No.

JAPAN INTERNATIONAL COOPERATION AGENCY

MINISTRY OF SETTLEMENT & REGIONAL INFRASTRUCTURE
REPUBLIC OF INDONESIA

THE STUDY
ON
RURAL WATER SUPPLY PROJECT
IN
NUSA TENGGARA BARAT AND NUSA TENGGARA TIMUR

FINAL REPORT

VOLUME I
EXECUTIVE SUMMARY

MAY 2002

NIPPON KOEI CO., LTD.
NIHON SUIDO CONSULTANTS CO., LTD.

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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct the Study on Rural Water Supply Project in Nusa Tenggara Barat and Nusa Tenggara Timur and entrusted the study to the Japan International Cooperation Agency (JICA).

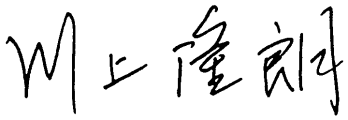
JICA selected and dispatched a study team headed by Mr. Masato FUJINAMI of Nippon Koei Co., Ltd. (and consists of Nippon Koei Co., Ltd. and Nihon Suido Consultants Co., Ltd) to the Republic of Indonesia, two times between March 2001 and March 2002. In addition, JICA set up an advisory committee headed by Mr.Yoshiki OMURA, Senior Advisor of JICA between February 2001 and May 2002, which examined the study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of the Republic of Indonesia and relevant personnel, and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

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

Finally, 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.

May 2002



Takao Kawakami
President
Japan International Cooperation Agency

May 2002

Mr. Takao Kawakami
President
Japan International Cooperation Agency(JICA)
Tokyo, Japan

Letter of Transmittal

Dear Sir,

We have the pleasure of submitting to you the Final Report of " The Study on Rural Water Supply Project in Nusa Tenggara Barat and Nusa Tenggara Timur", in accordance with the Scope of Work agreed upon between the Ministry of Settlement & Regional Development and Japan International Cooperation Agency (JICA).

The study was conducted by Nippon Koei Co., Ltd., and Nihon Suido Consultants Co., Ltd, under a contract to JICA, during the period from February 2001 to May 2002, aiming to formulate water supply development plan for the rural area of Nusa Tenggara Barat and Nusa Tenggara Timur (NTB and NTT).

In conducting the study, we have examined the project with due consideration to the present situation of rural water supply in NTB and NTT and formulated the appropriate water supply development plan. The study team sincerely hopes that the study results would contribute to the implementation of the rural water supply project in NTB and NTT.

We wish to express our deep appreciation and gratitude to the personnel concerned of your Agency, JICA Indonesia Office, the Embassy of Japan in Indonesia, as well as officials concerned of the Government of the Republic of Indonesia.

Sincerely yours,

藤浪正人

Masato Fujinami
Team Leader
The Study on Rural Water Supply Project
in Nusa Tenggara Barat and Nusa Tenggara Timur

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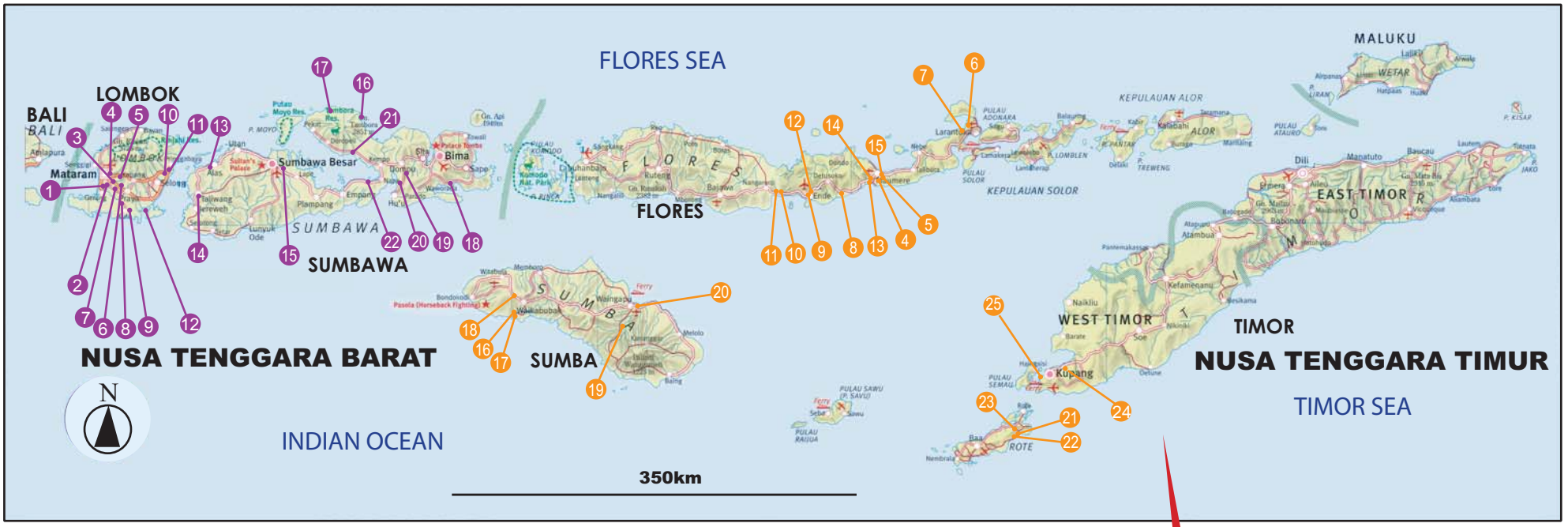
GARIS BESAR STUDI & SEMINAR UNTUK ALIH TEKNOLOGI

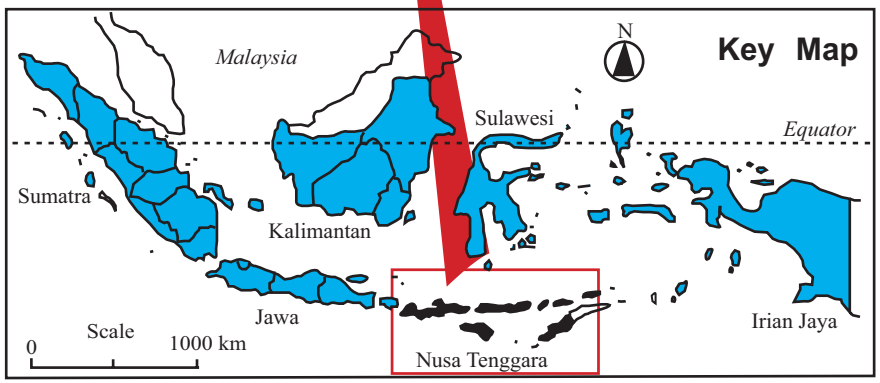


Nusa Tenggara Barat (NTB)

	< Village >	< District >
1	**Kuranji***	Lombok Barat
2	**Bajur***	Lombok Barat
3	**Sembung***	Lombok Barat
4	**Duman***	Lombok Barat
5	Peresak	Lombok Barat
6	Jelantik	Lombok Tengah
7	Labulia	Lombok Tengah
8	Setanggor	Lombok Tengah
9	Rembitan	Lombok Tengah
10	**Bagik Papan***	Lombok Timur
11	**Selaparang***	Lombok Timur
12	Batu Nampar	Lombok Timur
13	**Labuhan Mapin***	Sumbawa
14	**Labuhan Lalar***	Sumbawa
15	Poto	Sumbawa
16	**Piong***	Bima
17	Labuhan Kenanga	Bima
18	**Kawuwu***	Bima
19	Ranggo	Dompu
20	Jambu	Dompu
21	Hodo	Dompu
22	Kwangko	Dompu

Nusa Tenggara Timur (NTT)

	< Village >	< District >
4	Mekendatung	Sikka
5	Kokowahor	Sikka
6	**Sinar Hading***	Flores Timur
7	**Ile Padung***	Flores Timur
8	Watuneso	Ende
9	Borokanda	Ende
10	Bheramari	Ende
11	Nggorea	Ende
12	Ndetundora 1	Ende
13	Hepang	Sikka
14	Bloro	Sikka
15	Watuliwung	Sikka
16	Patialadete	Sumba Barat
17	Welibo	Sumba Barat
18	**Weerame***	Sumba Barat
19	**Kondamara***	Sumba Timur
20	Pulupanjang	Sumba Timur
21	**Oebau***	Kupang
22	Sonimanu	Kupang
23	**Nusakdale***	Kupang
24	**Tarus***	Kupang
25	Bolok	Kupang



Note:Kuranji* Selected Villeges for Preliminary Basic Design

Location Map of the Study Area

THE STUDY
ON
RURAL WATER SUPPLY PROJECT
IN
NUSA TENGGARA BARAT AND NUSA TENGGARA TIMUR

Study Period: February 2001- May 2002
Counterpart Agency: Ministry of Settlement & Regional Infrastructure, Republic of Indonesia

OUTLINE OF THE STUDY

1. OBJECTIVES

The objectives of the study, based on the agreed Scope of Works, were to formulate a rural water supply development program, including operation and maintenance plans, using water sources taken mainly from groundwater and springs, within the provinces of NTB and NTT; and to transfer technology to counterpart staff throughout the Study.

2. STUDY AREA

The Study covers 44 villages in 12 districts in NTB and NTT.

3. OUTLINE OF THE PROPOSED PROJECTS

3.1 Selection of Villages for Preliminary Basic Design

The following 4 criteria were adopted to select villages for the preliminary basic design.

(1) Villagers shall be willing to accept project.

(2) Clean water sources with sufficient volume shall be available in nominated villages.

(3) Water quality shall satisfy the Indonesian standards.

(4) Facilities shall require easy maintenance.

As the result, total of 17 villages out of 44 villages were selected for the preliminary basic design.

The List of Villages for Preliminary Basic Design

JICA No.	Village	District	JICA No.	Village	District
NTB-1	Kuranji	Lombok Barat	NTB-18	Kawuwu	Bima
NTB-2	Bajur	Lombok Barat	NTT-6	Sinar Hading	Flores Timur
NTB-3	Sembung	Lombok Barat	NTT-7	Ile Padung	Flores Timur
NTB-4	Duman	Lombok Barat	NTT-18	Weerame	Sumba Barat
NTB-10	Bagik Papan	Lombok Timur	NTT-19	Kondamara	Sumba Timur
NTB-11	Selaparang	Lombok Timur	NTT-21	Oebau	Kupang
NTB-13	Labuhan Mapin	Sumbawa	NTT-23	Nusakdale	Kupang
NTB-14	Labuhan Lalar	Sumbawa	NTT-24	Tarus	Kupang
NTB-16	Piong	Bima			

3.2 WATER SUPPLY DEVELOPMENT PLANS

3.2.1 Basic Concepts for the Formulations of Projects

The basic concepts for the formulation of projects were as follow:

- The over-riding design principle must be "KEEP IT SIMPLE";
- The selection and design of all components must be based on the requirement to minimize operating and maintenance costs;
- Gravity distribution must always be preferred over pumped systems;
- All specified components must be available within Indonesia to facilitate the purchase of replacements, spare parts and additional materials required for system extension and
- A planning period of ten years was adopted for the preliminary basic design purposes. The target year is thus the year of 2011.

3.2.2 The Proposed Projects

- The project is composed of 19 systems in 17 villages.
- The design population to be served in the 17 villages in 2011 is about 42,000, of which about 20,000 will be supplied through individual house connections. The remaining 22,000 will take their water from public hydrants and public taps.
- The projected total demand of the 10 villages of NTB is approximately 1,570 m^3/day, the 7 villages of NTT is approximately 640 m^3/day; for all of 17 villages in 2011 is approximately 2,210 m^3/day.
- The number of house connections will eventually reach about 4,000. The total number of public hydrants is estimated at 280 and the recommended

number of public taps is about 150. The length of transmission and distribution mains totals to some 37 km, and the diameter ranges from 50 mm to 150 mm.

4. ORGANIZATION AND MANAGEMENT SYSTEM

4.1 Health and Hygiene Education Implementation Plan

The objectives of the proposed health and hygiene education plan for the rural water supply project is to heighten awareness of health and hygiene, to enhance community members desire for clean and safe water, and thereby to motivate them to maintain the water supply facilities to be constructed.

The health and hygiene education program proposed should be carried out intensively through an information, education and communication (IEC) approach. It was proposed that 4 steps should be taken to implement the program, (1) preparation of manuals, (2) social preparation, (3) health and hygiene education in villages and (4) appraisal through a people participatory approach.

4.2 Operation and Maintenance Plan for WUA

Three types of O&M arrangements are proposed based on specific O&M issues for the proposed systems and discussions with key stakeholders including community leaders and local government officers.

- Type A. Operation and maintenance by PDAM.
- Type B. A hybrid arrangement whereby operation and maintenance is primarily managed by the communities themselves, but with technical supports provided by PDAM.
- Type C. Operation and maintenance by the communities themselves through specially constituted village organizations (Water Users' Association (WUA) / Water Users' Groups (WUG)).

Establishment of WUAs and WUGs are envisaged, regardless of the type of system. Operation & Maintenance Plans have been prepared detailing the roles and responsibilities of the communities and institutions for the implementation and management of each of the three proposed system types.

Summary O&M Arrangements

Management Arrangements	NTB	NTT	Total
Type A : PDAM management	Kuranji、Bajur, Sembung、Duman (lower) Seleparang、Lb Mapin	Sinar Hading Ile Padung Tarus	9
Type B: Community management with PDAM support	Lb Lalar Piong Kawuwu (lower)	Weerame Kondamara Oebau	6
Type C: Community management	Duman (upper) Bagik Papan Kawuwu (upper)	Nusakdale	4
Total Systems	12	7	19

4.3 Institutional Assessment

A consequence of low tariffs (as well as contributing to the substantial accumulated losses of many PDAM) is to constrain expenditure on a range of essential operation and maintenance activities. This leads to deterioration in service levels and a reduction in customer satisfaction. In time customers refuse to pay for unsatisfactory service. Nevertheless, the PDAM is the key institution at district level with skills and resources in water supply delivery. It will also support the development of cooperative arrangements between communities and PDAM whereby communities take on the primary responsibility for O&M with the PDAM providing technical support for more complex maintenance requirements (Type B systems). Five PDAM will have full responsibility for management of proposed village water supply systems (Type A systems).

5 IMPLEMENTATION PLAN

There are two implementation plans conceivable for a phased development of this project. One is phased development by province (Plan 1), the other simultaneous development in both provinces (Plan 2).

Plan 1: Phased development by province in two phases

This plan meets the decentralization objectives of the present national policy. It is a reasonable and realistic option from this standpoint. The study proposes this Plan 1 for implementation. It is proposed to develop the villages in NTB province before those in NTT, i.e. Phase 1 for NTB and Phase 2 for NTT, because development of the NTB villages has more advantages in construction and

management costs. The villages in NTB are located over a smaller area over two islands compared to four islands for NTT.

Plan 2: Simultaneous development of provinces in two phases

Plan 2 is to develop both NTB and NTT provinces in each phase (simultaneous development of both provinces). This plan is strongly wished to apply to the future implementation by the Indonesian counterparts. Plan 2 is discussed through in parallel with Plan 1 in the report. Plan 2 creates an equal opportunity for NTB and NTT provinces.

6 PROJECT COST

6.1 Estimated Project Cost

The following are the project cost estimates for project implementation for the plan 1 and plan 2.

Estimated project cost (Plan 1& 2)

Plan	Item	Total		Foreign portion		Local portion	
		Yen (Y, million)	Equivalent (Rp., billion)	Yen (Y, million)	Equivalent (Rp., billion)	Yen (Y, million)	Equivalent (Rp., billion)
Plan 1	Phase 1 (NTB)	521.6	44.6	489.2	41.9	32.5	2.8
	Phase 2 (NTT)	441.1	37.8	415.1	35.5	26.0	2.2
	Total	962.7	82.4	904.3	77.4	58.5	5.0
Plan 2	Phase 1	499.9	42.8	467.1	40.0	32.8	2.8
	Phase 2	479.8	41.1	450.7	38.6	29.2	2.5
	Total	979.7	83.9	917.8	78.6	62.0	5.3

Note: Price level: October 2001
Foreign portion: Amount that may be financed by foreign assistant agency
Local portion: Amount that would be borne by the Government of Indonesia

6.2 Operation and Maintenance Cost

The following are estimated O&M cost to be needed annually and replacement cost to be needed every 15 years.

Estimated cost

No.	Item	Replacement Cycle	Amount (Y, thousand)	Equivalent (Rp., thousand)
1.	Annual operation and maintenance cost	-	2,090	178,743
2.	Replacement cost	15 years	5,854	501,034

Note: Price level: October 2001

7. EVALUATION

7.1 Economic Evaluation

Since the study area is very rural, it is difficult to quantify all benefits properly and to evaluate them correctly. However, expected benefits such as time saving for water collecting; equal access to water; improvement of social status of women, health environment, physical health, infant mortality rate; are all essential as Basic Human Needs (BHN).

7.2 Financial Evaluation

(1) Type-A Villages

- **Financial Evaluation with the Construction and O&M Cost**

According to the financial evaluation with the construction and O&M cost, the obtained FIRR resulted in negative values. If PDAM should take on the construction costs, the projects will not be financially justifiable.

- **Financial Evaluation with O&M Cost only**

Financial evaluation with O&M cost only was also performed. For this evaluation, the construction cost was not included. The results are; (a) although two PDAM may have a financially negative impact from the project implementation, the impact will be negligible, (b) affordability of the people is much greater than the PDAM tariff.

Although the willingness to pay is smaller than the O&M cost, it can be enhanced to an affordable level through a health and hygiene education program as is experienced elsewhere.

Therefore the project is considered to be viable, if the capital investment cost is made available from external sources.

(2) Type B&C villages with O&M Cost only

For the community-managed schemes, tariffs will be set to recover O&M costs only. The financial evaluation for Type B&C with O&M cost only showed that the affordability of the people is much larger than the O&M cost for all the cases.

The willingness to pay in some communities is slightly smaller than the O&M cost at present. This situation can be addressed with public education as described before.

For this case too, the project is considered to be viable, if the capital investment cost is made available from external sources.

7.3 Institutional Evaluation

There will be a large number of organizations participating in the project during implementation (mainly such as Kimpraswil, P3P, district and village organizations), and providing an ongoing role in subsequent operation and maintenance (such as PDAM and WUA/WUG). These institutions/agencies include central, provincial and district level organizations.

The evaluation summarizes the significant institutional issues associated with project implementation and longer-term operation and maintenance, and the project responses provided to enhance their respective roles. The project design provides appropriate support to key agencies during implementation and includes important capacity building initiatives to enhance sustainability.

7.4 Technical Evaluation

Technical feasibility has been evaluated in terms of technical appropriateness, O&M requirements and arrangement, land acquisition, environmental impacts and project management. The provision of gravity systems, cheaper options such as public hydrants, or public tap connections, will enable poorer families to access the benefits of the proposed Project at a lower cost. The technologies will be considered to suit both women and men to maximize use of locally available spare parts for water supply systems. Operation and maintenance arrangements will be based on approaches developed by the other donor agencies, with adjustments appropriate to local conditions. It is not anticipated that land acquisition and/or compensation will be a significant factor in the implementation of the project.

As a result of screening, it was determined that negative environmental impacts will be i) temporary and related to construction, and ii) related to drainage from public hydrant/tap. The scale of construction will be small and the impacts negligible. Generally, the public hydrants/taps will be used for several hours in the morning and afternoon only, with the volume taken only a few cubic meters. The

volume of drainage water from each hydrant/tap will therefore be less than a cubic meter per day, having negligible impact on the surrounding environment.

7.5 Social Evaluation

The Project will have a significant beneficial social impact if communities gain improved access to and effective use of good quality drinking water. For example, the average time spent collecting water per day per household will be shortened from the present 57 minutes to 6 minutes, allowing 51 minutes to be devoted to other activities. The community development benefits include poverty alleviation, improved equity (including gender equity) within the community, increased community living standards, and both direct and indirect health benefits.

7.6 Overall Evaluation

The financial evaluation suggests that the project is barely justifiable if the construction cost is considered in the evaluation. On the other hand, the affordability for the water is greater than the costs for maintenance, and presently lower willingness to pay can be enhanced to a reasonable level by providing a comprehensive health and hygiene education program through the IEC approach. Therefore, the facilities are able to be maintained once those have been constructed with external funds.

The project design provides appropriate support to key agencies during implementation and includes important capacity building initiatives to enhance sustainability.

Technologies proposed were deliberately chosen to be simple, the facilities were designed to be easy to operate and spare parts were to be locally available.

The project will contribute to the villagers in satisfying one of the basic human needs and further in improving their living standards.

Based on the duly considerations of the positive impacts to the villagers, the project is considered to be viable.

8. CONCLUSION

Notwithstanding the negative financial returns, it is recognized that water supply development will satisfies one of the basic human needs for ensuring subsistence in the study area, due to a lack of safe and reliable water. It should be recognized that the rural water supply project provide essential benefits for low-income households and generate many non-quantifiable economic impacts, which will contribute to improve organizational, technical and social benefits.

9. RECOMMENDATIONS

There must be a properly established and recognized Water Users' Association (WUA), responding directly to Kepala Desa. It must be totally involved in the selection, planning, siting, design, financing, construction, operation, management, maintenance and especially the ownership of whatever project is implemented in their village. The community must have a sense of feeling that it is their project.

An intensive public education and promotion campaign is essential to address the poor hygiene practices. Information, Education and Communication (IEC) packages on health and hygiene issues should be developed and delivered effectively at the community level. An IEC Task Force should be established at sub-district level to identify appropriate IEC materials and methodologies. The IEC Task Force should include the local Puskesmas staff, Family Health Promotion volunteers, and Community Health Education Specialists. An IEC specialist shall facilitate the IEC Task Force.

THE STUDY
ON
THE RURAL WATER SUPPLY PROJECT
IN
NUSA TENGGARA BARAT AND NUSA TENGGARA TIMUR

DRAFT FINAL REPORT
VOLUME I
EXECUTIVE SUMMARY REPPORT

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ABBREVIATIONS

ADB	Asian Development Bank
APBD I	Anggaran Pendapatan dan Belanja Daerah Tingkat I (Provincial Budget)
APBD II	Anggaran Pendapatan dan Belanja Daerah Tingkat II (District Budget)
APBN	Anggaran Pendapatan dan Belanja National (National Budget)
ARI	Acute Respiratory Infections
AusAID	Australian Agency for International Development
BAPPEDA	Badan Perencanaan Pembangunan Daerah Tingkat-I and Tingkat-II (Development Planning Board for Provincial and District Level)
BAPPENAS	Badan Perencanaan Pembangunan Nasional (National Development Planning Board)
BDD	Bidan di Desa (Village midwife)
BHN	Basic Human Needs
BMG	Biro Meteorologi dan Geofisika (Meteorology and Geophysic Agency)
BPAM	Badan Pengelola Air Minum (Management Board for new Drinking Water Projects before being established as a PDAM)
BPD	Village Representative Council
BPL	Below Poverty Line
BPS	Biro Pusat Statistik (Central Bureau of Statistics)
BPT	Break Pressure Tank
Broncaptering	Any small structure built to 'capture' a water source
Buis beton	Traditional concrete rings used to line hand-dug wells
Bupati	Kepala Kabupaten (Head of a District; sometimes called "Regent")
Camat	Kepala Kecamatan (Head of a Sub-District)
CARE	Co-operative for Assistance and Relief Everywhere (International NGO)
CCF	Christian Children's Fund
CIDA	Canadian International Development Agency
Cipta Karya	Direktorat Jenderal Cipta Karya (Directorate General of Human Settlements DGHS)now restructured and integrated into Ministry of Settlement and Regional Infrastructure
CMR	Child Mortality Rate
DATI I	Daerah Tingkat I (Provincial Government Level)
DATI II	Daerah Tingkat II (District Government Level)
Desa	Rural village, lowest level of local Government
DG	Directorate General
Dinas	Provincial or District level governmental department
DIP	Daftar Isian Proyek (List of Development Projects)
DPU	Generic term for all departments of Public Works now included in Kimpraswil.
Dukun	Traditional birth attendant
DUPDA	Daftar Usulan Proyek Daerah (List of Proposed Yearly Development Projects at Tk.II.)
Dusun	Sub-Village/Hamlet in rural area
EC	Electric Conductivity
EIIKK	Eastern Islands IKK Water Supply and Sanitation Project (Aus AID program)

ESWS	NTB Environmental Sanitation and Water Supply Project (Aus AID program)
FGD	Focus Group Discussions
FIRR	Financial Internal Rate of Return
FLOWS	Flores Water Supply and Sanitation Reconstruction and Rural Development Project (AusAID program)
FRP	Fiber Reinforced Plastics
GIP	Galvanized Iron Pipe
GL	Ground Level
GOI	Government of Indonesia
GOJ	Government of Japan
GRDP	Gross Regional Domestic Product
GSP	Galvanized Steel Pipe
GTZ	German Technical Cooperation Agency
Hamlet	A small rural community not recognized as a Dusun
HC	House Connection (To a piped water supply system, usually metered)
HDPE	High Density Polyethylene Pipe
IBRD	International Bank for Reconstruction and Development (World Bank)
IEC	Information, Education and Communication
IGA	Income Generation Activities
IKK	Ibu Kota Kecamatan (Core Area of a Sub-District)
IMR	Infant Mortality Rate
Ir.	Insinyur (The Professional title 'Engineer')
JBIC	Japan Bank For International Cooperation
JICA	Japan International Cooperation Agency
K. Desa	Kepala Desa (Head of a Village - Lowest official level of local Government)
Kabupaten/Kab	District/Regency (Local Government level II or Tk.II)
Kampung	General term for any sub-village or hamlet, but more commonly used in urban and rural areas
Kecamatan	Sub-District
Kelompok	An unofficial committee or group of people
Kelurahan	Urban village, the lowest administrative unit in status equal to a Desa
Kepala Desa	Head of a Village (Lowest official level of local Government)
Kepala Dusun	Head of a Hamlet
Kepala Suka	Traditional Religions Leader (In Sumba)
Keputusan	Decree
KFW	German Development Bank
KHPPIA	Kelangsungan Hidup Perkembangan Perlindungan Ibu dan Anak (Development and Protection for Mother and Child)
Kimpraswil	Permukiman dan Prasarana Wilayah (Ministry of Settlement and Regional Infrastructure)
KK or K/K	Kepala Keluarga (Head of a family)
KLP	Koperasi Listrik Pedesaan
Kotamadya	City - equivalent administrative status to a Kabupaten
LBW	Low Birth Weight
LKMD	Lembaga Ketahanan Masyarakat Desa (Village self reliance organization, village development council)

LRWSS	Lombok Rural Water Supply and Sanitation Project (AusAID program)
Lb.	Labuhan (Common place name) Coastal plain behind the seashore
M.A.	Mata Air (Spring)
MOH	Ministry of Health
MOHA	Ministry of Home Affairs (Dalam Negeri)
MOU	Memorandum of Understanding
MSRI	Ministry of Settlement and Regional Infrastructure
Musbangdes	Musyawarah Pembangunan Desa (Village development planning discussion)
NGO	Non-governmental Organization
NTB	Nusa Tenggara Barat (West Nusa Tenggara)
NTT	Nusa Tenggara Timur (East Nusa Tenggara)
O&M	Operasi dan Pemeliharaan (Operation and Maintenance)
O/H	Overhead (High tension electric power line)
OECF	The former Overseas Economic Cooperation Fund of Japan (now JBIC)
P2AT	Proyek Pengembangan Air Tanah (Groundwater Development Project)
P3P	Proyek Peningkatan Prasarana Pemukiman (formerly P3AB) (Development and Management of Water Supply Construction Projects)
PAM	Perusahaan Air Minum (Water Enterprises) Generic term used for PDAM and BPAMs
PDAM	Perusahaan Daerah Air Minum (Regional Drinking Water Enterprise)
PEMDA	Pemerintah Daerah. Local government at any level, usually MOHA
PERPAMSI	Persatuan Perusahaan Air Minum Seluruh Indonesia (Indonesian Water Supply Association)
Peraturan	Regulation
PH	Public Hydrant
PKK	Pembinaan Kesejahteraan Keluarga (Local Women's Welfare Organization)
PLN	Perusahaan Listrik Negara (National Electricity Enterprise)
PMD	Department of Community Empowerment
POKMAIR	Kelompok Pemakai Air (WUG)
Polindes	Poliklinik Desa (Village health sub-clinic)
Propinsi	Province (First level of local government Tk.I.)
Puskesmas	Pusat Kesehatan Masyarakat (Village Health Center)
PVC	Unplasticized Polyvinyl Chloride (Pipe)
PVP	Photovoltaic System
Rakorbang	Rapat Koordinasi Pembangunan (Project/Budget selection discussion at Tk.II) (Coordination Meeting for Development Budget Planning)
RC	RC (Reinforced Concrete)
RDWS	GOI Rural Water Supply Development Program
RESV	Reservoir
RK	Rukun Kampung (Hamlet in a rural area)
RRA	Rapid Rural Appraisal
RT/RW	Rukun Tetangga (Neighborhood)/Rukun Warga (Hamlet in an urban area)
RWSS	Rural Water Supply and Sanitation Project (ADB program)
Sawah	An area of irrigated land used for growing paddy
SC	Specific Capacity
Sekretaris	Secretary, as in Sekretaris Desa

SISKES	GOI Health Services Improvement Program
SSF	Slow Sand Filter (Water Treatment Plant))
SWL	Static Water Level
T	Temperature
TB	Tuberculosis
TBA	Traditional Birth Attendant
TNI	Tentara Nasional Indonesia. The Indonesian armed force
TP-PKK	Women's Movement Organization
Tk.I	Tingkat I. The first level of local government. I.e. Province
Tk.II	Tingkat II. The second level of local government. I.e. District
U5MR	Under 5 Mortality Rate
UDKP	Usulan Kecamatan (List of Development Planning Proposals)
UFW	Unaccounted-for-Water
UNDP	United Nations Development Program
UNICEF	United Nation Children's Fund
UU	Undang Undang (Law)
VAP	Village Action Plan
VES	Vertical Electric Sounding
WSS	Water Supply and Sanitation
WSSLIC	Water Supply and Sanitation Project for Low Income Communities (World Bank program)
WTP	Water Treatment Plant
WUA	Water Users' Association
WUG	Water Users' Group

UNITS

Length

mm	=	millimeter
cm	=	centimeter
m	=	meter
km	=	kilometer

Area

cm^2	=	square centimeter
m^2	=	square meter
km^2	=	square kilometer
Ha/ha	=	hectare

Volume

cm^3	=	cubic centimeter
m^3	=	cubic meter
L	=	liter
MCM	=	million cubic meter

Weight

mg	=	milligram
g	=	gram
kg	=	kilogram

Time as denominator

/sec.	=	per second
/min.	=	per minute
/hr.	=	per hour
/day	=	per day
/month	=	per month
/yr.	=	per year

Electric Measurement

V	=	Volt
A	=	Ampere
Hz	=	Hertz
W	=	Watt
kW	=	Kilowatt
MW	=	Megawatt

Others

%	=	percent
HP	=	horsepower
°C	=	Celsius degree

Derived Measures

L/c/day	=	liter per capita per day
kWh	=	kilowatt-hour
MWh	=	megawatt-hour
kVA	=	kilovolt ampere
mg/L	=	milligram per liter
μg/L	=	microgram per liter
meq/L	=	milliequivalent per liter
mS/m	=	millisiemens per meter

Abbreviation

m.bgl	=	meter below ground level
m.agl	=	meter above ground level
m.asl	=	meter above mean sea level
m.bsl	=	meter below mean sea level

Chapter 1 INTRODUCTION

1.1 Background to the Study

The Government of Indonesia (GOI) has endeavored to develop the east Indonesia region. Despite their efforts, many people in the region still face difficulties in obtaining clean and safe water. People in rural areas are severely disadvantaged and use unsafe and unreliable sources; dug wells, surface water and rainwater. Water carrying for long distances is a common practice, particularly in the dry season. The installation of safer, more sustainable water supply systems is urgently required.

Under the above circumstances, the GOI requested the Government of Japan (GOJ) to provide a development study for a Rural Water Supply Project in the Provinces of Nusa Tenggara Barat (NTB) and Nusa Tenggara Timur (NTT).

1.2 Objectives of the Study

The objectives of the study, based on the agreed Scope of Works, are as follows:

- to formulate a rural water supply development program, including operation and maintenance plans, using water sources taken mainly from groundwater and springs, within the Provinces of NTB and NTT, and
- to transfer technology to counterpart staff throughout the Study.

1.3 Study Area

The Study covers 44 villages in 12 districts in NTB and NTT (See Location Map of the Study Area).

Chapter 2 METHODOLOGY

2.1 Introduction

The Study consisted of a socio-economic study, a technical study and an institutional study. The technical study composed of investigations on water sources and existing rural water supply systems. This chapter describes the methodologies applied for the Study.

2.2 Socio-economic Study

The socio-economic study was performed through the methodologies of an interview survey and a Rapid Rural Appraisal (RRA). The interview survey was conducted through a random sampling method in all 44 villages, by a local consultant under supervision of the Team. Rapid Rural Appraisal (RRA) was carried out in 7 villages by the Team. A hygiene and health education plan, and an operation and maintenance plan for Water User's Associations (WUAs) were prepared.

2.3 Technical Study

A field survey was carried out from March to June 2001 to evaluate water resources potential and present rural water supply conditions in 44 villages by two sub-teams, each consisting of a hydrogeologist, a water supply engineer, and a construction planner.

2.3.1 Water Resources

Investigation on water sources consisted of (1) field reconnaissance survey, (2) water quality testing, (3) electric sounding and (4) test well drilling.

During the field reconnaissance survey, water samples were taken from 44 villages and analyzed to evaluate the water quality. Following the reconnaissance survey, electric sounding survey was carried out in selected villages to determine groundwater development potential. Six test well drillings were carried out based on the results of the electric sounding. For 4 existing water sources, pumping tests were also performed.

In villages where water sources were to be obtained from PDAM existing pipe lines, water pressure and flowing volume in the pipes were also measured.

For all water sources potential for development, water quality tests were executed.

2.3.2 Rural Water Supply

Investigation on rural water supply was carried out in 2 stages.

In the first stage, the team performed a hearing and inspection survey for all nominated 44 villages to grasp overall present situations of the rural water supply systems. Combined with the information from the water sources investigation, the nominated 44 villages were screened to 25 villages.

In the second stage, the selected 25 villages were again visited to obtain additional information for the preliminary basic design. The topographic maps made by a local contractor under supervision of the Team were used.

In parallel with these survey and design works, the Team collected information on cost data, construction plan and so on for preparation of a preliminary implementation schedule.

2.4 Institutional Study

The institutional study consisted of (1) a study on institutional and organizational issues in relation to rural water supply and (2) a study on PDAM institutional and organization. The former study was carried out thorough the interview survey and RRA and the latter was performed through data collection and interview at each PDAM and site inspection.

The study on PDAM organization was included in this Study because that some of the rural water supply systems to be formulated in the Study would be operated directly by PDAMs and that all the water supply systems would be coming under the control of PDAM.

Chapter 3 GENERAL BACKGROUND OF THE STUDY AREA

3.1 Natural Conditions

3.1.1 Geography

The islands of NTB and NTT are segments of the volcanic inner Banda Arc. They lie in the transition zone of flora and fauna between southeast Asia and Australia, marked by the imaginary Wallace Line between Lombok and Bali islands. NTT and NTB are bounded by the Flores Sea in the north, Bali Strait in the west, the Indian Ocean and the Timor Sea in the south, and the East Timor in the east.

3.1.2 Topography

The islands of NTB and NTT are dominated by rugged mountainous areas. There are a number of young volcanos and old volcanic cones particularly on the islands of Lombok, Sumbawa, and Flores. Sedimentary rocks are mainly on the islands of Sumba, Rote and Kupang, with only a small percentage of flat areas.

Peak elevations of the mountains are in the range of 700 – 3,000 m.asl. Mt. Rinjani in Lombok has the highest elevation at 3,726 m. The slopes of the mountains are mostly steep, reaching 45 to 60 degrees in many places. Drainage patterns vary in accordance with the prevailing terrain forms. In areas with well-defined volcanic cones a radial drainage pattern is apparent. Elsewhere the drainage pattern is more or less dendritic. V-shaped valleys are common in the upper reaches of streams with a steep gradient. Lower downstream the valleys change their form to a U-shape and become broader

3.1.3 Geology

The islands of NTB and NTT are divided into two major geological units, one consisting of volcanic rocks and the other of sedimentary rocks. The boundary lies on the Sawu Sea.

The volcanic rock areas include the islands of Lombok, Sumbawa, and Flores. Volcanism in the area was active from the Tertiary to Recent age. A number of active volcanoes exist on these islands. The volcanic rocks are comprised mainly of andesitic and basaltic composition of volcanic breccia, lahar, tuff, ash and lava. The recent products of younger volcanic activity are found as volcanic cones. Sedimentary rocks of the Tertiary to Quaternary age also occur locally, mainly

composed of limestone. Raised coral limestone develop along coast, being overlain by the youngest geological units of the alluvial and coastal deposits

The sedimentary rock areas include the islands of Sumba, Rote and Timor. Sedimentary rocks of the Tertiary to Quaternary age are widely distributed in these islands, consisting mainly of limestone, clayey limestone intercalated with various rock facies. These overlie the oldest sedimentary rocks of the Cretaceous age and volcanic rocks of the Paleocene age. The terraces and reefs along the coast on the opposite side of the islands of NTB and NTT indicate that uplift still continues. Alluvium is observed locally in isolated places.

3.1.4 Hydrometeorology

The annual precipitation at Bima, Maumere and Waingapu, is less than 1,000 mm/year. At the many gauging stations, the annual precipitation is less than the annual potential evapotranspiration; and the period during which monthly precipitation is less than the monthly potential evapotranspiration continues for more than eight months.

Statistically five gauging stations, Sumbawa Besar and Bima in Sumbawa Island, Maumere and Larantuka in Flores Island and Waingapu in Sumba Island receive a precipitation of less than 1,000 mm/year in 1/10 drought year. In particular, Waingapu receives only 586 mm of rainfall in 1/10 drought year.

Summary of Meteorological Analysis

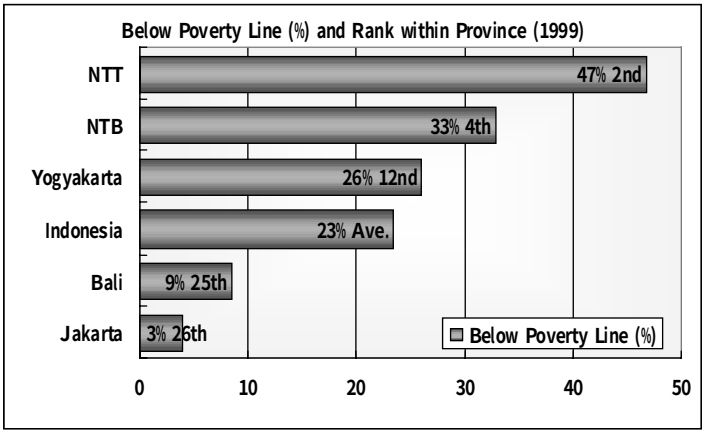
Province	Island	Station	Annual Precipitation (mm)			T	Ep	P-Ep	Duration
			Mean	Ordinary year	1/10 draught year	(°C.)	(mm)	(mm)	P-Ep<0 (months)
NTB	Lombok	Ampenan	1,687	1,779	1,275	26	1,559	128	6
	Sumbawa	Sumbawa Besar	1,377	1,391	966	27	1,641	-264	8
	Sumbawa	Bima	985	1,004	755	27	1,816	-831	9
NTT	Flores	Maumere	980	925	715	27	1,949	-969	10
	Flores	Laramtuka	1,202	1,208	975	27	1,838	-636	9
	Sumba	Waingapu	801	839	586	26	1,644	-843	9
	Rote	Baa	1,563	1,523	1,195	27	1,694	-131	8
	Timor	Kupang	1,581	1,592	1,227	27	1,713	-132	8

P: Precipitation; T: Temperature, C°: Degree Celsius , Ep: Potential Evapotranspiration

3.2 Socio-Economic Conditions

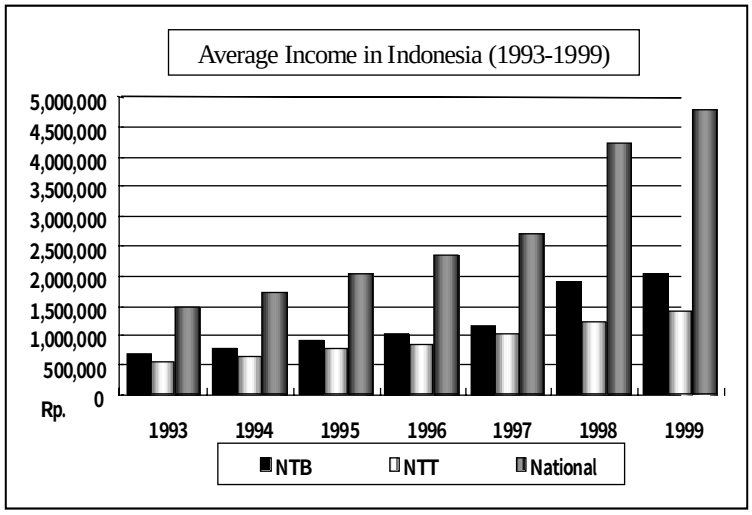
According to the 1999 National Socio-Economic Survey, the total population of NTB in 1999 was 3.9 million in 860 thousand households; and that of NTT was 3.7 million in 733 thousand households. The percentage of the population living in rural areas is extremely high, 80% in NTB and 87% in NTT, compared with the national average of 60%. The annual population growth rate was 1.3% in NTB and 1.9% in NTT between 1990-2000.

The Gross Regional Domestic Product (GRDP) per capita for both NTB and NTT are extremely low, Rp. 2.10 million (1999) and Rp. 1.47 million (1999) respectively, compared with a national average of Rp. 5.38 million. According to the Indonesian poverty profile, the percentage of poor is 47% in NTT and 33% in NTB (1999), the second and fourth poorest provinces in the country. In NTT, nearly half (49%) of the rural population is below the poverty line. Average incomes per capita of 1999 in NTB and NTT were 2 million and 1.4 million which were respectively 42% and 24% of the national average income per capita.



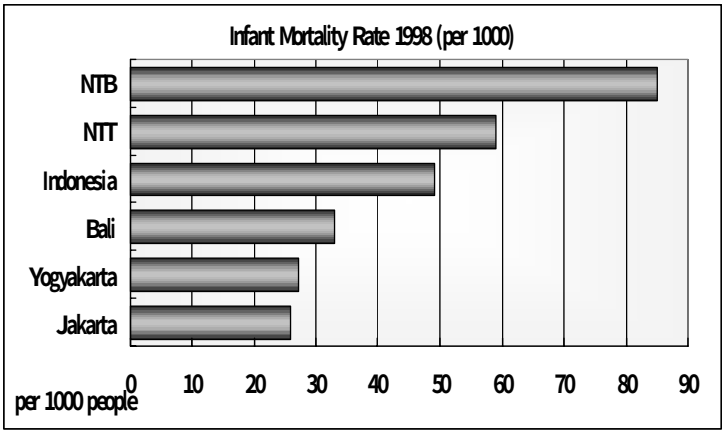
(Source: BPS 2000)

The health indicators show that the health condition in NTB and NTT is considerably inferior to that of the country as a whole. For example, the infant mortality rate of NTB was the highest amongst all provinces of Indonesia at 85 per 1,000 in 1998. It was also high (fourth highest amongst provinces) at 59 per 1,000 in NTT.



(Source: BPS 2000)

The present status of water supply, in terms of the percentage of the rural population having access to a reliable source of safe water is about 57% for NTB and 54% for NTT *(Data source Kimpraswil NTT and BAPPEDA NTB)*. The Provincial target for rural water supply coverage by the year 2003 is 80% for both NTB and NTT.



(Source: BPS 2000)

Chapter 4 PRESENT CONDITIONS OF THE STUDY AREA

4.1 Rural Water Supply

4.1.1 Water Sources Being Used

The predominant source of water in the project villages is hand-dug wells of some 1 m diameter, usually to a depth around 10 m below ground level. In some areas, however, the water level falls seriously in the dry season and the quality sometimes becomes saline in coastal areas. At the village level, small springs are usually left undeveloped for use as communal washing and bathing areas, although there are a few cases where the site has been improved to deepen the pool or separate drinking water sources from washing and bathing areas. In addition, rainwater is collected as water source in many villages.

Ladies washing clothes

4.1.2 Water Supply System

Thirty-three piped water supply systems were found serving at least one hamlet in the 44 villages. Some villages had two or even three systems. All were dependent on relatively long (up to 12 km) gravity transmission mains from remote sources. Sixteen of these systems were totally inoperative. Most had already been abandoned, despite the fact that they had been constructed quite recently. A further six were only partially operative. The problem, in all cases, was physical damage to the transmission main

'By-passed public hydrants' resulted in lack of water for villagers downstream, which usually made the facilities abandoned.

A public hydrant with a number of illegal hose connections

It is unfortunate that most Donor/Aid Agencies only provide capital/construction finance, leaving long-term operation and maintenance (O&M) responsibility to local government. Local government does not, in fact, have any institution at province or district level with the responsibility or funding to maintain rural water supply facilities on a routine basis. This is a major factor in the present deteriorated condition of most village water supply installations, the inadequate level of service provided and the high incidence of user discontent.

4.1.3 Meters and Payment

Systems operated by PDAM are invariably metered and users are billed for water whether through house connections or public hydrants. Even if no water is taken, or there is no supply at all, a standing administrative charge still has to be paid. Many resent this and damage, remove or by-pass the meter, complaining that they are protesting the inadequate service. Consequently, these practices form such a vicious circle that rejection of payment for inadequate services lead to the shortage of income to PDAM for adequate maintenance; inadequate maintenance cause the rejection of payments.

4.1.4 Project Acceptance

Some people already have a supply of water, free of charge (except perhaps at the height of the dry season), although such water is not clean and safe. Obviously, they will accept a water supply project that brings water into the house, if offered, but they do not see any reason to walk 300 m to pay for water from a public hydrant when it is available free of charge from the nearby well.

The only way for project acceptance is through community participation and public education programs. There must be a properly established and recognized Water Users' Association (WUA), responding directly to the Kepala Desa. It must be totally involved in the selection, planning, siting, design, financing, construction, operation, management, maintenance and especially the ownership of whatever project is implemented in their village. The community must have a sense of feeling that it is their project.

4.1.5 Present Technology and Facility Management at Village Level

All existing hand-dug wells and related structures, without exception, have been constructed and are being maintained by the villagers themselves. Rural communities, without any outside assistance, can site and construct hand-dug wells.

Conversely, the operation and maintenance of deep boreholes, electric generators, submersible pumps, elevated tanks or even the maintenance of simple distribution networks supplying public hydrants and a few house connections, is not commonly experienced at village level.

4.1.6 Water Supply Facility Construction, Operation and Maintenance Institutions

The construction, reconstruction, extension and rehabilitation of water supply facilities were the responsibility of DPU, now Kimpraswil or P3P. All work they undertake is funded on a specific project basis from the development budget at province or district level. International finance institutions, bi-lateral aid agencies and NGOs often provide development budget funding for such projects.

The management and routine O&M of all water supply installations in every district are the responsibility of the local PDAM.

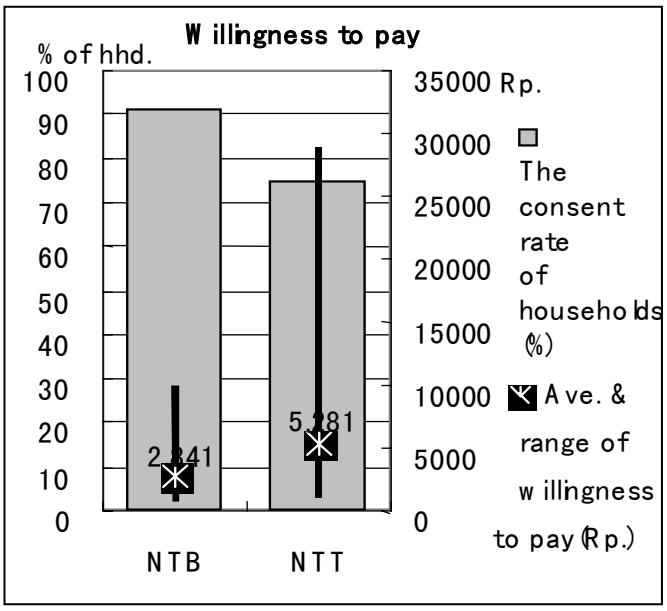
4.2 Water Use of the Villages

4.2.1 Access to Water Sources

Women in the surveyed villages have primary responsibility for water collection (80%), carrying 10-40 liters of water at once, and usually making 3-4 trips per day. Access to water resources is varied; the distances traveled per day are about 1 km in NTB and 5 km in NTT. Many people do not enjoy the present water facilities and would prefer an improved water supply system such as a house connection or public hydrant. Because of the limited existence of functioning WUAs, most of the interviewed households (93%) are willing to establish and participate in a WUA for improved water supply systems.

Girls carrying water

4.2.2 Willingness to Pay



Based on the Team's interview survey, most of the households (90% of NTB and 75% of NTT) in the 44 villages are consent to pay for the operation and maintenance of an appropriate water supply system that may be implemented in their village. This means that most of the households understand the importance of O&M and are willing to provide financial support for a system that meets their needs. The willingness to pay of household is estimated on an average per month for NTB at Rp. 2,800 and for NTT Rp. 5,300. In NTB the willingness to pay ranged from about Rp 1,000 to Rp. 10,000, and in NTT from about Rp 1,000 to Rp. 29,000. It is interesting that the income level in NTT is much lower than NTB, but the villagers in NTT are willing to pay much more for water because their need is greater.

4.2.3 Hygiene Practices and Water Use

Village meeting

The Interview Survey confirmed that hygiene practices and environmental health behavior are poor. Half of the households in the Study area do not boil water before drinking. Hand washing practices are poor and wastewater management is generally neglected. Most village people already have unwritten traditional rules about the use of water and hygiene practices related to water management. While these cannot be ignored, the people must be advised of the benefits of improved practices, so that they can review their traditional practices and develop new rules based on their own decisions.

4.3 Evaluation on Waters Sources Development Potential

4.3.1 Introduction

Identification of potential water sources for the nominated 44 villages was initially carried out, followed by further field surveys with a vertical electrical survey, test well drillings, pumping tests and the second field survey. Water quality for all the potential water sources was analyzed for evaluation of suitability for drinking purposes. Availability of water is summarized in the Table 4.3.1 (1/2) and 4.3.1(2/2).

4.3.2 Nusa Tenggara Barat (NTB)

In Lombok Island, NTB, water is available for 8 villages out of the nominated 12 villages from either nearby existing PDAM distribution lines or springs for new water supply systems. One village already has a new PDAM system. Water from PDAM systems is sometimes chlorinated, while spring water often contains coliform bacteria. Water sources could be available for the four villages of Kab. Lombok Tengah if a planned regional water-supply-system could be constructed. Individual development under the Study is not practicable.

In Sumbawa Island, NTB, water sources were identified from springs, groundwater (borehole) for seven villages out of the nominated ten villages. Spring water often carries coliform bacteria, while groundwater from boreholes usually does not. Water from two boreholes in two villages contained unacceptably high salinity that is not within the Indonesian Standards. There was a spring that is not within the Indonesian Standards and no population to serve.

4.3.3 Nusa Tenggara Timur (NTT)

In Flores Island, NTT, adequate water is available from a spring for two villages in Kabupaten Flores Timur, though coliform bacteria was detected. For 10 villages out of the nominated 12 villages in Flores Island, no adequate water sources were identified for various reasons. Adequate water sources were not identified in three villages: one borehole is productive but unavailable for a project due to a local reason in the village; two new boreholes in two villages were unproductive; there were three villages where a water source was only identified in an other village. In

one village, villagers were not willing to pay for water though usable springs were available.

In Sumba Island, NTT, water sources were identified for three villages out of the five nominated, though coliform bacteria was detected in the water sources. For the other two villages, no developable water sources were identified.

In Rote Island, NTT, cave water or spring water are available for development, though coliform bacteria were detected.

In West Timor, NTT, a spring and a borehole source proved adequate, although coliform bacteria was identified from the spring water, but not from the borehole water.

Table 4.3.1 Summary of Water Sources Evaluation (1/2)

Lombok Island, NTB

No.	Village	District	Water Source	Volume	Quality	Notes
NTB#1	Kuranji	Lombok Barat	A PDAM distribution line	25.7 L/sec	Within Standards	-
NTB#2	Bajur	Lombok Barat	A PDAM distribution line	66.7 L/sec	Within Standards	-
NTB#3	Sembung	Lombok Barat	A PDAM distribution line	170 L/sec	Within Standards	-
NTB#4	Duman (Upper)	Lombok Barat	M.A. Trawasan	4 L/sec in dry season	Coliform bacteria detected	-
	Duman (Lower)		A PDAM distribution line	2.1 L/sec	Within Standards	-
NTB#5	Peresak	Lombok Barat	M.A. Pura Petong	23.9 L/sec	Coliform bacteria detected	-
NTB#6	Jelantik	Lombok Tengah	A PDAM regional system or an existing tube well	-	-	Within a planed regional system.
NTB#7	Labulia	Lombok Tengah	A PDAM regional system	-	-	- ditto -
NTB#8	Setanggor	Lombok Tengah	- ditto -	-	-	- ditto -
NTB#9	Rembitan	Lombok Tengah	- ditto -	-	-	- ditto -
NTB#10	Bagik Papan	Lombok Timur	M.A. Balas-I	8 L/sec	Coliform bacteria detected	-
NTB#11	Selaparang	Lombok Timur	M.A. Lemor	250 L/sec in dry season	Within Standards	-
NTB#12	Batunampar	Lombok Timur	(A PDAM system)	-	-	A new PDAM system already available

Sumbawa Island, NTB

No.	Village	District	Water Source	Volume	Quality	Notes
NTB#13	Labuhan Mapin	Sumbawa	M.A. Remas	11 L/sec in dry season	Coliform bacteria detected.	-
NTB#14	Labuhan Lalar	Sumbawa	JICA Test Well TW-01	3.5 L/sec	Within Standards	-
NTB#15	Poto	Sumbawa	JICA Test Well TW-02	0.8 L/sec	Unacceptable	Saline water from the well
NTB#16	Piong	Bima	A new well to be drilled	Sufficient (2.0 L/sec required)	Unknown, no saline water anticipated Bacteria may be detected.	-
BTB#17	Labuhan Kenanga	Bima	M.A.Nanga Nae	103 L/sec	Coliform bacteria detected.	No immediate water supply problem identified.
NTB#18	Kawuwu (Lower)	Bima	A new well to be drilled	Sufficient (0.7 L/sec required)	Unknown, no saline water anticipated. Bacteria may be detected.	-
	Kawuwu (Upper)		M.A. Mpubeda	0.5 L/sec in dry season	Coliform bacteria detected.	-
NTB#19	Ranggo	Dompu	New wells including JICA Test Well TW-03	2.8 L/sec from TW-03	Within Standards	An existing system being re-constructed
NTB#20	Jambu	Dompu	JICA Test Well TW-04	1.5 L/sec	Unacceptable	Saline water from the well
NTB#21	Hodo	Dompu	M.A.Hodo	294 L/sec	Unacceptable	No habitants
NTB#22	Kwangko	Dompu	deep well (PDAM)	1.5 L/sec	Within Standards	existing system

Table4.3.1 Summary of Water Sources Evaluation (2/2)

Flores Island, NTT

No.	Village	District	Water Source	Volume	Quality	Notes
NTT#4	**Mekendatung**	Sikka	Not identified	-	-	-
NTT#5	Kokowahor	Sikka	P2AT borehole IKI-05	4.5 L/sec	Within Standards	Water not available for the project from the borehole
NTT#13	Hepang	Sikka	JICA Test Well TW-05	No appreciable water available	Unacceptable	-
NTT#14	Bloro	Sikka	Not identified	-	-	-
NTT#15	Watuliwung	Sikka	JICA Test Well TW-06	No appreciable water available	Unacceptable	-
NTT#6	Sinar Hading	Flores Timur	-	-	-	Ile Padung share water source with Sinar Hading
NTT#7	Ile Padung	Flores Timur	M.A. Wai Langu	20 L/sec in the dry season	Within Standards	
NTT#8	Watuneso	Ende	Springs in another village about 7 km	2 L/sec	Coliform bacteria detected.	Water source in a different village
NTT#9	Borokanda	Ende	Springs in another village	2 L/sec	Coliform bacteria detected.	- ditto -
NTT#10	Bheramari	Ende	Not identified	-	-	- ditto -
NTT#11	Nggorea	Ende	M.A. Maurongga in another village	10.0 L/sec	Coliform bacteria detected.	- ditto -
NTT#12	Ndetundora-I	Ende	Springs	0.6 – 6.0 L/sec	Coliform bacteria detected.	Unwilling to pay for water

Sumba Island, NTT

No.	Village	District	Water Source	Volume	Quality	Notes
NTT#16	Patialadete	Sumba Barat	Not identified	-	-	-
NTT#17	Welibo	Sumba Barat	M.A. Wee Karara	3.0 L/sec	Coliform bacteria detected	Spring as a sacred place. No water available for a public water supply system.
NTT#18	Weerame	Sumba Barat	M.A. Wee Paneru	More than 9.0 L/sec	Coliform bacteria detected	Cave water. Pumping required
NTT#19	Kondamara	Sumba Timur	M.A. Lailama	25 L/sec in the dry season	Coliform bacteria detected	Water source of an abandoned system
NTT#20	Pulupanjang	Sumba Timur	Not identified	-	-	-

Rote Island, NTT

No.	Village	District	Water Source	Volume	Quality	Notes
NTT#21	Oebau	Kupang	Cave water	More than 5.0 L/sec	Coliform bacteria detected	Pumping required from a shaft
NTT#22	Sonimanu	Kupang	M.A. Vuvuno	5.0 L/sec	Coliform bacteria detected	Pumping height 80 m required.
NTT#23	Nusakdale	Kupang	M.A. Meakoen	2.0 L/sec	Coliform bacteria detected	Water source of a abandoned system

Timor Island, NTT

No.	Village	District	Water Source	Volume	Quality	Notes
NTT#24	Tarus	Kupang	M.A. Tarus	25.0 L/sec	Coliform Bacteria detected	Water source of existing regional systems
NTT#25	Bolok	Kupang	P2AT borehole BPM-22	9 L/sec	Within Standards	Water source of an abandoned system

Chapter 5 WATER SUPPLY DEVELOPMENT PLAN

5.1 Selection of Villages for Preliminary Basic Design

5.1.1 Definitions of the nominated 44 villages.

Local government administrative boundaries are recently changing rapidly, in particular many districts have been sub-divided and village borders are continuously being adjusted to create smaller village. Some villages originally nominated by the S/W Team were subdivided and new villages with new village names were established.

It was defined that the nominated villages shall be so named villages with such boarder that the Team identified when they visited and confirmed by the villagers.

5.1.2 Criteria for the Village Selection

The criteria set for the village selections are as follows.

- Villagers shall be willing to accept project.

People themselves must request and welcome the proposed project. Effective community participation in the planning, design, implementation, management and O & M of each project is an essential prerequisite for the long term acceptance and sustainability of all proposed projects at village level.

- Clean water sources with sufficient volume shall be available in nominated villages.

It is essential that sufficient volume of clean water must always be available for a water supply project. The requirement is most important particularly for NTB and NTT where villagers suffer from prolonged dry seasons.

The water sources have to be located within the targeted village because utilization of such water sources off the village would be a matter of sustainability.

- Water quality has to satisfy the Indonesia standard.

Although most of the nominated water sources contained coliform bacteria, a simple and prevailing technique can treat such water that eventually can satisfy the

standard. On the other hand, water with excessive salinity is normally difficult to be treated with reasonable costs for rural villagers; and therefore saline water was excluded from the potential water sources.

- Facility at water sources shall require easy maintenance.

Simple facility and easy maintenance works are the key points for rural water supply systems. From this point of view, gravity systems using spring water were preferentially recommended. River water that usually requires a comprehensive treatment system was excluded from the consideration. Spring water requiring excessively large pumping operation, was also excluded.

5.1.3 Selected Villages

The 44 villages were classified into four types (I, II, III and IV), based on the present water use conditions and water source potential as shown on Table 5.1.1~5.1.6. A total of 25 villages of types I, II, and III have been selected for Preliminary Basic Design. Type I villages have no special issues to delay development of the project. Type II villages require confirmation of water quantity and water quality by test well or pumping test, and confirmation of willingness to pay by the inhabitants. Type III villages require the local PDAM to submit an acceptable plan for the long-term sustainable O&M of the proposed facilities. Type IV villages which were not selected for the preliminary basic design are explained below section.

5.1.4 Villages not Selected for Preliminary Basic Design

Type IV villages of above classification are not recommended for further study due to one or more of the following reasons. (a) No water source suitable for a sustainable water supply system, (b) a PDAM or community water supply system already exists, (c) no demand from the inhabitants, no inhabitants or social tradition problems. A total of 19 villages have been excluded from the list for the preliminary basic design.

5.1.5 Villages Subsequently Excluded from Preliminary Basic Design

Eight other villages were subsequently excluded from the preliminary basic design due to the following reasons.

(a) The adequacy of the proposed water sources could not be confirmed in four villages of Desa Poto, Jawbu, Hepang and Watuliwung.

(b) An alternative water supply system was either already available or under construciton by other agencies, although suitable water sources were available for the projects in the 4 vilages of Desa Peresak, Ranggo, Kokowahor and Bolok.

Therefore, the number of villages selected for preliminary basic design decreased from 25 to 17 as shown below. The locations of the17 villages are shown in Figure 5.1.1.

The List of Villages for Preliminary Basic Design

JICA No.	Village	District	JICA No.	Village	District
NTB-1	Kuranji	Lombok Barat	NTB-18	Kawuwu	Bima
NTB-2	Bajur	Lombok Barat	NTT-6	Sinar Hading	Flores Timur
NTB-3	Sembung	Lombok Barat	NTT-7	Ile Padung	Flores Timur
NTB-4	Duman	Lombok Barat	NTT-18	Weerame	Sumba Barat
NTB-10	Bagik Papan	Lombok Timur	NTT-19	Kondamara	Sumba Timur
NTB-11	Selaparang	Lombok Timur	NTT-21	Oebau	Kupang
NTB-13	Labuhan Mapin	Sumbawa	NTT-23	Nusakdale	Kupang
NTB-14	Labuhan Lalar	Sumbawa	NTT-24	Tarus	Kupang
NTB-16	Piong	Bima			

5.1.6 Project Duplication

The duplication of 15 villages in NTB between the JICA project and the World Bank long-term on-going WSSLIC Program was recognized in the course of the Study. A formal meeting was held under the auspices of BAPPEDA Tk. I NTB to clarify the duplication of villages between the JICA project and the World Bank long-term WSSLIC Program. The respective districts agreed to include these duplicated villages in the JICA Study.

All the selected villages were initially offered to JICA because they were listed as priority targets by local GOI authorities. They will continue to be offered to other donors and remain on the list of potential projects submitted for consideration by District and Provincial Development Budget committees each year.

5.2 Development Plan - The Target Year

A planning period of ten years was adopted for the preliminary basic design purposes. The target year is therefore year of 2011.

5.3 Development Plan – Areas and Populations to be served

Areas to be served: The areas to be supplied by each new system were determined by discussions between the Kepala Desa and the Study Team. A number of the selected service areas were subsequently adjusted to match the topography for gravity systems and the limitations of the available water source.

Service levels to be provided: There were different two Kepala Desa that insisted on house connections for all their people, and another that said that 100% public hydrant was all that was required. The ratios of HC/PH adopted for the preliminary basic design vary right across the spectrum from 0:100 to 80:20. The ratios adopted for each village are summarized in Table 5.3.1.

Present populations: In general, Kepala Desa or Sekretaris Desa are able to provide population figures for each hamlet within a village, but the figures quoted often vary quite significantly. The determination of the present populations in service areas which did not coincide with hamlet or village boundaries was, at best, somewhat subjective.

Populations to be served: Population growth rates have fallen significantly and consistently over the last 30 years. It is assumed this trend will continue. Average rates of growth over the last thirty years have been calculated on a district basis and projected forward to the median-planning year of 2006. This figure has then been applied uniformly over the ten years of the project-planning period from 2001 to 2011 for all villages within each district. This method will result in marginally high population figures for 2011. The population growth projections adopted for design purposes are summarized in Table 5.3.1. The total design population in 17 villages at 2011 is about 42,000. The maximum design population is about 6,000 in Desa Bajur in Kabupaten Lombok Barat. The minimum design population is about 400 in Desa Kawuwu (b) in Kabupaten Bima.

5.4 Design Criteria and Practical Guidelines

The design criteria adopted for the preliminary basic designs are based on the Cipta Karya's standard design for rural water supply. In addition to the formal design

criteria, a number of practical guidelines and recommendations are made in order to facilitate the detailed design, construction, and O & M of facilities.

5.5 Technical Guidelines

5.5.1 Per capita consumption per day (supply unit)

In accordance with Cipta Karya's standards, the per capita consumption per day was set forth as follows.

- Users of public hydrant and public tap : 30 L/capita/day
- Users of house connection: 60 L/capita/ day

5.5.2 Demand Calculations

The maximum hourly demand was set high at twice the average hourly demand, recognizing the social characteristics of the area. System losses have been assumed to be 20% of the basic demand. No allowance has been made for maximum day demands over average day demands or for non-domestic demand, taking into consideration the little seasonal variation and village water supply. The resulting demand predictions for each project are summarized in Table 5.3.1.

5.5.3 Pumping Facilities

Except in exceptional cases, electric generator sets should not be provided as they have low sustainability in the hands of village operators and are often misused to provide power for lighting and television sets. Where National Electricity Enterprise (PLN) power supplies are available, small electric submersible pumps should be specified, sealed inside the borehole or broncaptering, with only the electric meter and a single on/off switch located above ground. Shaft-drive turbine pumps must not be used. Where PLN power is not available, surface mounted direct diesel engine driven centrifugal pumps, without any intermediate electrical power generation requirement, are preferred. Wherever the capacity of the source permits, pumping facilities and the associated pipelines should be sized to provide the total daily demand in 8 hours. Increasing the pumping period can offset any lowering of borehole levels or deterioration in pump performance. The principle of specifying and installing two identical pumps in parallel, each having a capacity of two-thirds of the required production, is encouraged, where appropriate. Pumping installations must be protected from the weather in a securely fenced and locked

facility. In most cases a guardhouse or simple accommodation for the attendant should be provided.

5.5.4 System Storage

Where storage is essential, it must be provided by ground level reservoirs situated on higher ground. All storage facilities must be securely fenced. Inlet and outlet pipelines must be buried and inaccessible to vandals. In pumped systems, a single ground level reservoir should be designed to receive sufficient water during the pumping period to meet the total daily demand. Distribution to house connections, public hydrants and taps should then be by gravity.

5.5.5 Chlorination

The Study Team recommends that chlorination equipment be installed (except in those villages where the bulk supply is taken from PDAM Menang Mataram reservoirs that are already chlorinated). The facilities will be available for use in emergency situations (e.g. a cholera outbreak), and could be put into regular use if a positive consensus was established amongst the users through a public health education program, and adequate monitoring and chemical supply support services were made available.

5.5.6 Pipelines

Pipe materials to be employed for the project are mainly PVC and galvanized steel pipe of domestic product that are commonly used for water supply in Indonesia. All 'plastic' pipelines (PVC, HDPE etc.) must be buried to a standard depth of 75 cm and bedded in an approved sandy material. Where pipelines must be 'surface laid', at stream crossings and in extreme rocky areas, steel pipe should be specified. Roughness coefficients for Hazen-Williams formula have been assumed to be as follows:

- All 'plastic' pipes 120
- All steel pipes 100

The requirement for air valves and wash out points in long transmission mains is recognized, but these are high profile targets for invasion and vandalism. Siting and specification must be considered very carefully.

When detailed siting is completed, the proposal layout in each service area should be checked to confirm that the scale for public hydrants is approximately one per 125 persons i.e. one per 25 families or households.

5.5.7 Distribution Networks

A bulk-meter must be installed at the main supply point for all new distribution systems that are to be owned and operated by a PDAM.

All service connections to public hydrants, public taps and house connections should be 25 mm diameter GSP. Stop valves of 25 mm must be provided in all cases. For estimation purposes, at this preliminary basic design stage, the 'average' house connection and public hydrant has been assumed to consist of 20 m of 25-mm dia GSP, but only 10 m of 25-mm dia GSP has been allowed in the case of public taps. Twenty-five millimeter service meters should be provided in those cases where the system is to be owned and operated by a PDAM, systems that are to be owned and operated by village WUAs need not be metered. In addition to the demand requirement for public hydrants and house connections, supply must also be provided to all schools, health centers and mosques/churches. The use of simple public taps is encouraged in areas where the population is widely scattered.

5.5.8 Public Hydrants and Public Taps

The detailed siting of public hydrants and public taps must be carried out in agreement with the local WUA. Spacing should not normally be closer than 200 m. The water demand for public hydrant users has been assumed to be 30 L/c/day. Public hydrant design should be based on the standard blue-colored fiber reinforced plastics (FRP) tank, widely available in several sizes. Spring-loaded faucets should be specified to minimize the wastage of water. Public taps are simple concrete standpipes with two spring-loaded faucets, located along distribution mains in areas where the population is sparse and widely scattered. The supply to public hydrants and public taps on all systems that are to be owned and operated by a PDAM must be metered. Those on systems owned and operated by the village need not be metered. An internal float valve must be installed in all public hydrants.

5.5.9 House Connections

It has been assumed for design purposes that each house connection serves five persons. The water demand of house connection users is set at 60 L/c/day. All house connections on systems that are to be owned and operated by a PDAM must

be metered. The meter should be sited above ground in a secure and protected position, readily accessible to meter readers. All above-ground pipework and the connection to the local service line must be GSP, with a standard diameter of 25 mm. A stop-valve will be provided on the users' side of the meter only. The supply side of the meter may be 'spot-welded' to the supply line. The installation and maintenance of all pipework after the stop-valve is the responsibility of the user.

5.6 Development Plan and Preliminary Basic Designs

Preliminary basic designs for 19 projects in 17 villages were completed. A summary of the new components recommended for the 19 viable projects is shown on Table 5.6.1. A summary of the development plan is shown below.

Outline of the Development Plan

Province	Area (ha)	P/H	P/T	H/C	Population		Total Population	Average Demand (m3/day)
					P/H & P/T	H/C		
NTB	278	215	82	2,437	18,423	12,631	31,054	1,572
NTT	490	64	70	1,377	4,037	6,882	10,919	641
Total	768	279	152	3,814	22,460	19,513	41,973	2,213
P/H: Public Hydrant, P/T: Public Tap, H/C: House Connection								

The projected total demand of the 17 villages in year of 2011 is approximately 2,210 m^3/day. The number of house connections will eventually reach about 4,000. The total number of public hydrants is estimated at 280 and the recommended number of public taps is about 150. The capacity of the ground reservoirs ranges from 4 m^3 to 40 m^3. The total length of transmission and distribution mains reaches some 37 km, to be supplied in diameters ranging from 50 mm to 150 mm.

For the four projects to be supplied with treated water from PDAM systems of Menang Mataram (Matram & Lombok Barat), the Team confirmed the connection points and required water demand with the technical director of the PDAM in the course of the field survey.

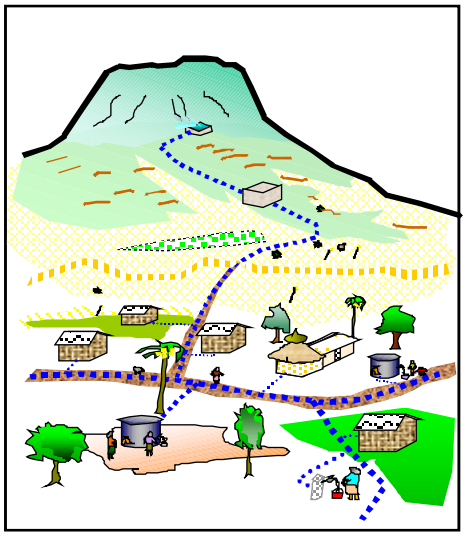


Image of Rural Water Supply System

Table 5.1.1 Summary of Potential Development Projects - Lombok

No.	Village	District	Total Pop.	Total Area (Ha)	Preferred Sources	Project Components	Comments and Recommendations	Classification
1	Kuranji	Lombok Barat	5,100	600	PDAM bulk supply PDAM capacity confirmed	500 m. transmission line Pipelines to 20 new PH & HC	Viable project	III
2	Bajur	Lombok Barat	7,104	320	PDAM bulk supply PDAM capacity confirmed	1.0 km. transmission line Pipelines to 25 new PH & HC	Viable project	III
3	Sembung	Lombok Barat	2,874	164	PDAM transmission main and existing distribution	Service lines to 15 new PH & HC	Viable project	III
4	(a) Duman (b)	Lombok Barat	5,244	1,400	M.A. Trawasan. --- M.A. Trawasan or PDAM transmission main	10.0 kms distribution mains Reconstruct/extend existing system --- 2.0 km transmission main supplying 20 new PH & HC	Viable secondary project --- Viable project	I --- III
5	(c) Peresak (d)	Lombok Barat	10,000	670	2 existing spring sources --- Several springs in Desa Suranadi or PDAM transmission main	Reconstruct/extend existing village systems to 20 new PH and HC --- New broncaptering, 1.0 km transmission main and distribution to 25 new PH & HC	Viable secondary project --- Several viable alternatives	I --- III
6	Jelantik	Lombok Tengah	8,100	776	PDAM Regional system planned No other source identified	None	No short-term project possible	IV
7	Labulia	Lombok Tengah	8,860	1,060	PDAM Regional system planned No other source identified	None	No short-term project possible	IV
8	Setanggor	Lombok Tengah	4,950	1,176	No source identified	None	No project possible	IV
9	Rembitan	Lombok Tengah	7,500	1,475	PDAM system planned No other source identified	None	No short-term project possible	IV
10	Bagik Papan	Lombok Timur	8,975	900	Existing M.A. Balas I system	Rehabilitate and extend CARE Australia system. 25 new PH.	Viable secondary project	I
11	Selaparang	Lombok Timur	3,566	800	PDAM Regional system No other source practicable	Rehabilitate PDAM pipeline May need new 5.0 km pipeline	More discussion with PDAM. Viable project	III
12	Batu Nampar	Lombok Timur	4,161	924	New PDAM system exists	None	No project required	IV

Notes:

(a) Scattered hamlets in highland area of village
(b) Hamlets in lowland area of village
(c) Densely populated western hamlets
(d) Scattered hamlets in eastern portion of village

I: No special issues
II: To require confirmation of water source potential and/or willingness to pay
III: To require the local PDAM to submit a plan for the sustainable O &M
IV: Not selected for Preliminary Basic Design, due to no water/ supply system exist/ no demand

Table 5.1.2 Summary of Potential Development Projects - Sumbawa

No.	Village	District	Total Pop.	Total Area (Ha)	Preferred Source	Project Components	Comments/ Recommendations	Classification
13	Labuhan Mapin	Sumbawa	5,021	2,369	Existing PDAM system.	Rehabilitate broncaptering Extend distribution system	Viable project	**III**
14	Labuhan Lalar	Sumbawa	3,656	3,079	New ground water source Potential "Good"	Test borehole, production wells pumping to 15 new PH and HC	Viable project	**II**
15	Poto	Sumbawa	2,332	1,367	New ground water source Potential "Medium"	Test borehole, production wells pumping to 15 new PH and HC	Viable project	**II**
16	Piong	Bima	1,708	36,600	New ground water source Potential "Excellent" or reconstruct old TNI system	Production well pumping to 5 new + 10 old PH and HC 3.0 km gravity transmission main	Alternative viable projects	**II**
17	Labuhan. Kenanga	Bima	1,700	2,383	No project required	None	No project required	**IV**
18	(a) Kawuwu (b)	Bima	841	1,324	New ground water source Potential "Good" ----------Existi ng spring sources	Production well pumping to 2 new PH and 2 existing tanks ---------- Rehabilitate and extend existing system	Viable project ---------- Viable secondary project	**II** ---------- **I**
19	Ranggo	Dompu	5,560	5,425	New ground water source Potential "Good"	Test borehole, 4 production wells pumping to 30 new + 5 old PH and HC	Viable project	**II**
20	Jambu	Dompu	3,383	3,550	New ground water source Potential "Medium"	Test borehole, production wells pumping to 25 new PH	Viable project	**II**
21	Hodo	Dompu	-	4,292	No project required	None	No project required	**IV**
22	Kwangko	Dompu	2.100	2,383	No project required	None	No project required	**IV**

Notes:
(a) Hamlet in lowland area of village - Dusun Lante
(b) Hamlet in highland area of village - Dusun Kalemba

Table 5.1.3 Summary of Potential Development Projects - Flores

No.	Village	District	Total Pop.	Total Area (Ha)	Preferred Sources	Project Components	Comments / Recommendation	Classification
4	Mekendatung	Sikka	1,712	527	No source identified	None	No project possible	**IV**
5	Kokowahor	Sikka	1,330	393	P2AT Deep Well	Pumping system, 1.0 km transmission, ground reservoir, 1.0 km service lines to 6 PH	Project will be planned subject to satisfactory results of a pumping test.	**II**
6	Simar Hading	Flores Timur	1,345	1,922	Secondary supply from Desa Ile Padung	2.0 km pumped transmission main to 10 new PH	Bupati has already decided this potential Regional system is to be owned and operated by PDAM. Viable project with social concerns	**III**
7	Ile Padung	Flores Timur	1,151	2,235	M.A.Wai Langu	Reconstruct the first AusAID pumped system	Bupati has already decided this potential Regional system is to be owned and operated by PDAM. Viable project with social concerns	**III**
8	Watuneso	Ende	1,508	371	M.A. Aikele in next Desa	None	No project permitted	**IV**
9	Borokanda	Ende	1,607	1,488	M.A. Rowa Aewromba in next Desa	None	No project permitted	**IV**
10	Bheramari	Ende	1,925	1,440	No source identified	None	No project possible	**IV**
11	Nggorea	Ende	1,863	1,214	M.A. Aesonga in next Desa	None	No project permitted	**IV**
12	Ndetundora I	Ende	718	590	New PDAM system planned	None	No project required	**IV**
13	Hepang	Sikka	2,526	447	New groundwater source Potential "Good"	A deep well with pumping system, 200 m transmission, ground reservoir, 800 m distribution to 11 PH	PDAM already serves a part of Desa. The new project will be planned subject to satisfactory results of a test boring.	**II**
14	Bloro	Sikka	1,478	1,553	No source identified	None	No project possible	**IV**
15	Watuliwung	Sikka	1,761	678	New groundwater source Potential "Good"	A deep well with pumping system, 100 m transmission, ground reservoir, 5 km distribution to 20 PH	The project will be planned subject to satisfactory results of a test boring.	**II**

Table 5.1.4 Summary of Potential Development Projects - Sumba

No.	Village	District	Total Pop.	Total Area (Ha)	Preferred Sources	Project Components	Comments / Recommendation	Classification
16	Patialadete	Sumba Barat	1,210	3,541	No source available	None	No project possible	IV
17	Welibo	Sumba Barat	1,522	899	No source available	None	No project possible	IV
18	Weerame	Sumba Barat	2,294	1,026	Groundwater in Wee Panel Cave	A pumping system at the cave, intake facilities, 500 m transmission, ground reservoir, 3 km distribution piping system to 21 PH.	The project will be planned subject to satisfactory results of a pumping test.	II
19	Kondamara	Sumba Timur	1,600	3,120	M.A.Lailama	A new pumping system at the spring site. Reconstruction and extension of existing system	Social considerations Intensive education program is required.	II
20	Pulupanjang	Sumba Timur	1,544	6,930	No source identified	None	No project possible	IV

Table 5.1.5 Summary of Potential Development Projects - Rote

No.	Village	District	Total Pop.	Total Area (Ha)	Preferred Sources	Project Components	Comments / Recommendation	Classification
21	Oebau	Kupang	940	2,800	Oekupi Dug Well	A pumping system, 1.2 km transmission, ground reservoir, 2 km distribution to 7 PH.	The project will be planned subject to satisfactory results of a pumping test.	II
22	Sonimanu	Kupang	574	576	M.A. Vuvuno too low	None	No project possible	IV
23	Nusakdale	Kupang	841	769	M.A. Meakoen	Intake facilities at the spring, 200 m transmission pipe, ground reservoir, 1.5 km distribution pipe to 3 PH.	Social considerations Intensive education program is required.	II

Table 5.1.6 Summary of Potential Development Projects - Timor

No.	Village	District	Total Pop.	Total Area (Ha)	Preferred Sources	Project Components	Comments / Recommendation	Classification
24	Tarus	Kupang	6,436	1,019	PDAM M.A. Tarus	A new pumping system at the PDAM spring site, 2 km transmission, ground reservoir, 4 km distribution to 40 PH.	PDAM already serves part of the Desa. Coordination with PDAM is required.	III
25	Bolok	Kupang	1,744	1,276	P2AT Deep Well	A pumping system at the deep well, 2 km transmission, elevated tanks, 3 km distribution to 16 PH	The project will be planned subject to satisfactory results of a pumping test.	II

Table 5.3.1 Population and Demand Projections

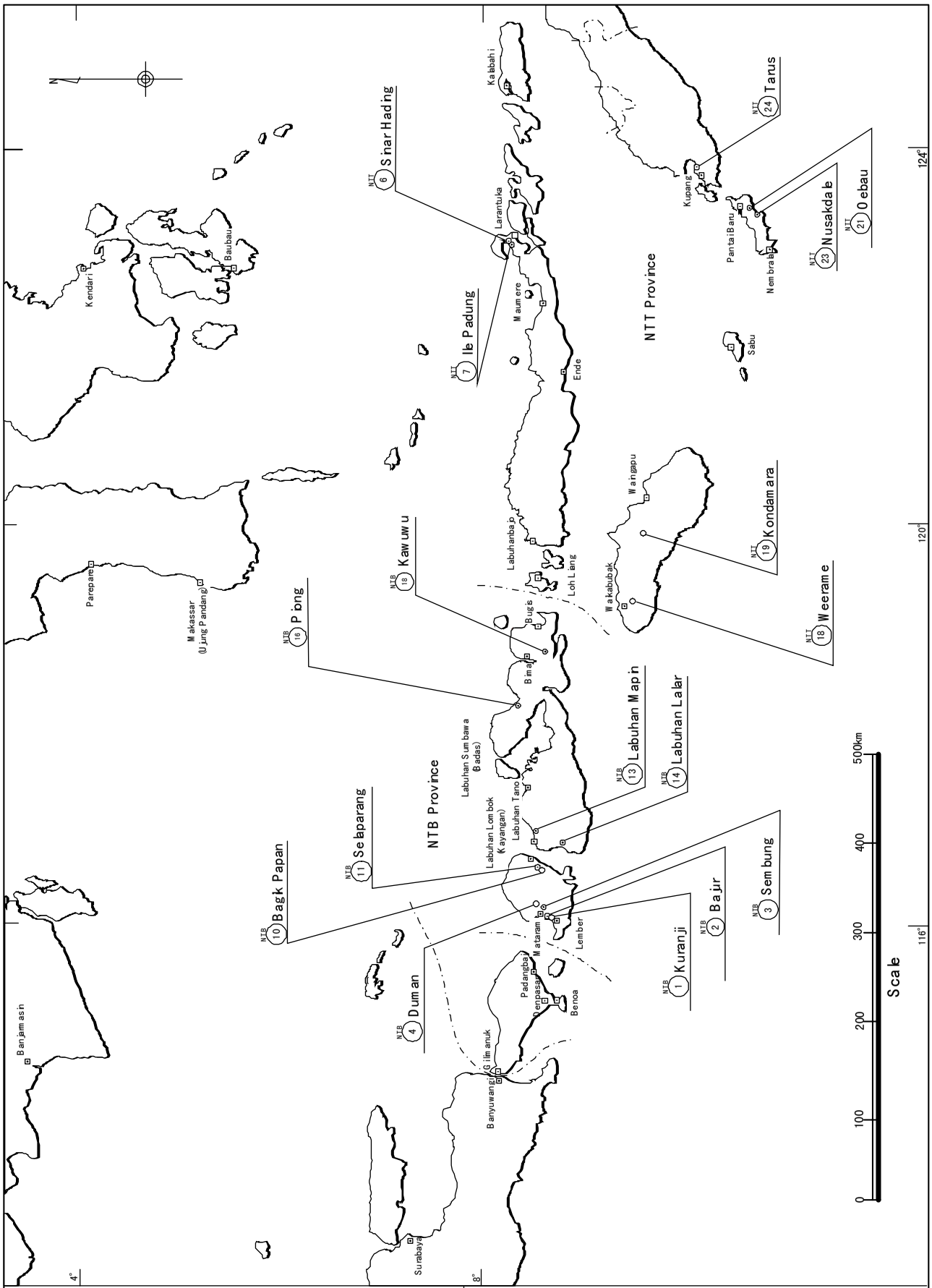
JICA No.		Village	District	2001 pop. in area to be served	predicted annual growth rate(%)	2011 design pop. in area to be served	Assumed Proportion		Pop. to be served by HC	Pop. to be served by PH	Basic Demand	Average Demand (including wastage)			Maximum Demand		Total estimated population in design year 2011	Design pop. ratio for total estimated pop.(%)
							HC	PH										
							(%)	(%)			(m3/day)	(m3/day)	(m3/hr)	(L/sec)	(m3/hr)	(L/sec)		
NTB	1	Kuranji	Lombok Barat	1,787	0.5855	1,894	30	70	568	1,326	73.86	88.63	3.69	1.03	7.38	2.06	5,407	35
	2	Bajur	Lombok Barat	5,782	0.5855	6,130	40	60	2,452	3,678	257.46	308.95	12.87	3.58	25.74	7.16	7,531	81
	3	Sembung	Lombok Barat	2,099	0.5855	2,225	30	70	668	1,557	86.79	104.15	4.34	1.21	8.68	2.42	3,047	73
	4 (a)	Duman (a)	Lombok Barat	2,903	0.5855	3,078	20	80	616	2,462	110.82	132.98	5.54	1.54	11.08	3.08	3,419	90
	4 (b)	Duman (b)	Lombok Barat	1,817	0.5855	1,926	30	70	578	1,348	75.12	90.14	3.76	1.04	7.52	2.08	2,140	90
	10	Bagik Papan	Lombok Timur	2,974	0.6775	3,182	20	80	636	2,546	114.54	137.45	5.73	1.59	11.46	3.18	9,602	33
	11	Selaparang	Lombok Timur	3,209	0.6775	3,433	80	20	2,746	687	185.37	222.44	9.27	2.57	18.54	5.14	3,815	90
	13	Labuhan Mapin	Sumbawa	3,119	1.3605	3,570	75	25	2,678	892	187.44	224.93	9.37	2.60	18.74	5.20	5,747	62
	14	Labuhan Lalar	Sumbawa	2,740	1.3605	3,136	30	70	941	2,195	122.31	146.77	6.12	1.70	12.24	3.40	4,185	75
	16	Piong	Bima	1,537	0.7835	1,662	40	60	665	997	69.81	83.77	3.49	0.97	6.98	1.94	1,847	90
	18 (a)	Kawuwu (a)	Bima	383	0.7835	414	20	80	83	331	14.91	17.89	0.75	0.21	1.50	0.42	461	90
	18 (b)	Kawuwu (b)	Bima	374	0.7835	404	0	100	0	404	12.12	14.54	0.61	0.17	1.22	0.34	449	90
NTT	6	Sinar Hading	Flores Timur	1,224	0.5570	1,294	80	20	1,035	259	69.87	83.84	3.49	0.97	6.98	1.94	1,422	91
	7	Ile Padung	Flores Timur	1,061	0.5570	1,122	80	20	898	224	60.60	72.72	3.03	0.84	6.06	1.68	1,217	92
	18	Weerame	Sumba Barat	1,350	1.8175	1,616	80	20	1,293	323	87.27	104.72	4.36	1.21	8.72	2.42	2,747	59
	19	Kondamara	Sumba Timur	1,500	1.9975	1,828	20	80	366	1,462	65.82	78.98	3.29	0.91	6.58	1.82	1,950	94
	21	Oebao	Kupang	513	2.1145	632	10	90	63	569	20.85	25.02	1.04	0.29	2.08	0.58	1,159	55
	23	Nusakdale	Kupang	365	2.1145	450	10	90	45	405	14.85	17.82	0.74	0.21	1.48	0.42	1,037	43
	24	Tarus	Kupang	3,226	2.1145	3,977	80	20	3,182	795	214.77	257.72	10.74	2.98	21.48	5.96	7,934	50
Total				**37,963**		**41,973**			**19,513**	**22,460**	**1,845**	**2,213**					**65,116**	Average **64**

Notes: Duman(a) : Scattered hamlets in highland area , Duman(b) : Hamlets in lowland area, Kawuwu(a) : Hamlet in lowland area - Dusun Lante, Kawuwu(b) : Hamlet in highland area - Dusun Kalemba

Table 5.6.1 Summary of Major Project Components

JICA No.	Village	Source	Pumps		Pumping, Transmission and Distribution Mains				Stream/River Crossings		Storage, Reservoirs and Break Pressure Tanks		Distribution Network							
			Electric Submersible	Surface Centrifugal	150 mm	100 mm	75 mm	50 mm	>15 m	<15 m	Number	Total Capacity	Area Served	Public Hydrant	Public Taps	House Connections	Service Pipelines			Service Meters
																	75 mm	50 mm	25 mm	
					(m)	(m)	(m)	(m)	(No.)	(No.)	(No.)	(m3)	(Ha.)	(No.)	(No.)	(No.)	(m)	(m)	(m)	(No.)
NTB 1	Kuranji	PDAM	-	-	-	-	360	-	-	1	-	-	28	17	10	114	1,560	1,380	2,720	141
2	Bajur	PDAM	-	-	-	580	-	-	-	3	-	-	25	35	15	490	440	2,403	10,650	540
3	Sembung	PDAM	-	-	-	-	500	-	-	2	-	-	16	17	10	134	1,250	1,140	3,120	161
4 (a)	Duman (a)	Spring	-	-	-	-	1,650	1,655	-	1	6	47	26	33	10	123	-	1,670	5,970	-
4 (b)	Duman (b)	PDAM	-	-	-	1,900	-	-	2	2	-	-	48	18	10	116	2,110	2,700	2,780	144
10	Bagik Papan	Spring	-	-	-	-	2,435	-	1	-	1	30	19	25	5	127	-	3,175	3,190	-
11	Selaparang	Spring	-	-	800	1,240	2,500	-	1	-	2	84	15	15	10	549	420	1,820	11,380	574
13	Lb. Mapin	Spring	-	-	-	-	-	-	-	-	-	-	29	7	-	446	-	1,810	8,460	454
14	Lb. Lalar	Deep well	1 x 4.0 kW	-	-	2,800	-	-	2	4	1	40	42	24	5	188	1,350	2,720	4,290	-
16	Piong	Deep well	1 x 1.5 kW	-	-	-	590	-	-	-	1	20	19	8	5	133	-	3,270	2,970	-
18 (a)	Kawuwu (a)	Large diameter well	1 x 1.5 kW	-	-	-	-	1,140	-	-	1	4	5	3	2	17	-	-	480	-
18 (b)	Kawuwu (b)	Spring	-	-	-	-	100	100	-	-	-	-	6	3	-	0	-	-	100	-
NTT 6	Sinar Hading	Desa Ile Padung	-	-	-	-	-	-	-	-	1	20	10	5	10	207	-	3,150	4,340	222
7	Ile Padung	Spring	-	2 x 2.2 kW 2 x 0.5 kW	-	3,500	1,340	115	-	-	3	17	10	7	-	180	-	2,850	3,890	202
18	Weerame	Cavern	-	2 x 2.2 kW	-	-	550	-	-	-	1	26	45	8	10	259	420	2,330	5,440	-
19	Kondamara	Spring	-	2 x 2.2 kW	-	-	3,275	4,025	-	3	-	-	306	15	20	73	-	-	1,960	-
21	Oebao	Cavern	-	1 x 0.75 kW	-	-	1,080	-	2	-	2	8	8	10	10	13	-	4,950	560	-
23	Nusakdale	Spring	-	-	-	-	-	1,500	-	3	-	-	16	6	10	9	-	1,000	400	-
24	Tarus	Spring	2 x 7.5 kW	2 x 7.5 kW	-	3,700	100	-	1	-	2	70	95	13	10	636	1,100	5,600	13,080	659
Totals			**5**	**11**	**800**	**13,720**	**14,480**	**8,535**	**9**	**19**	**21**	**366**	**768**	**269**	**152**	**3,814**	**8,650**	**41,968**	**85,780**	**3,097**

Notes: Duman(a) : Scattered hamlets in highland area Duman(b) : Hamlets in lowland area, Kawuwu(a) : Hamlet in lowland area - Dusun Lante Kawuwu(b) : Hamlet in highland area - Dusun Kalemba



Study on Rural Water Supply Project in Nusa Tenggara Barat and Nusa Tenggara Timur Japan International Cooperation Agency	**Figure 5.1.1** **Location Map of Selected Villages for Preliminary Basic Design**

Chapter 6 HEALTH & HYGIENE EDUCATION PLAN, OPERATION & MAINTENANCE PLAN, AND PDAM INSTITUTIONAL FORMATION

6.1 Health and Hygiene Education Plan

6.1.1 Present Health Status

The Rapid Rural Appraisal (RRA) undertaken as a part of the Study, and health statistics, indicate high incidence of water-related diseases, high morbidity and high infant mortality in the project region. The existing health status is a consequence of poor hygiene practices.

6.1.2 Objectives

The objectives of the proposed health and hygiene education plan for the rural water supply project is to enhance awareness of health and hygiene, to amplify people desire for clean and safe water, and thereby to motivate them to maintain the water supply facilities to be constructed.

On the horizon of the achievement of sustainable maintenance of the project, the community members will enjoy their healthy and hygienic lives free form such water-related diseases.

6.1.3 Implementation Policy and Plan

Health and hygiene education program proposed in the report should be carried out intensively through information, education and communication (IEC) approach. The basic policy and implementation plan to achieve the objectives are as follows.

(1) Implementation Policy

Based on the previous experiences in the similar projects in the region, the approaches described below are proposed.

- Manuals and guidelines for education, training and activities for health and hygiene education programs are to be prepared with an emphasis on the local characteristics.

- Information, education and communication activities are to be carried out in the villages to improve the fundamental awareness on health and hygiene. The activities will continue throughout the project period.
- Participatory appraisal approach is to be practiced for monitoring, evaluation of the health and hygiene education activities. The evaluation results are to be reviewed by the villagers themselves.
- Ministry of Health and Kimpraswil have to be coordinated in district level.

(2) Implementation Plan

Health and hygiene education should be implemented in the following 4 steps.

- Step-1: Mobilization works (1) – Preparation of manuals and guidelines:

An IEC Task Force will be established at sub-district to identify appropriate Information Education and Communication (IEC) materials and methodologies. An IEC specialist will facilitate the IEC Task Force. The IEC Task Force will include the Community Health Center (Puskesmas) staff, Environmental Health volunteers, and the Community Health Education Specialists (CHES). IEC packages on health and hygiene will be developed and delivered effectively at community level.

- Step-2: Mobilization works (2) – Social preparation

In order to increase community awareness, the IEC on health and hygiene must be started in the social preparation stage of the project before the detailed design and construction stage.

- Step-3: People's education and sensitization

An intensive public education and promotion campaign is essential. Existing Environmental Health (EH) Cadres will be trained to conduct intensive education programs for family members and communities under the guidance of Field Officers employed directly by the project. The IEC package will be presented intensively through home visits, community and group meetings and discussions, and through religious organizations and cultural events. Communities should be guided to take the initiative to improve their environment by building such facilities

as latrines and garbage disposal, and by changing their behaviors such as frequent hand washings. The active involvement of women should be ensured in recognition of the important role they play in the management of water and hygiene. The Health Department, through the Puskesmas, shall also play a major role in the organization and allocation of budget for health, hygiene and sanitation activities, and regular checking of water quality.

- Step-4: Participatory Monitoring

Monitoring and evaluation of the community health and hygiene promotion will be undertaken with community member's participation. The main counterpart for the implementation of IEC activities will be the Health Officers at district and sub-district level. Kimpraswil will provide support as coordinators of counterpart input at district level.

6.2 Operation & Maintenance Plan for Village Level

6.2.1 Present Status of Rural Water Supplies

The experience with rural water supply projects in many developing countries, including Indonesia, is that facilities function for only a short time after initial completion. Results in terms of sustainable and effective use have been poor.

For over a decade there has been a growing interest in and application of community management approaches for rural water supply in Indonesia, which absorb vast resources without being responsive to local needs. And this is reflected in the draft Development Policy for Small & Medium Scale Water Supply & Environmental Sanitation in Indonesia (October 2000).

6.2.2 Objectives

The objective of community operation and maintenance plan is to facilitate and support communities and institutions with the establishment of sustainable operation and maintenance arrangements.

6.2.3 Implementation Policy and Plan

(1) Identification of O&M Types

There are a limited number of options for the operation and maintenance of village level water supply systems. Three types of O&M arrangements are proposed. These arrangements were developed after an assessment on sustainability, and discussions with key stakeholders including community leaders and local government officers, who have agreed in principle to these arrangements.

- Type A. Operation and maintenance by the district water enterprises (PDAM).
- Type B. A hybrid arrangement whereby operation and maintenance is primarily managed by the communities themselves, but with technical support provided by PDAM.
- Type C. Operation and maintenance by the communities themselves through specially constituted village organizations [Water Users' Association (WUA) / Water Users' Groups (WUG)].

Summary O&M Arrangements

Management Arrangements	NTB	NTT	Total
Type A : PDAM management	Kuranji Bajur, Sembung Duman (lower) Seleparang Lb Mapin **6 systems**	Sinar Hading Ile Padung Tarus **3 systems**	9
Type B: Community management with PDAM support	Lb Lalar Piong Kawuwu (lower) **3 systems**	Weerame Kondamara Oebau **3 systems**	6
Type C: Community management	Duman (upper) Bagik Papan Kawuwu (upper) **3 systems**	Nusakdale **1 system**	4
Total Systems	12	7	19

The objectives, roles and responsibilities of the community management will vary. For Type A O&M system, there will be a very limited requirement for community involvement in financial management as tariffs will be paid by consumers to the PDAM directly. For Types B & C, the communities have total responsibility for all aspects of system O&M, even though technical support will be provided by the PDAM for Type B systems.

(2) Implementation Policy - Community Management Approach

Basic policies for implementation are as follows.

- Villagers have to participate in decision-making of key aspects througout the projects. Communities need to be fully informed as to matters where they did not participate in decision-making processes. An essential part of a community management approach is community participation approach.
- Community management will be undertaken through the establishment of a WUA at village level. The WUA will represent all village water users. WUG are proposed to organize the village sub-groups such as individual public hydrant users or the residents of remote hamlets.
- Establishment of WUAs and WUGs is envisaged, regardless of the type of system (Type A, B or C).
- Necessary experts will be input at necessary stages intermittently throughout the project to achieve the sustainable and reliable water supply systems.

(3) Implementation Plan

Similar to the implementation plan of health and hygiene education, the implementation is to be performed in 4 steps.

- Step-1: Mobilization (1) – Preparation of manuals and guidelines

O & M manual for the constructed facilities are to be prepared by an expert. At the same time, regulation and operation manuals for WUA/WUG will have to be prepared by a community development specialist. The regulation and operation manuals will cover such aspects as management, accountant, participatory monitoring and evaluation, gender issue, and problem solving.

- Step-2: Mobilization (2) – Social Preparation

The social preparation work, community awareness and the WUA/WUG organization will be implemented on water management and O&M arrangement by community field officer. After a series of workshops and meetings between community members and related officers including PDAM, O&M arrangements for implementation will be agreed. Social preparation work has to be implemented before the project implementation.

- Step-3: Supporting WUA/WUG

There will be a strong emphasis on capacity building through training program for a comprehensive range of skills including technical requirements for system operation and maintenance, management, accountant, setting up of community regulations, participatory monitoring and evaluation, gender issue, and problem solving. Relationships between WUA/WUG members and their relevant stakeholders including government, community and NGOs are to be strengthened. Community members will be facilitated and provided with training and technical assistance by experts, including training organizations, NGOs, local consultants and directly appointed field officers for each community. Basically it is preferable that the field officers should live in the community during the week.

- Step-4: Monitoring and evaluation through participatory approach

Monitoring and evaluation will be undertaken through participatory approach. A monitoring and evaluation specialist, participatory planning specialist and community field officers will practice these activities. This activity will occur at the same time when monitoring and evaluation of the health and hygiene education.

6.3 PDAM Institutional Assessment and Recommendations

6.3.1 Background

The role of the PDAM is to provide water supply services to district cities and towns. In recent years, although there has been a clear need for importance in the rural water supply, PDAM have not been actively involved in their development. PDAM have however have taken over the management of piped systems at the request of government, particularly those systems implemented without extensive community involvement. There has been recognition that small systems can place a

financial burden on PDAM because revenues from tariffs do not meet the cost of operation and maintenance. Many district governments now recognize the experience available in their PDAM and are promoting its broader involvement to assist in water supply service delivery improvements throughout their districts.

PDAM will have some involvement in the management of rural water supply facilities in many of the communities selected for the Study. Therefore, an assessment of PDAM in the Project area was undertaken in order to understand their capacity to contribute to the Project and the impact that the Project may have on their operations. Then necessary recommendations are put forward a suggestion as follows.

The assessment included 10 PDAM namely Menang Mataram, Lombok Timur, Sumbawa, Dompu, Bima, Kupang, Sikka, Flores Timur, Sumba Timur and Sumba Barat.

6.3.2 Status of PDAM in Project Area

(1) Status and Role of PDAM

A Perusahan Daerah Air Minum (PDAM) is an autonomous water enterprise (public cooperation) that is established in accordance with a government regulation. There is a considerable body of legislation and regulation governing their operation. The owner of the PDAM is the district (or city) government.

The role of the PDAM is to provide water supply services to district cities and towns essentially on a commercial basis. For most PDAM the focus is on operation & maintenance with funding for capital investments usually under the control of Kimpraswil. Therefore the PDAM usually does not have a major role in the construction of new facilities or major rehabilitation and/or augmentation projects for which there is frequently financial support from higher level of government. Kimpraswil at the provincial level is the key agency in the management of such projects. The completed facilities are handed over to the PDAM on completion.

(2) Status of PDAM in Proposed Area

The attached tables summarize the status of the PDAM which were included in the Study. Table 6.3.1 provides a quantitative summary of various capacity and performance data and Table 6.3.2 summarizes the Study Team's overall PDAM assessment according to the following categories:

- Policy framework;
- Organization and staffing;
- Service levels;
- Financial management; and
- Technical issues.

1) Management, administrative and financial conditions of PDAM

The study indicates significant variations in key measures of PDAM capability. PDAM Menang Mataram (Mataram & Lombok Barat) is by far the best performing PDAM and the only PDAM making a profit. Kupang as the second largest PDAM, whilst not profitable, is not too far behind Mataram by several measures.

In terms of management, administrative and financial performance, with the exception of Menang Mataram, all PDAMs perform poorly. As an example, PDAM Sumbawa has 18 staff/1,000 connections (compared with 6 for Menang Mataram), loses almost Rp 1.0 billion/year, has accumulated losses of more than Rp 7.0 billion, and continues to sell water at about half the cost of production.

2) Low Tariffs

Tariffs are crucial to PDAM performance and all except PDAM Menang Mataram are currently selling water at below cost. Increases of between 18% (Kupang) and 94% (Sumbawa) are required to simply break-even.

3) Policy

The current policy and institutional framework, as applied at district level, is not conducive to efficient management. There is a lack of political will to raise tariffs to a level that is appropriate for sustainable operations. A consequence of low tariffs (as well as contributing to the substantial accumulated losses of many PDAMs) is to constrain expenditure on a range of essential operation & maintenance activities. This leads to deterioration in service levels and a reduction in customer satisfaction. In time demand will reduce and increased bad debts will result as customers refuse to pay for unsatisfactory service.

There is confusion in local government about the role of PDAMs and the financial arrangements required for them to operate successfully and sustainably.

(3) Needs of PDAM in Rural Water Supply Services

Notwithstanding the shortcomings in PDAM management, the existing PDAM resources represent a significant pool of experience and a skills base for the water supply sector in their respective district. There is no alternative source of such capacity within government agencies and very limited private sector capacity available. The Study Team supports the concept of promoting and developing the PDAM as the district level organization that provides the skills for water supply system management.

However, these skills need to be enhanced in several areas, particularly in business & financial management, customer service and in improved technical operation & maintenance.

(4) Impact of Project

Five PDAM, Menang Mataram, Lombok Timur, Sumbawa, Flores Timur and Kupang will have a direct role in the operation & maintenance of water supply systems proposed for implementation under the Project.

On an aggregated basis the estimated incremental operation & maintenance costs is estimated at Rp 150 million/year compared with the anticipated revenue of Rp 165 million/year.

However, for PDAM Flores Timur and Kupang the impact is estimated as a net loss. For the worst case, PDAM Flores Timur, the incremental operation & maintenance costs for the PDAM is estimated at Rp 34 million/year compared with the anticipated revenue of Rp 23 million/year. The net burden therefore represents only about 2.3% of the PDAM annual operating cost. For Kupang the net burden is less than 0.2%.

On the other hand for type B&C system, the impact of the addition of the proposed villages on overall PDAM operations will not be significant. Three PDAM, Bima, Sumba Barat and Sumba Timur will have a role in providing operation & maintenance support to villages particularly in relation to maintenance of pumping systems and larger pipeline repairs. The staffing implications are minimal with the

personnel required for operation & maintenance expected to be reallocated from the surplus of staff in the various PDAM.

(5) Recommendation for Institutional Development – Capacity Building

It is recommended to strengthen the capability of PDAM in the management of rural water supply systems through various measures. In addition the Project will assist those PDAM with responsibility for operation & maintenance of rural water supply systems, to prepare business plans and implement increased tariffs to enhance sustainable long-term operations. The key areas for capacity building include:

- Strengthen the policy and institutional framework as an autonomous water enterprise;
- Financial management, particularly in the area of tariff setting;
- Ensuring that the PDAM organization and staffing is responsive to the requirements of the proposed rural water supply systems;
- Enhancing the skills in the operation and maintenance of the proposed rural water supply systems.

The summary of capacity building proposals is shown Table 6.3.1. It is recommended to provide training as well as essential infrastructure, spare parts, tools and equipment required for the O&M of rural water supply systems.

It will also support the development of cooperative arrangements between communities and PDAM whereby communities take on the primary responsibility for O&M but PDAM will provide technical support (on a fee for service basis) for more complex maintenance requirements

Table 6.3.1 Key PDAM Capacity and Performance Data

Item	Units	PDAM									
		Menang Mataram	Lombok Timur [9]	Sumbawa	Dompu	Bima	Kupang	Sikka	Flores Timur [4]	Sumba Timur [5]	Sumba Barat
Established [6]	year	1986	1991	1992	1992	1991	1986	1991	2000	1991	2000
Connections	No.	31,004	7,750	9,326	4,183	9,226	21,756	6,132	3,611	5,189	244
Staff	No.	174	89	165	46	123	231	87	63	74	31
Staff/1000 connections		6	11	18	11	13	11	14	17	14	37 [1]
Base tariff	Rp/m^3	345	300	400	300	450	210	200	200	350	150
Last tariff adjustment	Date	2001	1999	1998	2001	2001	1994	1995	1992	2001	1991
Annual revenue	,000 Rp	10,350,546	NA	1,345,695	628,202	1,555,973	5,548,390	828,070	414,160	936,956	NA
Profit (loss) after tax	,000 Rp	1,415,525	NA	(972,791)	(307,876)	(536,039)	(962,458)	(166,690)	(44,977)	(391,787)	NA
Total assets	,000 Rp	48,497,397	NA	8,532,846	3,547,178	3,409,360	18,777,617	2,600,308	8,121,294	4,938,440	NA
Accumulated profit (loss)	,000 Rp	1,801,580	NA	(7,273,526)	(4,524,330)	(5,286,448)	(5,030,787)	(1,294,473)	(44,977)	(1,232,524)	NA
Accumulated profit (loss)	% of annual revenue	17%	NA	(540%)	(732%)	(340%)	(91%)	(156%)	(11%)	(132%)	NA
Accounts receivable (debtors)	,000 Rp	1,884,586	NA	967,302	677,278	1,173,540	1,287,646	259,639	210,133	335,746	NA
Accounts receivable (debtors)	% of annual revenue	18%	NA	72%	110%	75%	23%	31%	26%	36%	NA
Average water sale price	Rp/m^3	932	NA	848	510	805	732	591	NA	520	NA
Average water production cost	Rp/m^3	840	NA	1647	772	1,100	867	712	NA	793	NA
Average invoice	Rp/month	25,583	NA	10,662	12,319	13,834	21,034	11,222	NA	13,975	NA
Water production (total)	M^3/year	14,108,944	5,124,356	2,162,789	1,927,207	2,970,670	9,372,181	1,986,645	NA	2,790,000	NA
Water production (average rate)	L/s	447	162	68	61	94	297	63	NA	88	NA
Water sales	M^3/conn/mth	27.4	27.5	12.6	19.1	17.2	28.7	18.6	19.5	26.9	NA
Unaccounted for water	% production	28%	50%	35%	57%	36%	20%	30%	NA	40%	NA
Operating regime	Hours/day	24	24	7 - 24	8 - 24	16 – 24	9 - 24	8 - 24	4 - 17	24	NA
Coverage	% of service area population	42%	27%	41%	40%	25%	54% [2]	39% [2]	NA	58%	NA
Water systems	No.	14	11	11	3	8	8	6	3	4	5
Source [7]	R, S, GW	S,R	S,R	R,S,GW	R,S,GW	R,S,GW,D	S,GW	R,S,GW	R,S,GW	S	S
Pumped/Gravity [8]	P, G	G	G,P	P,G	G,P	P,G	P,G	P,G	G,P	G	G,P
Water treatment	No. of plants	1 [3]	1 [3]	4	1 [3]	2	1 [3]				

Notes: Based on FY 2000 except where noted otherwise. [1] Includes water supply system for Waikabubak which is not operating. If excluded ratio would be 127. [2] Based on data for kabupaten capital only. [3] Slow sand filter plants only. No chemical dosing. [4] Financial data for Flores Timur appears in consistent and should not be used to draw firm conclusions. [5] Financial data for Sumba Timur is based on FY 1999. [6] Effective establishment date - not the date of local government decree or regulation. [7] S = spring; R = river; GW = groundwater (bore, well); D = dam. [8] G = gravity; P = pumped. [9] March 2001.

Table 6.3.2 Summary of PDAM Assessment

Policy Framework	Organisation & Staffing	Service Levels	Financial Management	Technical Issues
PDAM Mission • Confusion between PDAM and PEMDA over PDAM mission and role • Commercial enterprise or social policy vehicle?	**Staffing Levels & Capability** • Generally excessive staff numbers by Indonesian and international standards. • Imbalance between administration and technical staffing. • Well qualified but lacking specific management & technical skills.	**Coverage** • Low service coverage even in kabupaten towns. • Range 25% - 58%. • Reason is poor service delivery rather than affordability.	**Tariffs** • Tariffs do not meet essential requirement of O&M recovery, depreciation & debt service. • Tariff increases infrequent and "lumpy".	**Unaccounted-for-water (UFW)** • UFW is excessive in most towns. • Range is 20-50%. • Data is not accurate because of lack of meters and inaccurate metering. • Annual cost of UFW in 8 PDAM is Rp 8.1 billion.
Tariffs • Low tariffs - often a political decision. • Should cover O&M plus depreciation & debt service. • Low tariffs put maintenance of existing assets and system performance at risk. • Result is reduced customer satisfaction - impacts on revenue and sustainability.	**Supervisory Boards and Management** • Lack of focus on service delivery • Supervisory boards reportedly not effective & do not have correct range of skills. • Consumers are not represented on supervisory boards (except Kupang).	**Water Quantity** • Generally adequate quantities supplied to consumers. • Wide variations across Project PDAM. • Supply constraints apply in some towns particularly Sumbawa Besar. • Constrains revenue in some case particularly in Sumbawa.	**Profit & Loss** • All except PDAM Menang Mataram make losses annually. • Accumulated loss substantial in many PDAM. Total Rp 23 billion. • PDAM Sumbawa, Dompu and Bima particularly noteable for high accumulated losses.	**Construction & Equipment Quality** • Evidence of poor construction practices such as lack of pressure testing, inadequate pipe depth etc. • Equipment procured does not consider life cycle costs (eg consumer meters). • Frequent lack of PDAM involvement in procurement & construction.
Transparency on Social Policy Delivery • Social policy objectives of PEMDA can be met through transparent subsidies based on realistic O&M requirements.	**Technical Planning & Management** • Technical planning capability is weak. • Exacerbated by reliance on external support for planning & design. • Maintenance is reactive rather regular and proactive.	**Continuity of Supply** • 24 hour supply is generally limited to gravity systems. • 5 – 24 hours/day.	**Accounts Receivable (Debtors)** • Excessive debtors in most PDAM. • Lack of follow-up. • Losses understated because of accounting standards. • Many debts should be written off.	**Workshops & Stores** • Workshop facilties generally basic. • Stores very basic and poorly organized. • Inadequate management of spare parts and equipment. • Lack of appropriate inventory management systems.
Accountability & Efficiency • Boards and management are not held accountable for performance outcomes • Lack of appropriate business planning means there are no realistic performance objectives • Political interference used as an excuse for failure to deliver appropriate level of services.	**Business Processes** • No focused business planning. • Reporting is excessive and does not focus on key business requirements. • Reports are not utilised - - lack of follow up in key areas such as UFW, debtors, P&L.	**Pressure** • Generally less than design standards. • Lombok Barat/Mataram is an exception.	**Assets & Equity** • Total value of fixed assets very substantial - more than Rp 80 billion. • Non-functioning assets are maintained on books – should be written off. • In some PDAM the accumulated losses exceed the book value value of fixed assets.	**Planning & Record Keeping** • Lack of masterplans even for large kabupaten towns. • Lack of hydraulic model to assist in planning system augmentation & expansion. • Lack of as-built drawings and asset registers for use in technical planning.
Limited Participation • PDAM excluded from planning and investment decision making. • Results in lack of ownership and commitment	**Use of Private Sector** • Limited use of private sector resources. • Selective private sector resource use would improve workload balancing and increase sector skills base generally.	**Water Quality** • Limited data available. • Physical/chemical quality generally OK. • Some seasonal variations • Bacteriological quality below standard – no chlorination.	**Computerisation** • Advantages of computerization not fully utilised in some PDAM. • Lack of standardization across NTB/NTT.	**Specific Issues** • Refer details in Appendix 20.

Table 6.3.3 PDAM Capacity Building Proposals

Area of Focus	Participating PDAM	Proposed Capacity Building Measures
Policy & institutional framework	Menang Mataram Lombok Timur Sumbawa Flores Timur Kupang	Provide training and support to PDAM management (and relevant staff of other district planning agencies) with business planning, budgeting and tariff policy. ***Objective:*** To strengthen sustainability of PDAM through improved business policies.
Finance & administration	Menang Mataram Lombok Timur Sumbawa Flores Timur Kupang	Provide training and support to PDAM management (and relevant staff of other district planning agencies) to establish appropriate tariffs. ***Objective:*** To ensure that PDAM tariffs are established at an appropriate level to ensure sustainable operations. The approach will incorporate appropriate consideration of district policies in relation to social policy for water supply through transparent subsidies.
Organization & staffing	Menang Mataram Lombok Timur Sumbawa Flores Timur Kupang Bima Sumba Timur Sumba Barat	Provide training and support to PDAM in relation to the specific management requirements for the proposed rural water supply systems. ***Objective:*** To ensure the PDAM organizations are able to respond to the needs of rural water supply consumers through allocation of appropriate resources.
Technical (operation maintenance)	Menang Mataram Lombok Timur Sumbawa Flores Timur Kupang Bima Sumba Timur Sumba Barat	Provide training, support, appropriate infrastructure, spare parts and equipment specifically for operation & maintenance of the proposed village water supply systems. ***Objective:*** To ensure PDAM staff are trained and equipped for their role in operation & maintenance of Project facilities.

Chapter 7 IMPLEMENTATION PLAN

7.1 Phased Development

There are two implementation plans conceivable for a phased development of this project. One is phased development by province (Plan 1), the other simultaneous development in both provinces (Plan 2). Number of phasing is set at two because of the scale of the project. The two plans are outlined below.

Plan 1: Phased development by province in two phases

This plan meets the decentralization objectives of the present national policy. It is a reasonable and realistic option from this standpoint. The Study proposes this Plan 1 for implementation.

- It is proposed to develop the villages in the NTB province before those in NTT, i.e. Phase 1 for NTB and Phase 2 for NTT, for the following reasons.
- It is better for the investors/donors to develop a more advantageous area first to ensure the success of the development.
- Development of the NTB villages has more advantageous in terms of construction cost and management because the villages in NTB are closely located compared with the villages in NTT. Also, the number of islands involved for NTB villages is 2 compared to 4 for NTT.
- Therefore, it would lead to short cut to the budget arrangement.

Plan 2: Simultaneous development of provinces in two phases

Plan 2 is to develop both NTB and NTT provinces in each phase (simultaneous development in both provinces). This plan is strongly wished to apply to the future implementation by the Indonesian counterparts. Plan 2 is discussed through in parallel with Plan 1 in the report. Plan 2 has a feature to put an equal opportunity on NTB and NTT provinces.

7.2 Implementation Agency

After an Inter-Governmental Agreement (E/N) for the implementation of a rural water supply project between the donor and the Ministry of Foreign Affairs,

Indonesia, the Ministry of Settlement and Regional Infrastructure will be the execution agency for the project.

The Directorate General (DG) of Urban and Rural Affairs in the Ministry of Settlement and Regional Infrastructure has overall responsibility for rural water supply development in Indonesia. The Director General should also issue the certificates to settle the payment to the consultant and contractors in accordance with the contracts.

The DG has three regional Directorates; the eastern, central and western Directorates. NTB and NTT Provinces come under the Directorate of Urban and Rural Affairs, Eastern Region. The Directorate General will be responsible for the negotiation and signature of any procurement contract, such as employment of consultant and civil works, under the project. The Directorate of Urban and Rural Affairs, Eastern Region has a role of project management works to execute the contracts.

The Director of Urban and Rural Affairs will delegates, through the Directorate of Eastern Region, a provincial government officer to act as the Project Manager for the project at each phase. It will also dispatch a coordinator for the monitoring and coordination of on-site works. The coordinator will go to the site for inspection and for meeting from time to time. The implementation arrangements are proposed as shown in Figure 7.2.1 (Plan 1) and Figure 7.2.2 (Plan 2) for Plan 1 development and Plan 2 development, respectively.

7.3 Implementation Schedule

After the completion of this Study, the following activities will be carried out before the commencement of construction works.

1) The financing arrangements will be agreed.
2) An Environmental Impact Assessment (EIA) will be carried out.
3) Any land acquisition problems will be resolved.
4) Consultants will be selected.
5) Detailed designs and tender documents will be prepared.
6) Social preparation will be carried out in the villages, including the creation of WUAs and the writing of VAPs.
7) Contractors will be pre-qualified and selected.

The social preparation, training, and extension activities will be carried out by consultants simultaneously with the design works, in order to ensure the villagers' acceptance of the proposed projects. After the completion of the construction works, a one-year maintenance period will be provided during which the contractor remains liable for defect repair. Also, after the completion, a three-months period will be provided during which the consultant monitor the soft component services.

Proposed implementation schedules are shown in Figure 7.3.1 (Plan 1) and Figure 7.3.2 (Plan 2) for Plan 1 development and Plan 2 development, respectively.

7.4 Scope of Works for Consultancy Services

7.4.1 Personnel Requirements and Setup

The following foreign and local experts are required to execute the design, supervision, and soft component services.

Required Consultant Personnel

(Unit: M/M)

Work	Phase 1 (F)	Phase 1 (L)	Phase 1 Total	Phase 2 (F)	Phase 2 (L)	Phase 2 Total	Total
(Case of Plan 1)							
1. Design	21	16	37	21	16	37	74
2. Supervision	22	51	73	21	54	75	148
3. Soft component services *1	19	234	253	14	171	185	438
1) Manual *2	(10)	(24)	(34)	(7)	(23)	(30)	(64)
2) Other services *3	(9)	(210)	(219)	(7)	(148)	(155)	(374)
Total	**62**	**301**	**363**	**56**	**241**	**297**	**660**
(Case of Plan 2)							
1. Design	21	16	37	21	16	37	74
2. Supervision	22	51	73	20	57	77	150
3. Soft component services *1	19	203	222	14	208	222	444
1) Manual *2	(10)	(24)	(34)	(7)	(23)	(30)	(64)
2) Other services *3	(9)	(179)	(188)	(7)	(185)	(192)	(380)
Total	**62**	**270**	**332**	**55**	**281**	**336**	**668**

Note: (F): Foreign experts
(L): Local experts and staff, including field officers
*1: Field officers (L) account for much of the personnel requirements; i.e. 123 M/M in Phase 1 and 132 M/M in Phase 2.
*2: Preparation of manuals for community development works and of business planning including budgeting and tariff policy for PDAM capacity building
*3: Employment and training of field officers, social preparation works, extension works of community development and PDAM capacity building

The team leader, who is not involved in physical work, will manage the overall services of the consultants in each phase. A design engineer, a design/supervision engineer and a community specialist, who would all be foreign experts, will be in charge of overall design, supervision, and soft component services, respectively under the team leader.

The soft component services are composed of health and hygiene education, community development, and PDAM capacity building. The health and hygiene education and community development will be conducted both before and during construction. The PDAM capacity building will only be conducted during construction. The education and extension works before construction are called social preparation.

The proposed arrangements for consultants in the case of Plan 1 development are shown in Figure 7.4.1 (Plan 1) and Figure 7.4.2 (Plan 1) for Phase 1 and Phase 2, respectively.

The proposed arrangements for consultants in the case of Plan 2 development are shown in Figure 7.4.3 (Plan 2) and Figure 7.4.4 (Plan 2) for Phase 1 and Phase 2, respectively.

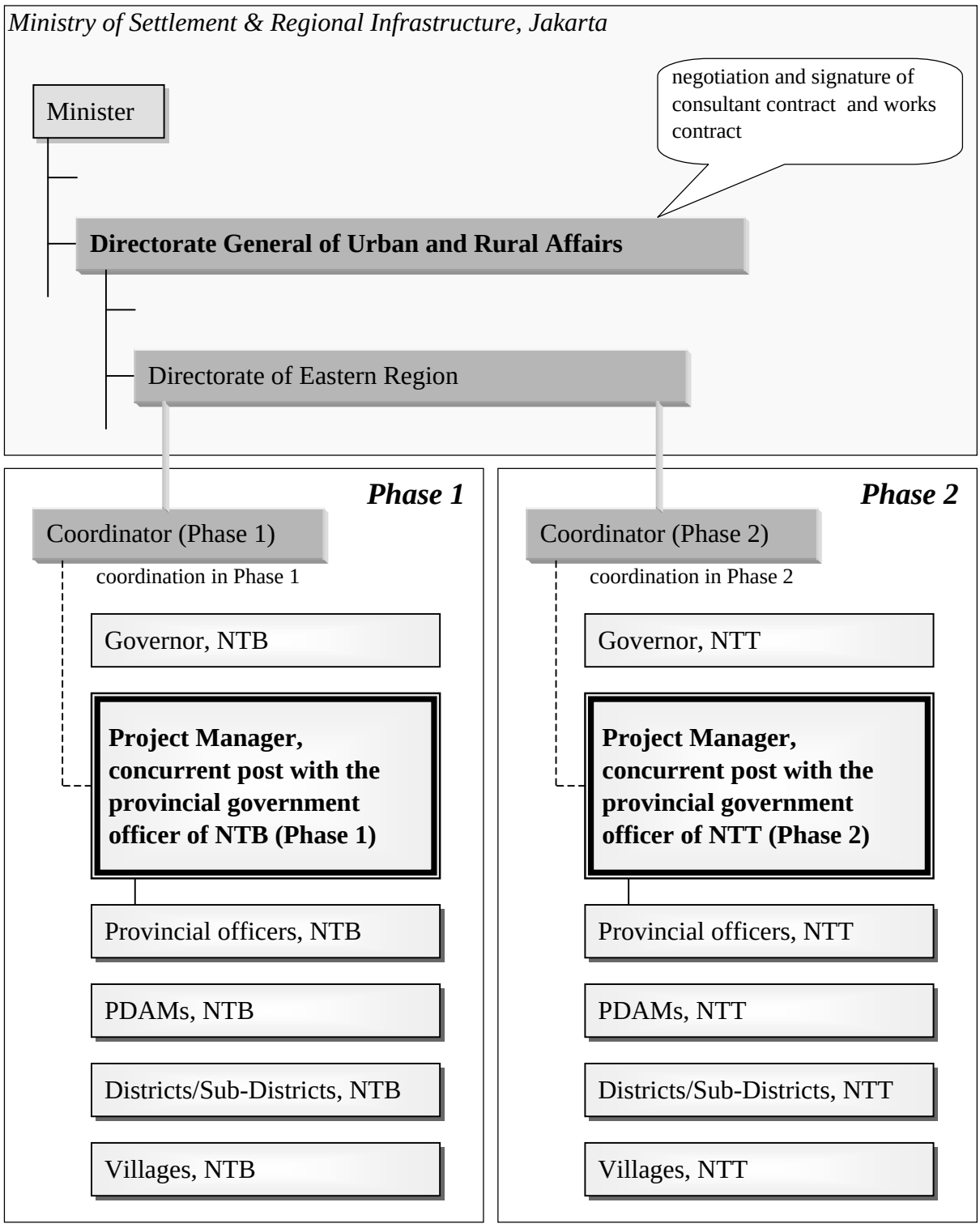
7.4.2 Design and Supervision Works

The works will be designed by six foreign experts and five or six locals headed by a foreign design engineer under the control of the team leader. The design works will be carried out at the main office for each phase. The experts will be based at the main office and travel for site investigation as required.

Three foreign experts and eight to ten locals headed by a foreign design/supervision engineer will supervise the construction works under the control of the team leader. Foreign experts will work at the main office while two local engineers will be based at each of the branch offices to supervise the site physical works. The foreign experts can reach site by airplane, ferry or fast ferry from the main office at any time as required.

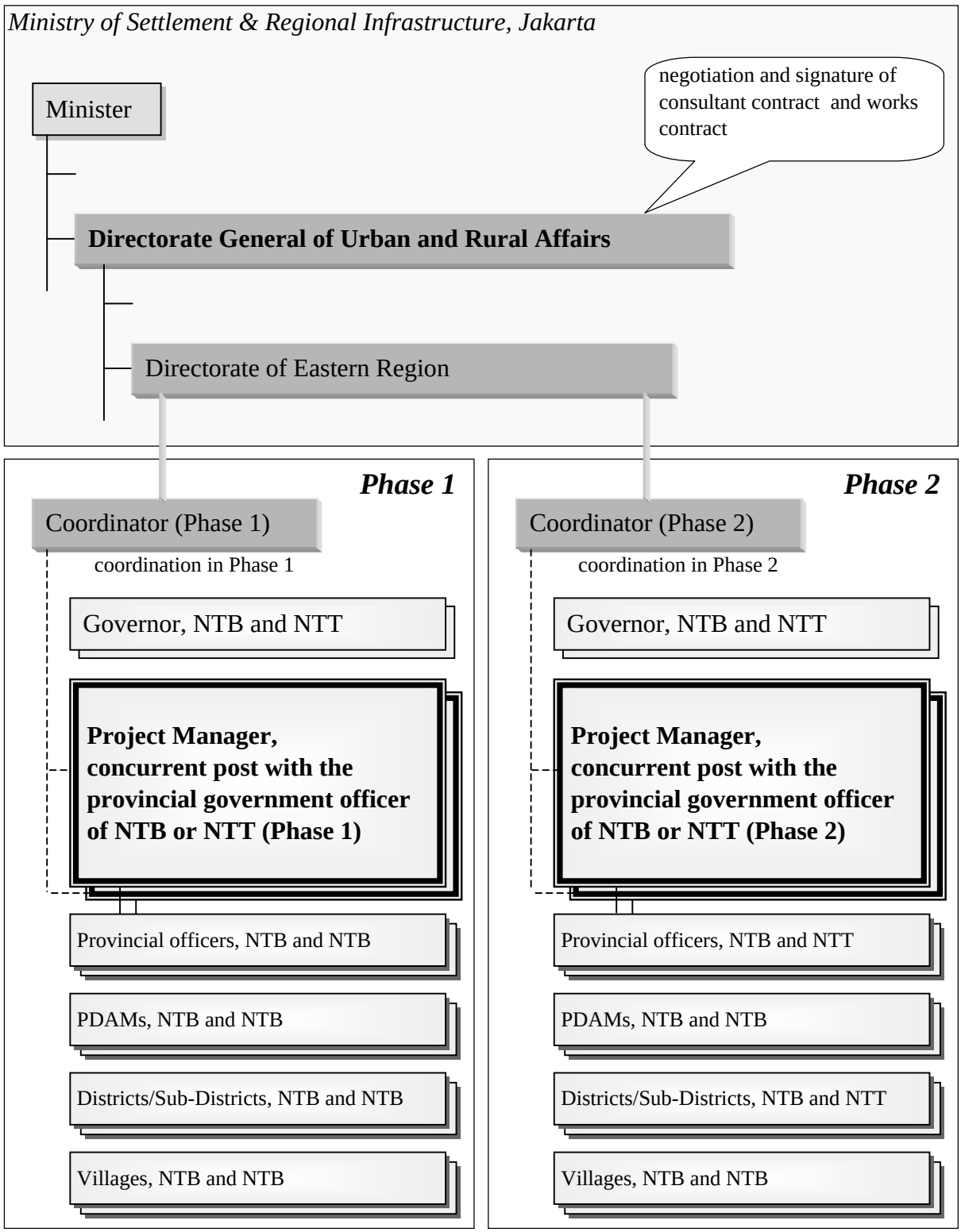
7.4.3 Soft Component Service

Soft component services should be implemented in the following steps. Prparation of manuals and guidelines of health and hygiene education, and operation and maintenance for WUA/WUG are to be performed by experts under the guidance of a foreign expert at Mobilization works (1). Social preparation work has to be implemented by field officers at Mobilization works (2). Community members will be facilitated and provided with training and technical assistance for operation and maintenance by experts and field officers after construction work started. In addition, capacity building of PDAM should be also carried out.



The Directorate of Eastern Region will give a delegation to a provincial government officer who holds post in each of NTB (Phase 1) and NTT (Phase 2), to execute the project management.
The Directorate of Eastern Region will also dispatch a coordinator to monitor the project and to coordinate opinions and procedures among the project manager, governor, provincial offices and other related offices/agencies at each phase.

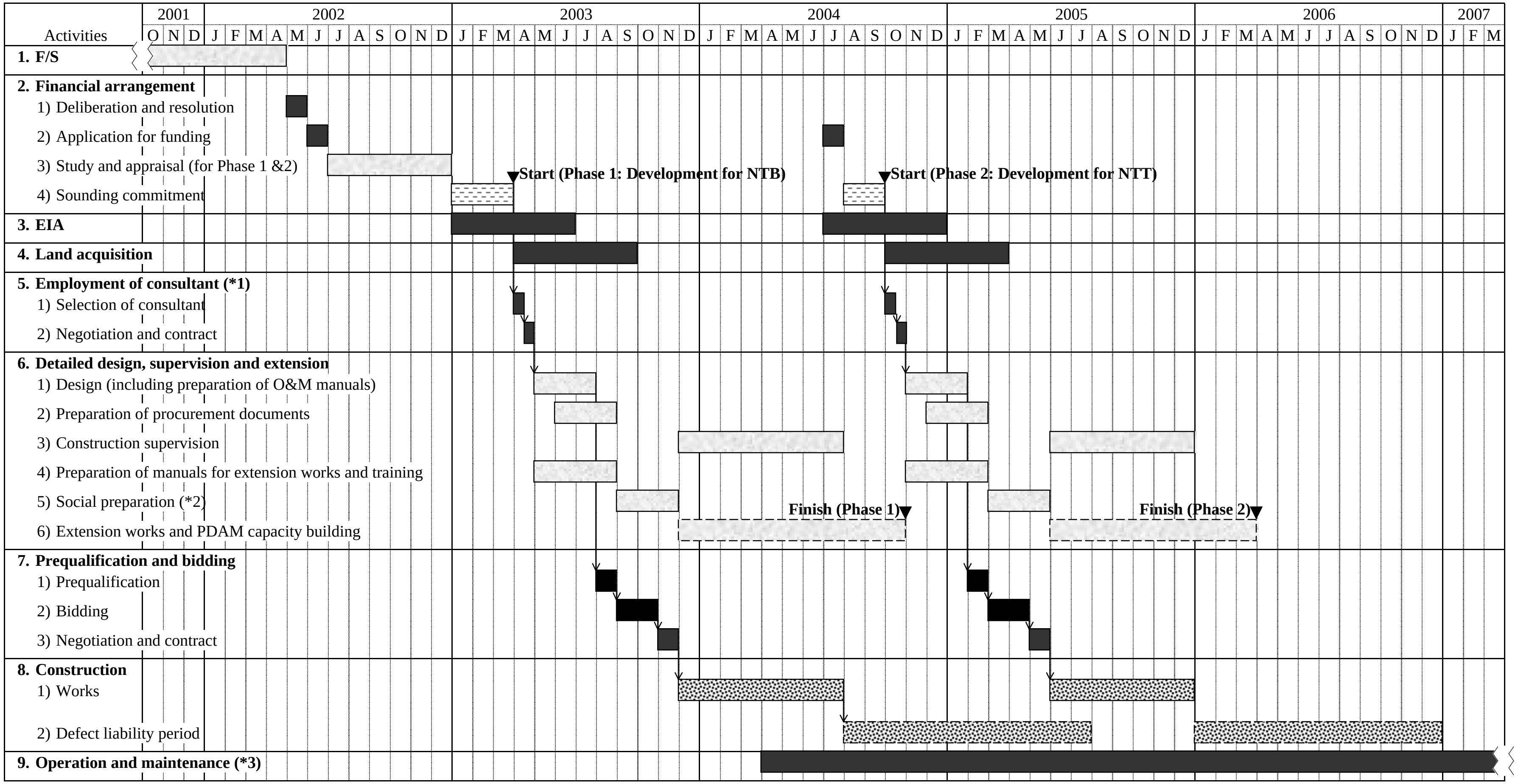
Study on Rural Water Supply Project in Nusa Tenggara Barat and Nusa Tenggara Timur	**Figure 7.2.1 (Plan 1)**
Japan International Cooperation Agency	**Proposed Implementation Arrangements**



The Directorate of Eastern Region will give a delegation to two provincial government officers who holds post in NTB and NTT, to execute the project management, in each of Phase 1 and Phase 2.
The Directorate of Eastern Region will also dispatch a coordinator to monitor the project and to coordinate opinions and procedures among the project manager, governor, provincial offices and other related offices/agencies at each phase.

Study on Rural Water Supply Project in Nusa Tenggara Barat and Nusa Tenggara Timur	**Figure 7.2.2 (Plan 2)**
Japan International Cooperation Agency	**Proposed Implementation Arrangements**

Study on Rural Water Supply Project in
Nusa Tenggara Barat and Nusa Tenggara Timur
Japan International Cooperation Agency



Note: - **The implementation schedule is programed under a year-month calender not to give any commitment of doner but to only show an assumption for cost estimate.**

(*1): Employment of consultant may require eight to ten months depending on the guidelines of the assistant fund provided.

(*2): Social preparation is made simultaneously with the design works to form acceptant willingness for the works in the villages.

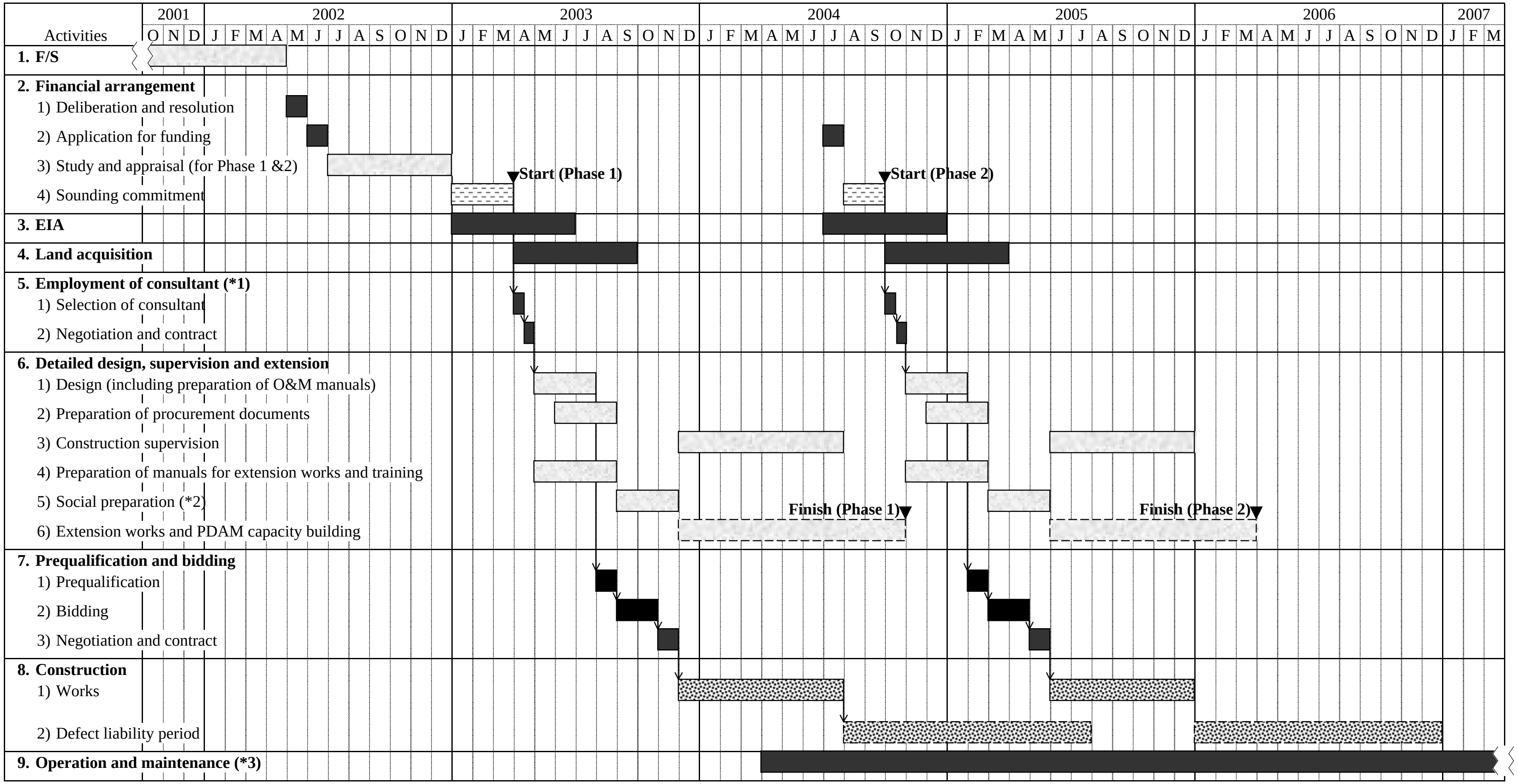
(*3): Operation and maintenance will start during the construction period of Phase 1, assuming that the works finish progressively starting four months after the commencement of the works.
Application for funding for Phase 2 will be made after confirming the issue of operation and maintenance for Phase 1.

Legend:
- : Activity to be conducted by recipient country
- : Activity to be conducted by donor country
- : Activity to be performed by consultant
- : Activity to be performed by contractor

Figure 7.3.1 (Plan 1)
Proposed Implementation Schedule

Study on Rural Water Supply Project in
Nusa Tenggara Barat and Nusa Tenggara Timur
Japan International Cooperation Agency

Figure 7.3.2 (Plan 2)
Proposed Implementation Schedule



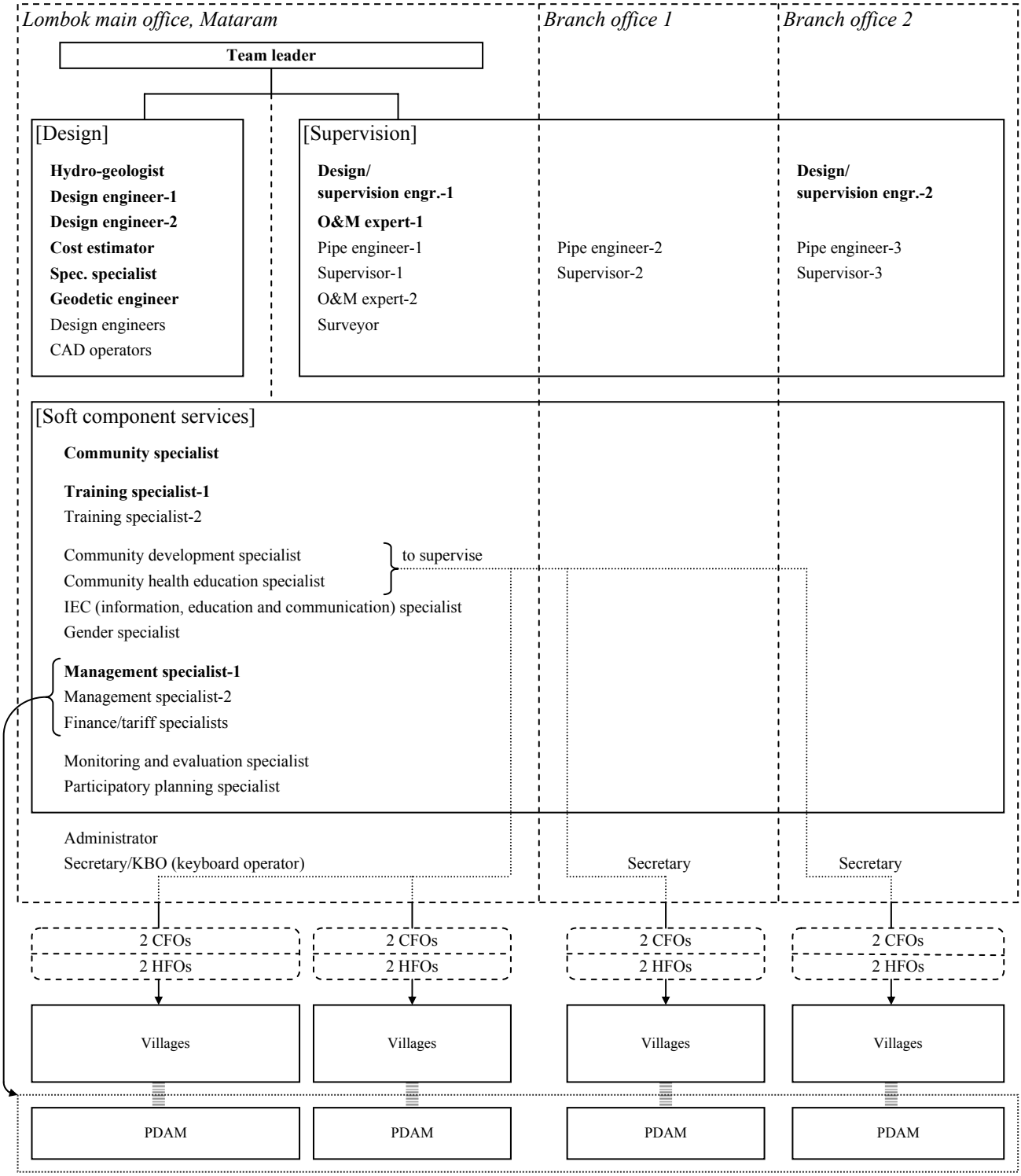
Note: - **The implementation schedule is programed under a year-month calender not to give any commitment of doner but to only show an assumption for cost estimate.**

(*1): Employment of consultant may require eight to ten months depending on the guidelines of the assistant fund provided.

(*2): Social preparation is made simultaneously with the design works to form acceptant willingness for the works in the villages.

(*3): Operation and maintenance will start during the construction period of Phase 1, assuming that the works finish progressively starting four months after the commencement of the works. Application for funding for Phase 2 will be made after confirming the issue of operation and maintenance for Phase 1.

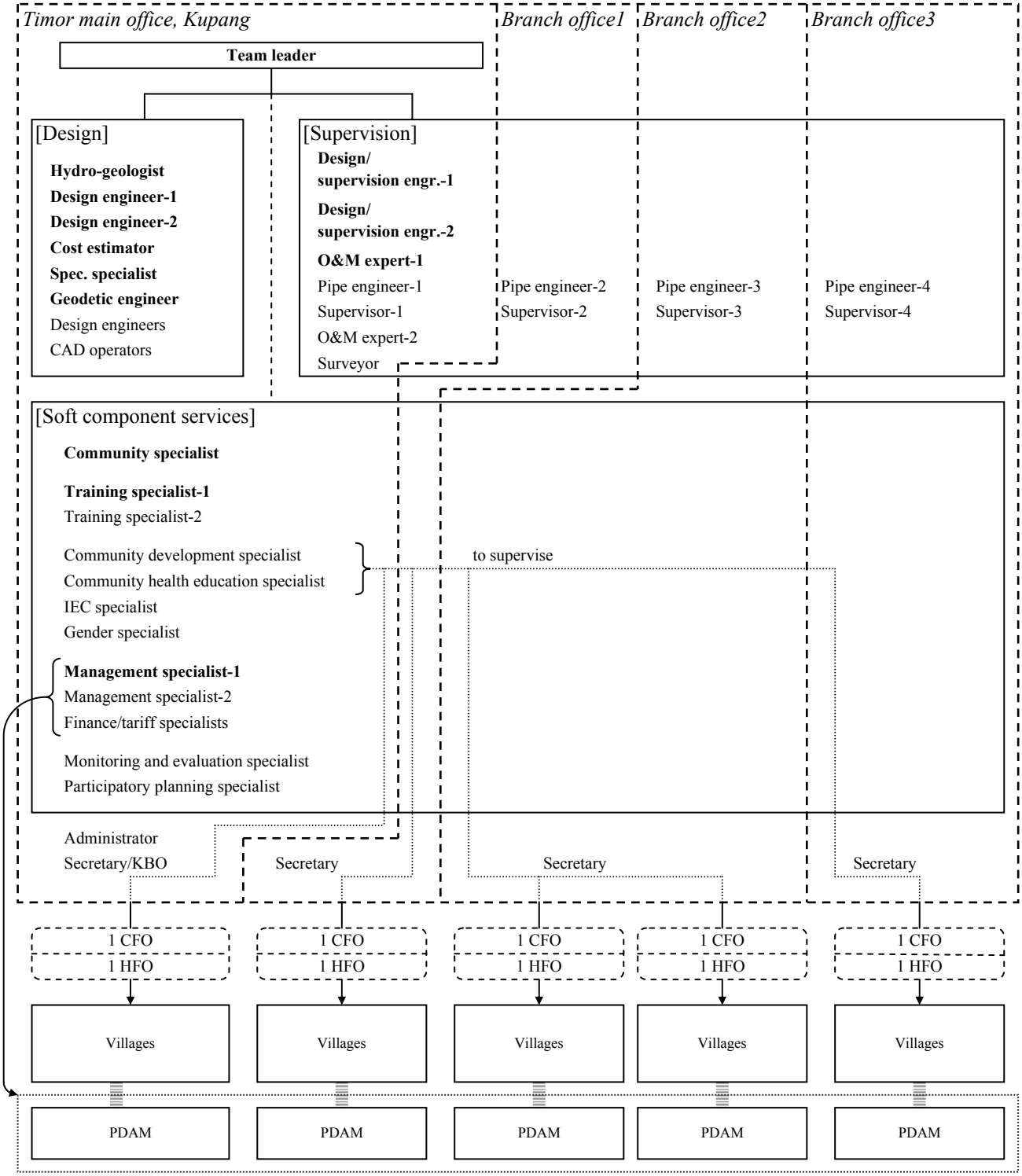
Legend:
- ■ : Activity to be conducted by recipient country
- : Activity to be conducted by donor country
- : Activity to be performed by consultant
- : Activity to be performed by contractor



Phase 1 Consultant (NTB)

Note: (A): PDAM will be responsible for O&M of water supplies.
(B): Villages will be responsible for O&M of water supplies with support provided by PDAM.
(C): Villages will be responsible for O&M of water supplies.
2 CFOs : two community field officers
2 HFOs : two health field officers
- Bold specialists are foreigners, and plain local.
- Every specialist having the same title is distinguished from others suffixing "-1", "-2" and "-3".
- The main office will be provided through the implementation period, while branch offices only for construction period.

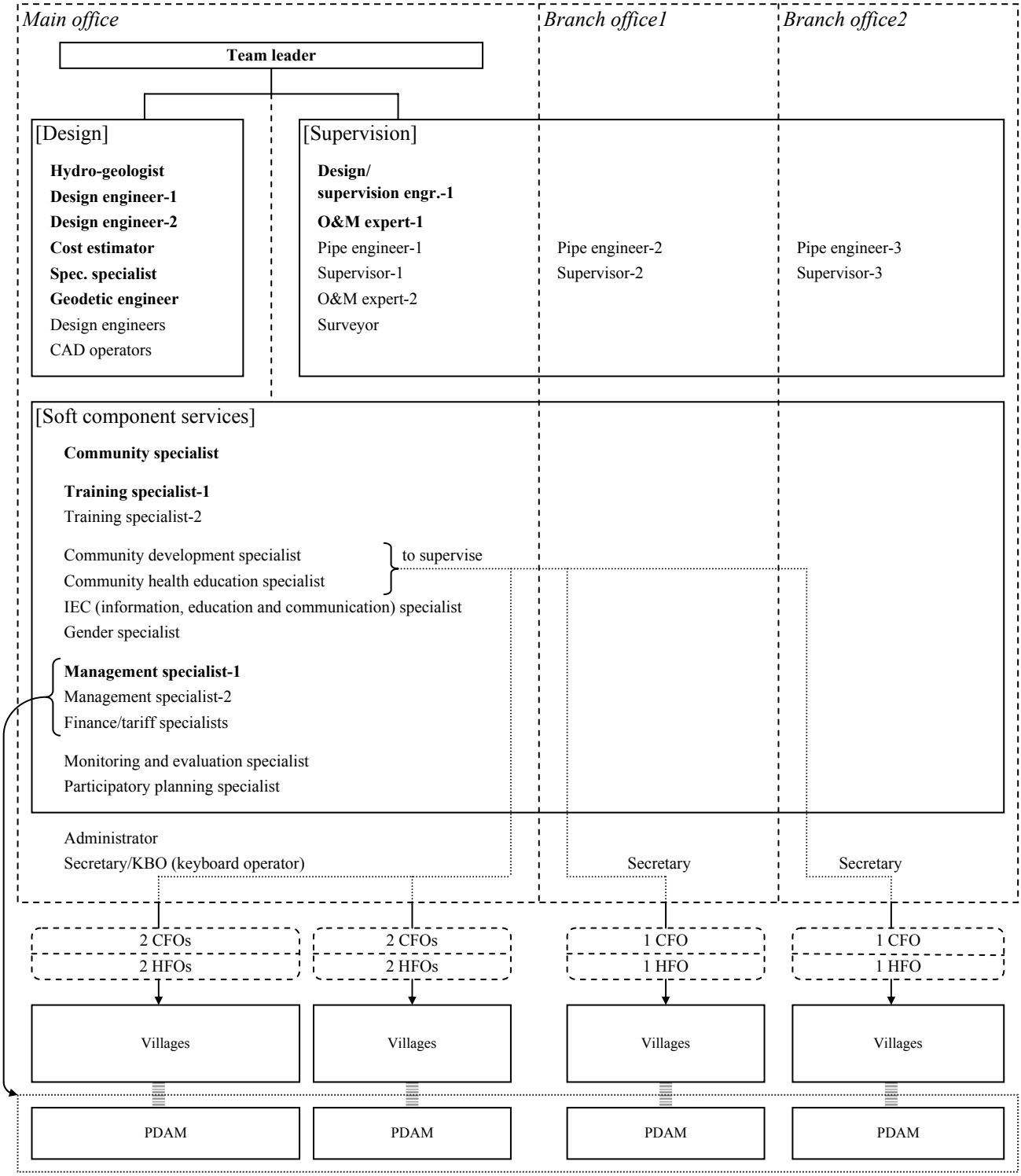
Study on Rural Water Supply Project in Nusa Tenggara Barat and Nusa Tenggara Timur Japan International Cooperation Agency	**Figure 7.4.1 (Plan 1)** **Proposed Consultant's Setup for Phase 1**



Phase 2 Consultant (NTT)

Note: (A): PDAM will be responsible for O&M of water supplies.
(B): Villages will be responsible for O&M of water supplies with support provided by PDAM.
(C): Villages will be responsible for O&M of water supplies.
2 CFOs : two community field officers
2 HFOs : two health field officers
- Bold specialists are foreigners, and plain local.
- Every specialist having the same title is distinguished from others suffixing "-1", "-2" and "-3".
- The main office will be provided through the implementation period, while branch offices only for construction period.

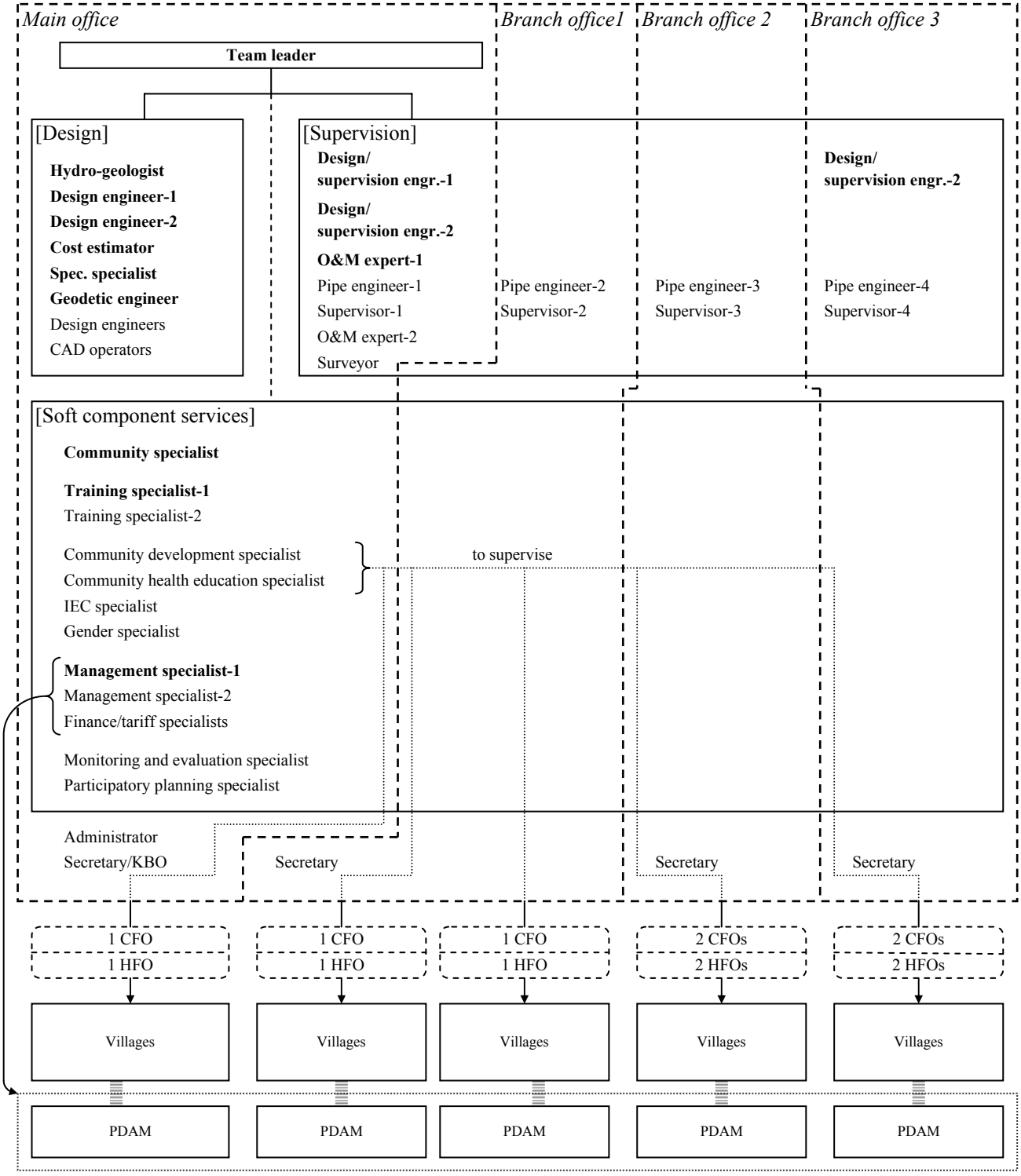
Study on Rural Water Supply Project in Nusa Tenggara Barat and Nusa Tenggara Timur Japan International Cooperation Agency	**Figure 7.4.2 (Plan 1)** **Proposed Consultant's Setup for Phase 2**



Phase 1 Consultant

Note: (A): PDAM will be responsible for O&M of water supplies.
(B): Villages will be responsible for O&M of water supplies with support provided by PDAM.
(C): Villages will be responsible for O&M of water supplies.
2 CFOs : two community field officers
2 HFOs : two health field officers
- Bold specialists are foreigners, and plain local.
- Every specialist having the same title is distinguished from others suffixing "-1", "-2" and "-3".
- The main office will be provided through the implementation period, while branch offices only for construction period.

Study on Rural Water Supply Project in Nusa Tenggara Barat and Nusa Tenggara Timur Japan International Cooperation Agency	**Figure 7.4.3 (Plan 2)** **Proposed Consultant's Setup for Phase 1**



Phase 2 Consultant

Note: (A): PDAM will be responsible for O&M of water supplies.
(B): Villages will be responsible for O&M of water supplies with support provided by PDAM.
(C): Villages will be responsible for O&M of water supplies.
2 CFOs : two community field officers
2 HFOs : two health field officers
- Bold specialists are foreigners, and plain local.
- Every specialist having the same title is distinguished from others suffixing "-1", "-2" and "-3".
- The main office will be provided through the implementation period, while branch offices only for construction period.

Study on Rural Water Supply Project in Nusa Tenggara Barat and Nusa Tenggara Timur Japan International Cooperation Agency	**Figure 7.4.4 (Plan 2)** **Proposed Consultant's Setup for Phase 2**

Chapter 8 COST ESTIMATES

8.1 Conditions and Assumptions for Cost Estimates

8.1.1 Price Level

The project cost is estimated at the price level as of October 2001.

8.1.2 Exchange Rate

The following exchange rates are used for the cost estimate. (The mean value for selling and buying, as of the end of October, 2001.)

US$ 1.0	=	¥ 121.92
US$ 1.0	=	Rp. 10,435
¥ 1.0	=	Rp. 85.59

8.1.3 Project Cost Component

The project cost is made up of the following components:

(1) Construction cost,
(2) Consultancy service cost,
(3) Administration cost,
(4) Land acquisition cost, and
(5) Taxes and duties

Note: - Items (1) and (2) are estimated excluding taxes and duties.
- Items (3) and (4) include taxes and duties.
- Item (5) includes all the taxes and duties levied on items (1) and (2).
- Items (1), (2), (3), (4), and (5) include physical and price contingencies.

Cost for the civil works including equipment supply and consulting services will be financed under a loan to be agreed between the Government of Indonesia and a foreign country or other assistant fund, or under grant aid. Costs other than the construction and consultancy services will be borne by the Government of Indonesia.

8.2 Estimated Project Cost

The following tables present the total estimated project cost.

Estimated project cost (Plan 1)

No.	Item	Total		Foreign portion		Local portion	
		Yen (Y, million)	Equivalent (Rp., billion)	Yen (Y, million)	Equivalent (Rp., billion)	Yen (Y, million)	Equivalent (Rp., billion)
Phase 1	**NTB**						
1.	Construction cost	301.7	25.8	283.3	24.2	18.4	1.6
2.	Consultancy services cost	205.9	17.6	205.9	17.6	0	0
	1) Design	(70.9)	(6.1)	(70.9)	(6.1)	(0)	(0)
	2) Supervision	(73.8)	(6.3)	(73.8)	(6.3)	(0)	(0)
	3) Soft component services	(61.2)	(5.2)	(61.2)	(5.2)	(0)	(0)
	i) Manual*1	((19.0))	((1.6))	((19.0))	((1.6))	((0))	((0))
	ii) Other services*2	((42.2))	((3.6))	((42.2))	((3.6))	((0))	((0))
3.	Administration cost	12.1	1.0	0	0	12.1	1.0
4.	Land acquisition cost	0.08	0.007	0	0	0.08	0.007
5.	Taxes and duties	1.8	0.16	0	0	1.8	0.16
	Total for Phase 1 (NTB)	521.6	44.6	489.2	41.9	32.5	2.8
Phase 2	**NTT**						
1.	Construction cost	237.2	20.3	226.3	19.4	10.9	0.9
2.	Consultancy services cost	188.8	16.2	188.8	16.2	0	0
	1) Design	(68.3)	(5.8)	(68.3)	(5.8)	(0)	(0)
	2) Supervision	(71.9)	(6.2)	(71.9)	(6.2)	(0)	(0)
	3) Soft component services	(48.6)	(4.2)	(48.6)	(4.2)	(0)	(0)
	i) Manual*1	((14.0))	((1.2))	((14.0))	((1.2))	((0))	((0))
	ii) Other services*2	((34.6))	((3.0))	((34.6))	((3.0))	((0))	((0))
3.	Administration cost	14.0	1.2	0	0	14.0	1.2
4.	Land acquisition cost	0.03	0.003	0	0	0.03	0.003
5.	Taxes and duties	1.1	0.09	0	0	1.1	0.09
	Total for Phase 2 (NTT)	441.1	37.8	415.1	35.5	26.0	2.2
Total of Phase 1 and Phase 2		**962.7**	**82.4**	**904.3**	**77.4**	**58.5**	**5.0**

Note: Price level: October 2001
Foreign portion: Amount that may be financed by foreign assistant agency
Local portion: Amount that would be borne by the Government of Indonesia
*1 : Manual: Preparation of manuals for community development works and of business planning including budgeting and tariff policy for PDAM capacity building
*2 : Other services: Employment and training of field officers, social preparation works, extension works of community development and PDAM capacity building

Estimated project cost (Plan 2)

No.	Item	Total		Foreign portion		Local portion	
		Yen (Y, million)	Equivalent (Rp., billion)	Yen (Y, million)	Equivalent (Rp., billion)	Yen (Y, million)	Equivalent (Rp., billion)
Phase 1							
1.	Construction cost	276.4	23.7	259.2	22.2	17.3	1.5
2.	Consultancy services cost	207.9	17.8	207.9	17.8	0	0
3.	Administration cost	13.8	1.2	0	0	13.8	1.2
	1) Design	(71.4)	(6.1)	(71.4)	(6.1)	(0)	(0)
	2) Supervision	(76.1)	(6.5)	(76.1)	(6.5)	(0)	(0)
	3) Soft component services	(60.4)	(5.2)	(60.4)	(5.2)	(0)	(0)
	i) Manual*1	((19.0))	((1.6))	((19.0))	((1.6))	((0))	((0))
	ii) Other services*2	((41.3))	((3.5))	((41.3))	((3.5))	((0))	((0))
4.	Land acquisition cost	0.07	0.006	0	0	0.07	0.006
5.	Taxes and duties	1.7	0.15	0	0	1.7	0.15
	Total for Phase 1	499.9	42.8	467.1	40.0	32.8	2.8
Phase 2							
1.	Construction cost	267.3	22.9	255.1	21.8	12.2	1.0
2.	Consultancy services cost	195.6	16.7	195.6	16.7	0	0
	1) Design	(69.4)	(5.9)	(69.4)	(5.9)	(0)	(0)
	2) Supervision	(70.7)	(6.1)	(70.7)	(6.1)	(0)	(0)
	3) Soft component services	(55.5)	(4.8)	(55.5)	(4.8)	(0)	(0)
	i) Manual*1	((14.0))	((1.2))	((14.0))	((1.2))	((0))	((0))
	ii) Other services*2	((41.5))	((3.6))	((41.5))	((3.6))	((0))	((0))
3.	Administration cost	15.7	1.3	0	0	15.7	1.3
4.	Land acquisition cost	0.04	0.003	0	0	0.04	0.003
5.	Taxes and duties	1.2	0.10	0	0	1.2	0.1
	Total for Phase 2	479.8	41.1	450.7	38.6	29.2	2.5
Total of Phase 1 and Phase 2		**979.7**	**83.9**	**917.8**	**78.6**	**62.0**	**5.3**

Note: Price level: October 2001
Foreign portion: Amount that may be financed by foreign assistant agency
Local portion: Amount that would be borne by the Government of Indonesia
*1 : Manual: Preparation of manuals for community development works and of business planning including budgeting and tariff policy for PDAM capacity building
*2 : Other services: Employment and training of field officers, social preparation works, extension works of community development and PDAM capacity building

8.3 Operation and Maintenance Cost

8.3.1 Annual Operation and Maintenance Cost

The operation and maintenance cost at the full development stage is estimated below.

Estimated annual operation and maintenance cost

No.	Item	Amount (Y, thousand)	Equivalent (Rp., thousand)
1.	Annual operation and maintenance	2,090	178,743

Note: Price level: October 2001

8.3.2 Replacement Cost

Some of the project facilities, especially equipment and mechanical works such as pumps and generators, have a shorter life time than the civil and pipe works. The life of the pumps and generators is set at 15 years, while the PVC pipe laid underground and exposed GSP (galvanized steel pipe) could be usable for about twenty years, or more in the case of GSP. Since the project life is set at 20 years for

the pipe works, the replacement cost is estimated for the pumps and generators whose life is less than that of pipe works.

The following are the estimated replacement cost.

Estimated replacement cost

No.	Item	Replacement cycle	Amount (Y, thousand)	Equivalent (Rp., thousand)
1.	Replacement cost	15 years	5,854	501,034

Note: Price level: October 2001

Since it is difficult for villagers to pay the entire cost of replacement at the time of replacement, the villagers need to save money regularly every month for 15 years for the replacement.

Chapter 9 PROJECT EVALUATION

9.1 Economic Evaluation

The economic evaluation examines the economic feasibility by comparing economic cost and economic benefit. However, since the study area is very rural, it is difficult to quantify all benefits properly and to evaluate them correctly. Value of time spent for collecting water can only be quantified. Benefits with difficult quantification are considered to be improvements of such matters as accessibility to water, social status of women, health environment, physical health conditions, and etc.

Even though it is difficult to quantify the economical viability, it should be recognized that the rural water supply project provide essential socio-economic and health benefits for low-income households, and generate many unquantifiable economic impacts, which will contribute to organizational, technical and social benefits.

9.2 Financial Evaluation

(1) Financial analysis on the construction and O&M for type A Villages

A financial analysis was undertaken to compare the cost including initial investment cost, and the benefit at each of the type A villages. The following are the resulting Benefit/Cost (B/C) ratio, cash flow and Financial Internal Return Rate (FIRR).

B/C ratio, Cash flow and FIRR of type A villages

Village	B/C ratio	Cash flow (Rp.)	FIRR
Kuranji	0.02	-3,689	-22.1%
Bajur	0.05	-4,570	-14.3%
Sembung	0.02	-3,707	-20.9%
Dumang, lower	0.02	-3,977	-22.3%
Selaparang	0.03	-5,090	-20.1%
Labuhan Mapin	0.05	-4,168	-14.9%
Sinar Hading	0.02	-8,232	-35.7%
Ile Padung			
Tarus	0.03	-5,962	-51.8%

The result shows that it is not financially possible for PDAM to undertake the project if investment costs are to be incurred by PDAM itself. It is necessary for PDAM to obtain external funds for construction of facilities.

(2) Financial analysis on O&M for type A villages

Financial analysis was also undertaken to compare the PDAM tariff, O&M cost, WTP (willingness to pay) and villagers ability to pay based on household income levels at each of the type A villages. The results are shown in the following table.

Financial analysis on O&M for type A villages

(Unit: Rp./household/month)

Village	PDAM tariff		O&M cost	WTP	3% of Income
	HC	PH			
Kurangi	6,605	1,742	1,590	2,200	25,205
Bajur	6,605	1,742	720	1,500	25,205
Sembung	6,605	1,742	1,399	1,700	25,205
Duman, (lower)	6,605	1,742	1,567	1,015	25,205
Selaparang	4,200	1,580	1,799	1,000	25,205
Labuan Mapin	6,350	1,940	1,088	5,900	25,205
Sinar Hading	7,140	2,570	6,977	3,500	17,472
Ile Padung	7,140	2,570	6,977	5,757	17,472
Tarus	3,390	1,256	4,797	10,000	17,472
Average	6,071	1,876	2,990	3,257	22,628

Note: > Each of the above indicates the value per household.
HC: Average house connection tariff, PH : Average public standpipe tariff
Income data source: BPS statistics of NTB and NTT 1999

- Impacts on PDAM Financial Management

PDAM tariff is greater than O&M costs for 3 PDAM (Menan Mataram, Lombok Timur, Sumbawa), but otherwise for 2 PDAM (Flores Timur, Kupang). The project will have a positive impact on the 3 PDAM, and a negative impact on the 2 PDAM. However, a financial assessment in the Chapter 6 concluded that incremental O&M costs are only about 2% and less than 1% for Flores Timur and Kupang respectably, which is considered negligible. GOI/district could support PDAM with subsidiaries for the increased O&M cost. Therefore the project is generally considered to be viable.

- Willingness to Pay

Willingness to pay is generally smaller than PDAM tariff, while larger amounts for willingness to pay are shown in Labuhan Mapin and Tarus.

People of Labuhan Mapin have a strongest desire for water. People of Tarus presently buy water and therefore they are aware of the price standards for water. The people in other villages who show lower willingness to pay are considered not to be aware of the real value of safe water. Comprehensive health and hygiene

education program will help people in becoming aware of the real value of safe water, which will increase the willingness to pay. This is proved elsewhere in other projects, such as Eastern Islands IKK Water Supply & Sanitation Project (EIIKK) – AusAID funded (1987-90), at Desa Maria, O'o, and Donggo in Bima, after intensive education programs, most of the people are still paying the tariff regularly.

Furthermore, as an alternative, poor households who cannot afford to pay, may be preferred to use public hydrant or public taps due to the lower prices.

- Affordability

According to the World Bank 'rule of thumb', the cost of water should not exceed 3% of total household income. Although the present willingness to pay is smaller, the hygiene and health education proposed will increase the willingness to pay to such a level as shown in Labuhan Main. Consequently, the PDAM tariffs will financially be affordable by the people.

3% of Estimated Household Income

(Unit: Rp.)

Province	Income per capita	Income per household (5 persons)	3% of Income per household
NTB	168,032	840,160	25,205
NTT	116,483	582,415	17.472

Note: 5 persons per household

(3) Financial analysis on O&M for type B&C villages

Financial analysis was also undertaken to compare the O&M cost, WTP (willingness to pay) and household income (3%) at each of the Type B&C villages.

Financial analysis on O&M for type B&C villages

(Unit: Rp/household/month)

Village	Type	O&M cost	WTP	3% of Income
Dumang, upper	C	392	1015	25,205
Bagik Papan	C	389	1000	25,205
Labuhan Lalar	B	1880	9300	25,205
Piong	B	1853	875	25,205
Kawuwu, lower	B	5704	675	25,205
Kawawu, upper	C	1115	675	25,205
Weerame	B	3792	1810	17,472
Kondamara	B	3250	1000	17,472
Oebau	B	3169	1025	17,472
Nusakdale	C	1050	1107	17,472
Average		2,259	1,848	22,111

Note: Each of the above indicates the value per household.
Income data source: BPS statistics of NTB and NTT 1999

- Tariff Settings

For the community-managed schemes, tariffs will be set to recover O&M costs only and thus the estimated O&M cost largely varies among communities due to the various types of water supply system adapted.

- Willingness to Pay

Willingness to pay in some communities is slightly lower than O&M cost at present. This is a result of the community members not fully understanding the importance of improved water supply and real value of safe water. Comprehensive educational activities will help people in becoming aware of the real value of safe water, which will increase the willingness to pay. In fact, the RRA survey has clarified that the willingness to pay was increased generally through group discussions. For an example; the Desa Nusa in Kabupaten Timor Tengah Selatan at the beginning wished to pay only about Rp. 350 per household for O&M of the photovoltaic rural water facilities; intensive educational activities were carried out; the villagers have become aware of necessity and importance of O&M; consequently they all are paying Rp. 2,500 per household for more than three years. (Rural drinking water supply using photovoltaic powered pumping system at Desa Nusa in Kabupaten Timor Tengah Selatan by Lahmeyer International, Germany).

- Affordability

A comparison between the O&M costs and 3% of estimated household income based on per capita income indicates the communities on average can afford to meet the O&M costs. Whilst this is simplistic, even if rural incomes were less than half of the provincial average the schemes would remain affordable.

9.3 Institutional Evaluation

While the primary impact of the project, in terms of the roles and responsibilities of stakeholder groups, will be on the communities themselves, there will be a large number of organizations participating in the project during implementation (mainly such as Kimpraswil, P3P, district and village organizations), and providing an ongoing role in subsequent operation and maintenance (such as PDAM and WUA/WUG). These institutions/agencies include central, provincial and district level organizations. The evaluation summarizes the significant institutional issues associated with the project implementation and longer-term operation and

maintenance. The project design provides appropriate support to key agencies during implementation and includes important capacity building initiatives to enhance sustainability.

9.4 Technical Evaluation

Technical feasibility has been evaluated in terms of technical appropriateness, O&M requirements and arrangement, land acquisition, environmental impacts and project management. The provision of gravity systems, as an alternative to a pumped system provides a means of ensuring that the poor within the communities can also have access to a water supply. Alternative and cheaper options such as public hydrants, or public tap connections, will enable poorer families to access the benefits of the proposed project at a lower cost. The technologies to be adopted for the rural aspects of the project will be considered to suit both women and men to maximize use of locally available spear parts for water supply systems. Operation and maintenance arrangements for rural water supplies will be based on approaches developed by the other donor agencies, with adjustments appropriate to local conditions, including the developed arrangements whether the PDAM management or the WUA/WUG management approaches to the communities. It is not anticipated that land acquisition and/or compensation will be a significant factor in the implementation of the project.

As a result of screening, it was determined that negative environmental impacts will be i) temporary and related to construction, and ii) related to drainage from public hydrant/tap. The scale of construction will be small and the impacts negligible. Generally, the public hydrants/taps will be used for several hours in the morning and afternoon only, with the volume taken only a few cubic meters. The volume of drainage water from each hydrant/tap will therefore be less than a cubic meter per day, having negligible impact on the surrounding environment.

9.5 Social Evaluation

The social impact of the project will be very significant and positive if community access to, and effective use of, good quality drinking water is improved. For example, the average of time spending to collect water per day per household will be shortened from the present 57 minutes to 6 minutes, and 51 minutes will be created for surplus. The benefits will be in terms of community development impacts, poverty alleviation, improved equity (including gender equity) within the

community, upgrading of community living standard, and both direct and indirect health benefits

9.6 Overall Evaluation

The financial evaluation suggests that the project is hardly justifiable if the capital investment cost should be considered for the evaluation. On the other hand, the affordability for the water is greater than the costs for maintenance, and presently lower willingness to pay can be enhanced to a reasonable level by providing a comprehensive health and hygiene education program through IEC approach. Therefore the facilities are able to be maintained once those have been constructed with external funds.

The project design provides appropriate support to key agencies during implementation and includes important capacity building initiatives to enhance sustainability.

Technologies proposed were deliberately chosen to be simple, the facilities were designed to be easy to operate and spare parts were to be locally replaceable.

The project will contribute to the villagers in satisfying one of the basic human needs and further in improving their living standards.

Based on the duly considerations of the positive impacts to the villagers, the project is considered to be viable.

Chapter 10 CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusions

1) From the nominated 44 villages, 10 villages consisting 12 projects in NTB and 7 villages of 7 projects in NTT; 17 villages comprising 19 projects in total were finally selected for the preliminary basic design.

2) In the target year of 2011, population to be served was estimated as 31,0000 in NTB and 11,000 in NTT, totaling to 42,000 in both NTB and NTT. The daily average demands were estimated to 1,570 m^3/day for 12 projects in NTB and 640 m^3/day for 7 projects in NTT, totaling to 2,210 m^3/day for all 19 projects. An average of 97 m^3/day is to be supplied to each village in 2011.

3) As the project sites are sparsely located in 6 islands, implementation in 2 phases was recommended. Due to a greater population in the narrower areas, the Plan-1 was recommended.

4) From the viewpoint of 'equal opportunity' for the two provinces, the Plan-2 was strongly wished to apply to the future implementation by the Indonesian counterparts.

5) FIRR analysis resulted in negative figures. It is therefore difficult to justify the project from a viewpoint of financial effectiveness, if the construction cost should be incurred by the beneficiaries. However, a financial balance indicates that the O&M costs are smaller than affordability of the villagers. The projects are considered viable once these are constructed.

6) In course of the Study various issues were identified on operation and maintenance of the existing rural water supply systems in NTB and NTT.

7) Many of the rural water supply systems are not properly maintained and the villagers are not adequately supplied with water through the systems. Distribution lines and public hydrants are damaged in places; empty water tanks

can be observed. Additional connections with small diameter flexible hoses without taps from public hydrants are seen. Water from such hoses is often left flowing continuously, resulting in a water shortage for villagers downstream.

8) Most Donor/Aid Agencies only provide capital/construction finance, leaving long-term operation and maintenance (O&M) responsibility to local government. However, there is no institution at province or district level with the responsibility or funding to maintain rural water supply facilities on a routine basis. There are no effective institutional services available to provide management, technical, operational, or maintenance support for present rural water supply facilities. Opinions for villagers were not always considered for the design and villagers themselves possessed only vague desires for water supply systems.

9) It is of paramount importance that villagers have to accept and welcome water supply projects from irresistible desires for clean water. A people's participation approach shall follow for sustainable operation and maintenance. The Team therefore made the proposals with a great emphasis on 'soft components' for capacity building of villagers.

10) The irresistible desires for clean water will become greater as the information and knowledge on health and hygiene increases. A comprehensive education program was proposed. The program is to be continued throughout the project period as the Team considers that improving/changing traditional hygiene practices will require continuous and long-term persistent education.

11) The proposed systems were classified to Type A, B and C in accordance with type of proposed O&M systems. It was proposed that Water Users Association (WUA) should undertake operation and maintenance work for the village level. Community management will be undertaken through the establishment of a WUA at village level. The WUA will represent all village water users. WUGs are proposed to represent the interests of village sub-groups such as individual public hydrant users or the residents of remote hamlets. Establishment of WUAs and WUGs is envisaged, regardless of the type of system (Type A, B or C).

12) Community approach was proposed to ensure the O&M activities by the villager. Consciousness of ownership and management regulation has to be established and enrooted. This process will need a continuous and persistent education and therefore this program needs long-term activities.

13) Key conclusions in relation to institutional aspects are summarized as follows. PDAM in the project area generally perform poorly in relation to service delivery and business management and there is an urgent need to clarify the institutional and policy framework within which they operate. Staffing levels are generally too high and there is a need to improve skills in some key areas particularly in management, business planning, and technical planning and operations. PDAM need to develop a customer service culture. Financial management requires substantial improvement particularly in the areas of tariff setting and debtor management.

10.2 Recommendations

1) Notwithstanding the negative financial return, it is recognized that water supply development is one of the basic human needs for insuring subsistence in the study area, due to lack of the safe and reliable water. It is recommended that the proposed water supply systems be implemented, considering the following recommendations.

2) There must be a properly established and recognized Water Users' Association (WUA), responding directly to the Kepala Desa. It must be totally involved in the selection, planning, siting, design, financing, construction, operation, management, maintenance and especially the ownership of whatever project is implemented in their village. The community must have a sense of feeling that it is their project.

3) An intensive public education and promotion campaign is essential to address the concerns over poor hygiene practices. Information, education and communication (IEC) packages on health and hygiene should be developed and delivered effectively at community level.

4) An IEC Task Force should be established at sub-district level to identify appropriate IEC materials and methodologies. The IEC Task Force should include the local Puskesmas staff, Family Health Promotion volunteers, and the Community Health Education Specialists (CHES). An IEC specialist will facilitate the IEC Task Force.

5) The social preparation, training and extension activities should be carried out simultaneously with the design works, in order to ensure the villagers' acceptance of the proposed projects. After the completion of the construction works, a one-year maintenance period should be provided during which the contractor remains liable for defect repair.

6) The soft component services are composed of health and hygiene education, community development, and PDAM capacity building. The health and hygiene education and the community development should be conducted before and during construction. The PDAM capacity building should be conducted during construction with a sufficient leading time.