian (Sub-Division)
SUBDIT	:	Sub-Direktorat (Sub-Directorate)
WALIKOTA	:	Mayor of Municipality