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 II
MAIN REPORT

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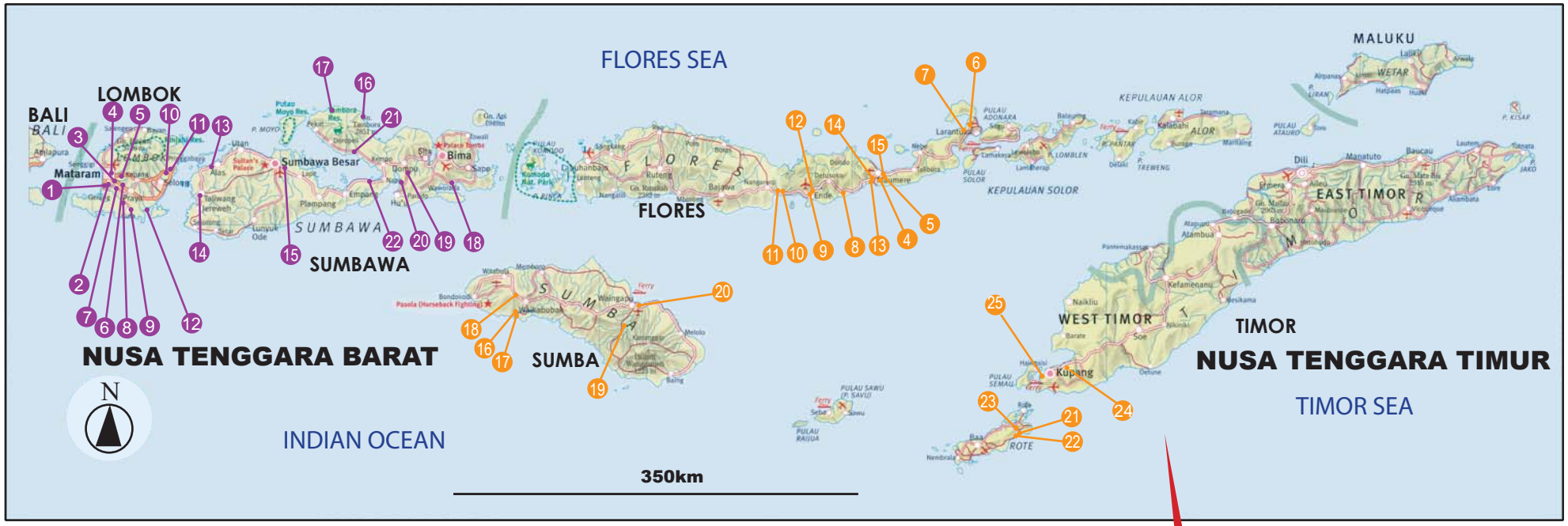
LIST OF VOLUMES

VOLUME VI SUPPORTING REPORT 4

ORGANIZATION AND MANAGEMENT

OUTLINE OF THE STUDY – Bahasa Indonesia
GARIS BESAR STUDI & SEMINAR UNTUK ALIH TEKNOLOGI

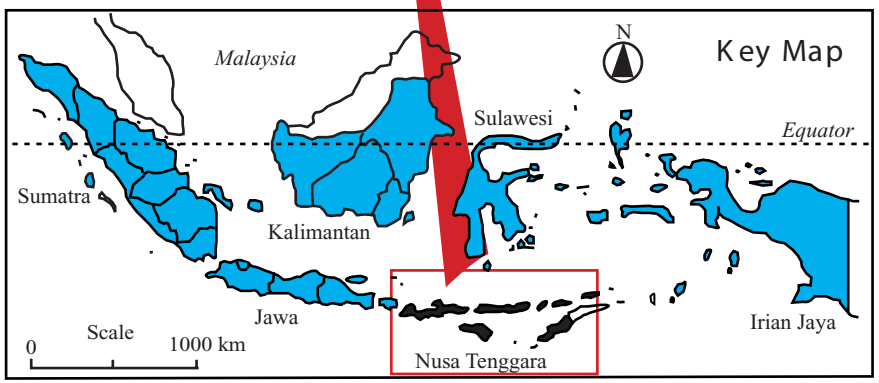


Nusa Tenggara Barat (NTB)

	< 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

SUMMARY

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.

Other negative environmental impacts of the proposed projects, such as construction-related environmental problems (e.g., noise, traffic) would be minor.

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 (kecamatan 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.

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IN
NUSA TENGGARA BARAT AND NUSA TENGGARA TIMUR

DRAFT FINAL REPORT
VOLUME II
MAIN REPORT

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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
μ g/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 of the Study

The two provinces of Nusa Tenggara Barat (NTB) and Nusa Tenggara Timur (NTT), located in the East of Indonesia, are both influenced by the Australian continental climate. This makes these provinces the driest areas in Indonesia.

The Government of Indonesia (GOI) has endeavored to develop the east region. Despite their efforts, villagers in the region still face difficulties in obtaining clean and safe water. Water supply facilities, the funding and experience for the sustainable maintenance of such facilities are not sufficiently available. People in rural areas are under severe constraints on using 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 additional safe, sustainable water supply systems is urgently required.

The Water Supply & Management Project (PPPAB) units of the two provinces have prepared expansion plans for water supply services on the basis of the targeted water supply service ratios (90% in urban areas, 80% in rural areas) determined by the former Cipta Karya (Directorate General of Human Settlements). However, the present service ratio still remains at some 57% in NTB and 54% in NTT due to insufficient financial resources.

Under the above circumstances, the GOI requested the Government of Japan (GOJ) to provide a technical and financial assistance program for the development of a rural water supply project in the Provinces of NTB and NTT. The Study on Rural Water Supply in NTB and NTT, Indonesia, is a result of that request. This report is the Final Report of the Study prepared as scheduled in the Inception Report of March 2001.

1.2 Objectives of the Study

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

1) To formulate a rural water supply development program, including an operation and maintenance plan using water sources taken mainly from groundwater and springs, within the Provinces of Nusa Tenggara Barat and Nusa Tenggara Timur.

2) To transfer technology to counterpart staffs of the two provinces through the Study.

1.3 Study Area

The Study covers 44 villages in 12 districts in NTB and NTT. The inventory and location of the 44 villages are shown on the figure titled "Location Map of the Study Area" at the front of this report.

1.4 Activities of the JICA Study Team

The study team was dispatched by JICA in accordance with the agreed "Scope of Works". The work schedule is shown in Figure 1.4.1. Fieldwork began on March 6, 2001. The Inception Report was submitted to the Director General of Urban and Rural Development, Ministry of Settlement and Regional Infrastructure (MSRI) on March 7th 2001. The JICA Study Team and representatives of the GOI discussed the methodology, the work schedule and the selection of villages for the Study. The Inception Report was accepted by the Indonesian government representatives. The JICA Study Team and MSRI signed the Minutes of Meeting on the Inception Report on March 16th 2001.

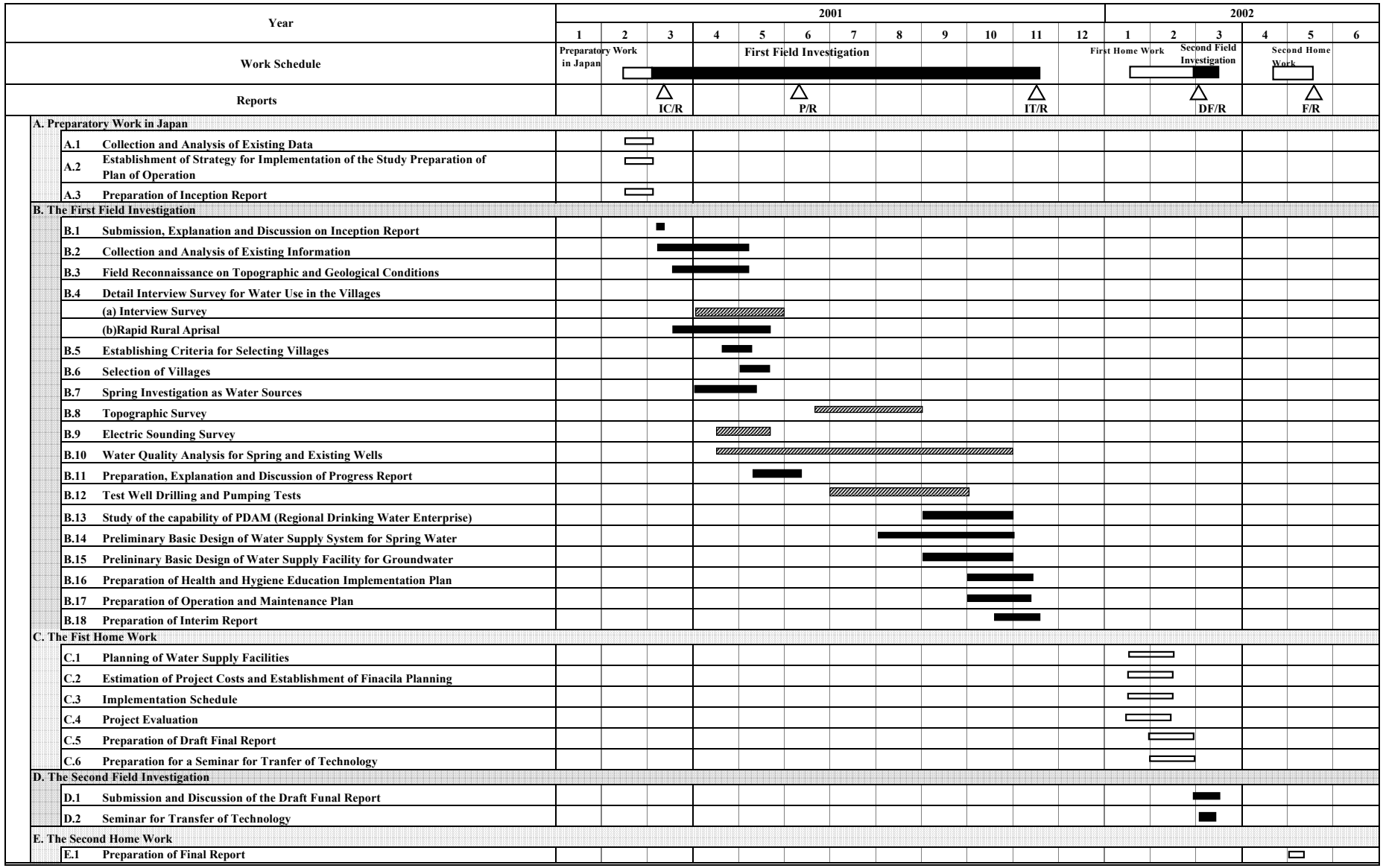
The Progress Report, which included the preliminary selection of villages recommended for basic design studies, was submitted to MSRI on June 14th 2001. The Progress Report was accepted by the Indonesian government representatives. The JICA study team and MSRI signed the Minutes of Meeting on Progress Report on June 15th 2001.

This Interim Report has been prepared at the end of the First Field Work to present the findings and recommendations resulting from this phase of the Study. The Interim Report was accepted by the Indonesian government representatives. The JICA study team and MSRI signed the Minutes of Meeting on Progress Report on November 22nd 2001.

This Draft Final Report has been prepared at the First Home Work to integrate all the study results. The Draft Final Report was accepted by the Indonesian government representatives. The JICA study team and MSRI signed the Minutes of Meeting on Draft Final Report on March 12, 2002.

In May 2002, the Final Report was prepared with reference to the comments of Indonesian government representatives through the discussion, and it sent to MSRI.

Figure 1.4.1 Work Schedule



Chapter 2 METHODOLOGY

2.1 Introduction

The 44 villages were initially classified into four types (I, II, III and IV) in order to facilitate the selection of villages for preliminary basic design, based on the conditions of present water use and potential water sources. Villages of Type I had no special issues to delay development of the project, except minor problems. Type II required confirmation of the water quantity and quality through test wells and pumping tests and confirmation of the inhabitants' willingness to pay. Type III required regional drinking water enterprise's (PDAM) sustainable operation and maintenance (O&M) plan. Type IV is not recommended for JICA projects, either because there is no water source for a water supply system, the existence of a water supply system, no demand from the inhabitants or social traditional problems.

A total of 25 villages of type I, II, and III were selected for preliminary basic design. During the progress of the preliminary basic design, a further eight villages were omitted.

2.2 Socio-economic Study

The relevant experts of the study team carried out field studies to identify the socio-economic issues related to rural water supply in the study area. An interview survey was held by random sampling methods in all 44 villages by local sub-contract under the supervision of the study team. The sample for random sampling was based on the total population in each village. Samples were collected and analyzed from 20 to 35 households per village. In addition to the interview survey, Rapid Rural Appraisal (RRA) was carried out at 7 villages by the study team.

The hygiene and health education plan, and the operation and maintenance plan for Water User's Associations (WUAs) were prepared, based on the results of the socio-economic survey and present water use conditions.

2.3 Technical Study

The technical studies included water resource evaluations and present rural water supply surveys. 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

During the field survey, water samples were taken and analyzed from 44 villages to evaluate the water quality. In addition to the field survey, six test wells were drilled to confirm the groundwater development potential based on the results of electric soundings and field survey. Pumping tests were carried out to confirm the quantity and quality at four existing water sources.

2.3.2 Rural Water Supply

Water supply engineers carried out additional field surveys from August to October 2001 to prepare the basic design for 25 villages using topographic maps of the previously selected target areas. The topographic maps were prepared by a sub-contracted local contractor. Construction planners carried out collection of cost data and prepared a preliminary implementation plan.

2.4 Institutional Study

An institutional expert carried out a study of the PDAMs concerned from September to November 2001 to analyze the capabilities of each for supporting the sustainability of rural water supply projects.

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 which curves around the Banda Sea. They lie in the transition zone of flora and fauna between Southeast Asia and Australia, as marked by the imaginary Wallace line, which passes between Lombok and Bali islands.

Geographically NTT and NTB are bounded by the Flores Sea in the north, Lombok Strait in the west, and the Indian Ocean and the Timor Sea in the south.

The vegetation in the area is not dense, most of the areas is covered by savanna, known as *alang-alang* grassland. Dense forest, secondary forest and bush are only found locally.

3.1.2 Topography

Topographically, the islands in NTB and NTT are dominated by mountainous areas with very rugged topography consisting of a number of young volcanos and old volcanic cones, particularly on the islands of Lombok, Sumbawa, and Flores. The islands of Sumba, Rote and Kupang are composed of sedimentary rocks, with only a small percentage of flat areas. The coastline of the islands varies greatly, embayments and bays are common features.

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 asl. 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 can be 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 area includes the islands of Lombok, Sumbawa, and Flores. Volcanism in these islands 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 of andesitic to basaltic composition and are composed of lava, breccia and agglomerates with intercalation of tuff and volcanic sand. Sedimentary rocks of the Tertiary to Quaternary age occur locally, mainly composed of limestone. Raised coral limestone occurs along the coast, being overlain by the youngest geological units of the alluvial and coastal deposits

The areas of sedimentary rock 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 sandy marl and tuffaceous marl, marly sandstone, tuffaceous sandstone, sandy marl, limestone intercalations, and coral limestone. These overlie the oldest sedimentary rocks of the Cretaceous age and volcanic rocks of the Paleocene age. The oldest rocks consist of greywacke alternating with shale, claystone, silty marl and clayey sandstone; associated with andesitic volcanics, while the volcanic rocks consist of lava and breccia of andesitic composition and tuff.

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.

Simplified geological maps are shown in Figure 3.1.1 and Figure 3.1.2.

3.1.4 Hydrometeorology

(1) General

The climates of NTB and NTT are strongly influenced by the continents of both Asia and Australia. The distinct wet season is related to the Asiatic northwest monsoon from November to April, whereas the dry season is related to the southeasterly Australian winter anticyclone. The islands are subjected to a prolonged dry season, with rainfall less than 250 mm, during the period from May to October.

(2) Data Collection

Hydrometeorological information for NTB and NTT was provided by the Meteorological Center in Denpasar, Bali. The information consists of precipitation and temperature observed at six gauging stations for about ten years, as shown in Appendix 2. An analysis and interpretation was made of the precipitation, temperature and evapotranspiration data, as is explained in the following sections.

(3) Data Presentation and Analysis

1) Data Presentation

The meteorological information for each gauging station is presented in the forms of; (a) precipitation, (b) temperature, (c) potential evapotranspiration and (d) water resources evaluation. Each consisting of; (i) a table of recorded data, (ii) a figure of monthly total variation in years, (iii) a figure of monthly average variation, and (iv) a figure of annual average variation, in Appendix-2.

2) Evapotranspiration

Potential evapotranspiration was calculated using the Thornthweight Method.

3) Frequency of Exceedance

Annual precipitation was plotted on normal probability papers. A Hazen Plot was applied to determine the positions of frequency of exceedance. The plotted results are shown in Appendix-2.

(4) Explanation and Interpretation

A summary of the meteorological analysis is shown in the table overleaf.

The table shows;

- at seven out of eight stations, the annual precipitation is less than the annual potential evapotranspiration,
- at seven gauging-stations, the period during which monthly precipitation is less than the monthly potential evapotranspiration continues for more than eight months.

- Statistically, five gauging stations receive precipitation of less than 1,000 mm/year once every 10 years on average (a 1/10 drought year). In particular, Waingapu receives only 586 mm of rainfall in a 1/10 drought year.

The data indicate that both NTB and NTT are under such severe conditions that water resources are considered to be extremely limited.

Summary of Meteorological Analysis

Island	Station	Annual P. (mm)			Duration of P<100mm (months)	T	Ep	P-Ep	Duration P-Ep<0 (months)
		mean	Statistic						
			Ordinary year	1/10 drought year		(°C.)	(mm)	(mm)	
Lombok	Ampenan	1,687	1,779	1,275	5	26	1,559	128	6
Sumbawa	Sumbawa Besar	1,377	1,391	966	6	27	1,641	-264	8
Sumbawa	Bima	985	1,004	755	7	27	1,816	-831	9
Flores	Maumere	980	925	715	6	27	1,949	-969	10
Flores	Laramtuka	1,202	1,208	975	6	27	1,838	-636	9
Sumba	Waingapu	801	839	586	8	26	1,644	-843	9
Rote	Baa	1,563	1,523	1,195	8	27	1,694	-131	8
Timor	Kupang	1,581	1,592	1,227	6	27	1,713	-132	8

P: Precipitation; T: Temperature, Ep: Potential Evapotranspiration

3.2 Socio-Economic Conditions

3.2.1 Rural Administration

Rural communities will be the main beneficiaries of the program. The aim is to improve community access to reliable, safe water supply facilities and to promote improved water use, sanitation and hygiene practices at the village level. In order to understand the process by which perceived community needs are identified and addressed, it is necessary to know the organizational hierarchy of local government in rural areas of Indonesia.

Local Government Project Planning Process

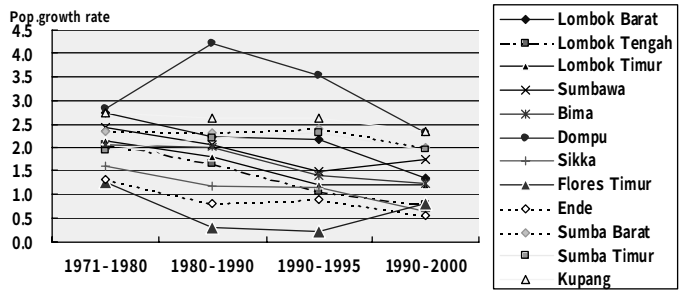
LEVEL	HEAD	PLANNING HIERARCHY	OUTCOME
District	Bupati	RAKORBANG Tk.II Development coordination meeting at District level	DUPDA List of Program Proposals at District level
Sub-District	Camat	DISKUSI UDKP Planning meeting at Sub-district level	Usulan Kecamatan Sub-district Development Proposals
Village	Kepala Desa	MUSBANGDES Musyawarah Pembangunan Desa Village Development Planning meeting	Rencana Kerja Tahunan Tingkat Desa termasuk O&M Village annual Development Plan, including O&M needs
Hamlet	Kepala Dusun	Hamlet Programming meeting	Hamlet Plan of Action, including O&M requirements
Sub-hamlet	Ketua RW/RK	Analysis of lists from RT	Sub-hamlet Plan of Action including O&M requirements
Rukun Tetangga (RT) Neighborhood	Ketua RT	List of needs	Problem identification including WUA requests

The process is "bottom-up", i.e. requests for projects to be included in the annual development project planning cycle are initiated at the user level (the Water Users' Association in the case of village-managed water supply systems) and progress up the selection and approval hierarchy for inclusion in the annual development budget.

3.2.2 Demography

According to the 1999 National Socio-Economic Survey, the total population of NTB in 1999 was 3.9 million in 860 thousand households. The population of NTT was 3.7 million in 730 thousand households. Nusa Tenggara, as a region, lies at the transition point between the Malay and Papuan racial groups and therefore exhibits very complex ethnicity. More than 50 distinct languages are spoken in the area. The percentage of the population living in rural areas is extremely high, 80% in NTB and 87% in NTT, compared with a national average of 60% (See Table 13.1 in Appendix 13).

Population Growth Rate (%) by Kabupaten, 1971-2000



Data source: Population Census 1971, 1980, 1990, Intercensal Survey 1995, Population Indonesia 2000

The population can be categorized as "young". The percentage aged between 0 and 19 years is 46% in NTB and 48% in NTT (See Table 13.3 in Appendix 13). The annual population growth rate was 1.31 in NTB and 1.92 in NTT between 1990-2000. The growth rate has varied between extremes of 0.57% in Kabupaten Ende and 2.31% in Kabupaten Dompu, as shown in the figure below.

3.2.3 Infrastructure

(1) Electricity

In 1999, 343.5 million kWh was generated in NTB and 275.9 million kWh was sold. In NTT, 179.6 million kWh was generated and 167.0 million kWh was sold. The National Electricity Company (PLN) supplies almost all the electricity in NTB and NTT. A very small proportion was supplied by other small companies, cooperatives, and local community groups.

(2) Water Supply

Water demand increases year by year. The number of customers receiving piped water supply was estimated at 62,272 for NTB in 1998, and at 57,570 for NTB in 1999. The table below shows that the drinking water is mainly obtained from wells and springs.

Source of Drinking Water by Province in 1999 (Percentage of Households)

	Pipes & mineral water	Protected wells and springs	Unprotected wells and springs	Rivers, rain water, other
NTB	14.10	65.59	19.20	1.10
NTT	19.53	42.70	29.60	8.13
INDONESIA	19.47	54.83	18.99	6.70

Source: National Socio-Economic Survey, 1999

(3) Land Transportation

The road length in NTB in 1999 totaled 7,090 km, of which 541 km were National roads, 1,870 km Provincial roads, and 4,678 km District roads. The road surface conditions are grouped into three levels; 54.9% good, 15.3% fair, and 29.8% poor. The road length in NTT in 1999 totaled 16,796 km, of which 1,244 km were National roads, 3,496 km Provincial roads, and 12,056 km district roads. The road surface conditions were assessed as; 58.7% good, 25.1% fair, and 16.2% poor.

(4) Sea and Air Transportation

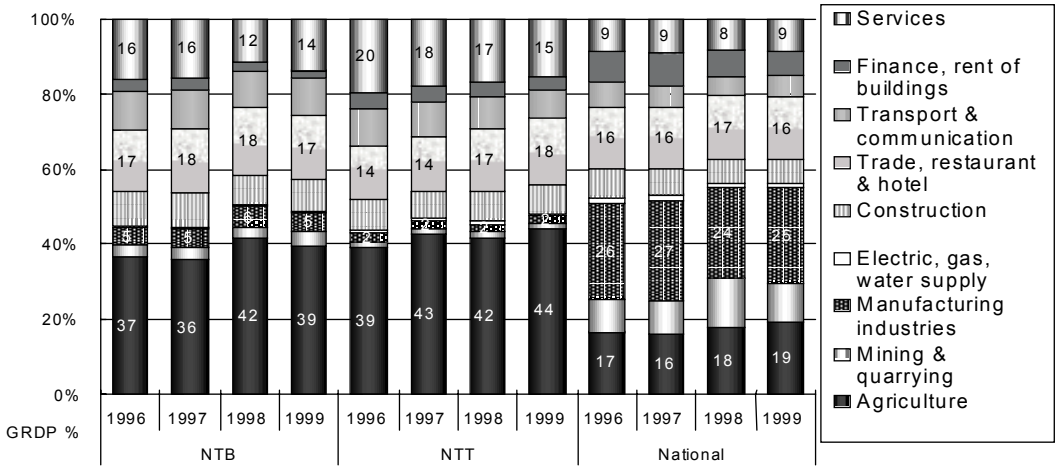
According to BPS statistics, three commercial airports exist in NTB and fourteen in NTT. The number of airplane arrivals and departures in NTB in 1999was 4,786 and 4,767, respectively; and in NTT, they were 4,599 and 4,522 respectively.

There are seven sea ports in NTB and fourteen in NTT.

3.2.4 Regional Economy

The Gross Regional Domestic Product (GRDP) figures per capita for both NTB and NTT are extremely low, Rp. 2.1 million (1999) and Rp. 1.47 million (1999) respectively, compared with a national average of Rp. 5.38 million (See Table 13.7 in Appendix 13). Primary industries are the foundation of both Provincial economies, 43% in NTB and 48% in NTT, whereas manufacturing industries are the principle sector of the National economy. The breakdown of the GRDP, as shown below, indicates that the most important economic sector is agriculture. In recent years, small industries such as food processing, weaving, pottery and tourism have become more important.

Percentage GRDP Share by Sectors - NTB, NTT and National, 1996-1999



Source: Gross Regional Domestic Product of Nusa Tenggara Barat 2000

Pendapatan Regional Nusa Tenggara Timur 1993-1999, BPS

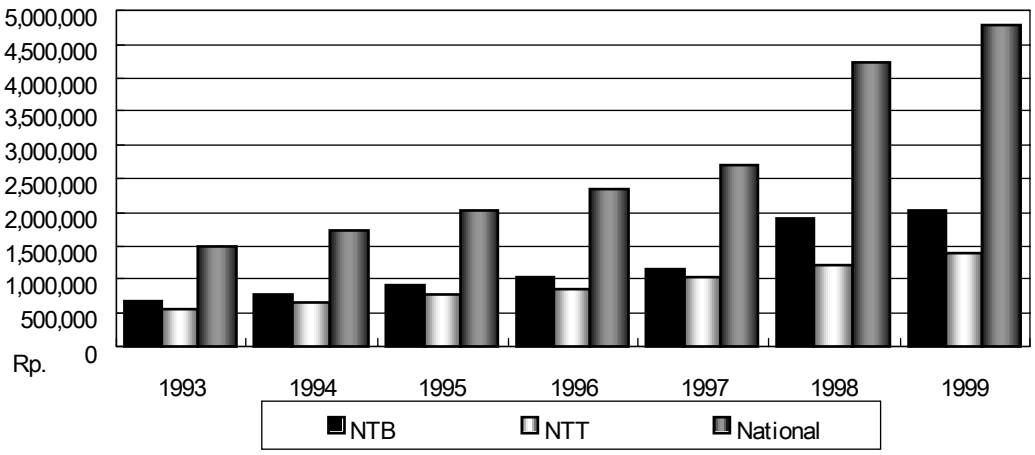
3.2.5 Household Economy

According to the Indonesian poverty profile, the percentage of poor is as high as 47% in NTT and 33% in NTB (1999), which are the second and fourth worst provinces in the country. In NTT the proportion of the rural population below the poverty line is nearly half (49.39%). The overall population below the poverty level is more than 3 million in NTT and NTB combined, or 6.3% of the poor population in Indonesia as a whole. Furthermore, the poverty population increased by 16% in NTB and NTT between 1996 and 1999 (See Table 13.11 in Appendix 13).

Income per capita figures also indicate poor household economic conditions. Average incomes per capita in NTT and NTB were respectively 29% and 45% of the national average income per capita, as shown in the figure below. Moreover the income gap between the national average and Nusa Tenggara is growing year by year (See Table 13.7 in Appendix 13).

The National Socio-Economic Survey published by the National Statistic Office, focuses on insecure working conditions in rural areas. Seventy eight percent of the villagers in NTT and 53% in NTB are unpaid workers or unstable workers. Furthermore 84% of workers in employment in rural areas in NTT and 59% in NTB are working in the agricultural sector, where employment is often casual or part-time (See Table 13.12 in Appendix 13).

Income per Capita in NTB, NTT and National 1993 - 1999



Source: Gross Regional Domestic Product of Nusa Tenggara Barat 2000
Regional Income Nusa Tenggara Timur 1993 – 1999

3.2.6 Public Health and Hygiene

Inadequate water quality and quantity, and unsanitary conditions, together with poor personal hygiene and food handling practices, continue to be a major cause of poor health in many rural communities.

The present condition of public health in NTB and NTT can be seen from the table below. The birth rates per 1,000 people in 1999 for NTB and NTT were still a considerably high 27 and 26 respectively, compared with the national average of 22. The death rates per 1,000 people is also high at 10 in NTB, whilst only 7.5 for the national average. The infant mortality rate in NTB is the highest amongst all provinces of Indonesia at 85 per 1,000 in 1998. It is also high (fourth highest amongst provinces) at 59 per 1,000 in NTT. The priority disease profile includes diarrhea, intestinal worms, water related diseases (including malaria and dengue), acute respiratory infection, and skin diseases(See Table 13.14 in Appendix 13). In the same way, other indices together show that the health condition in NTB and NTT is considerably inferior to that of the country as a whole, despite significant improvement over the past ten years (See Table 13.17 in Appendix 13).

Health Indicators in NTB, NTT and National

	Birth Rate (/ 1,000) 1999	Death Rate (/ 1,000) 1999	Life Expectancy at Birth 1999 (years)			Infant Mortality Rate (/ 1,000)	
			Male	Female	Total	1986	1998
NTB	27.28	9.68	55.96	59.45	57.76	145	85
NTT	25.69	7.29	61.25	65.03	63.20	77	56
Indonesia	22.41	7.51	63.55	67.41	65.54	71	50

Source: Estimation of demographic parameters, BPS, 1999

The principles of public health and sanitation are not well understood, either by the provider groups or the user communities. In rural areas of NTB and NTT, traditional methods of curing and preserving corn include smoking the husk above the kitchen stove. People traditionally sleep with the stove burning, using minimum ventilation to keep warm and to ward off mosquitoes. As a result many village people suffer from eye and acute respiratory infections. In many communities, women (mothers) are unable to perform their role as the agents best suited to effect improved water use and sanitation behavioral changes due to a lack of training and information. This includes the promotion of improved personal and food hygiene practices amongst family members.

The root cause of most health and hygiene problems is attributable to generally low levels of awareness and incorrect perceptions of the relationship between

water use, environmental and sanitation management issues. In order to increase awareness amongst target groups at each project location, it will be necessary to provide public education programs to promote personal behavioral changes in the following cultural attitudes and practices.

- Defecation in rivers, bushes and canals is not perceived as improper and unhealthy.
- Women, the main collectors of water, do not perceive that clean water is usually safer. They often use water from sources that are neither sanitary nor protected.
- Poor hygiene practices prevail with regard to the storage and handling of food and water in the house.
- Regular hand washing, especially before handling and preparing food, is rarely practiced.
- The importance of the proper disposal of wastewater and garbage is not understood and often not practiced.

3.2.7 Land Use and Vegetation

Because of the variety of climatic and soil conditions, land utilization has a variety of distinctive features. In NTB, over 50% of all dry lands are State forest. Comparatively, the forest covers only 7% of the land area in NTT, grassland and estates are widespread (See Table 13.19 in Appendix 13). There are extensive areas of single or double-cropped paddy in NTB and Kabupaten Kupang, but farming practice on Sumba and Flores islands is largely based on maize and cassava as the staple crops. Extensive grazing of livestock (cattle, water buffalo, horses, goats and sheep) is practiced throughout the region. A wide variety of forestry and food products (coconut, cashew, coffee, cacao, mango, banana, etc) provide important sources of income for the villagers (See Table 13.20 in Appendix 13).

3.2.8 Development Planning

(1) Rural Water Supply Development Targets

The Provincial target for rural water supply by the year 2003 is 80% for both NTB and NTT. 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 NTT: Rural water supply plan 2000-2001, Kimpraswil NTT and NTB: BAPEDEDA NTB 1999).

(2) Local Government Planning Procedures

The annual local government rural water supply development (RDWS) program is based on requests initiated at village level. The villagers develop their own proposals for development at a formal village planning meeting called Musbangdes, (Musyawarah Pembangunan Desa). These are presented at the district planning forum called Diskusi UDKP. The output of the UDKP meeting is an integrated development plan consisting of all proposed development activities, including water supply and sanitation, from the village level. The next step is the presentation of the UDKP at the annual district planning forum called RAKORBANG II (Rapat Koordinasi Pembangunan Daerah Tk.II). The outcome of this meeting is the DUPDA (Daftar Usulan Proyek Daerah Tk.II) which is submitted to the Bupati for approval.

(3) Local Budgeting and Project Selection

Not all development project requests are approved and forwarded through every stage of the annual planning process. The approved construction program for the year must, of course, match the available funding. Local government budgets at each level are divided into Routine and Development categories. The Routine Budget is funded solely from revenues generated within the district from local taxation, government owned enterprises, miscellaneous charges and trading activities. It has to fund the O&M of all existing facilities such as roads, schools, hospitals, water supply, local government buildings, staff salaries and benefits. The Development Budget, which covers all new construction, and rehabilitation, was primarily funded from central GOI sources but since 'Divolusi Provinces and districts have become increasingly more dependent on International Finance Agency and Bi-lateral Donor support.

(4) National Rural Water Supply Development Program

APBN, APBD I and APBD II is the "top-down" annual budget allocation planning cycle of the GOI. A specific budgetary allocation is made each year to support the RDWS program for new construction, rehabilitation, facility extension, major repairs and some specific O&M functions. Kimpraswil manages the RDWS budget at each level. (P3P at Tk.I.)

(5) Program Integration

It would be advantageous to integrate the JICA program with the GOI annual project planning cycle. In line with the recent 'Divolusi' decentralization mechanism, water supply planning and implementation (the construction of new systems and rehabilitation), even if funded by donor organizations, must be integrated with local program initiatives to avoid duplication and because they still have to give design and construction approval.

In order to achieve both the immediate and long-term goals of the JICA project, the implementation of new water supply facilities should be matched with other goals such as environmental, hygiene and sanitation initiatives. Integrated project planning is needed in order to complement other project activities.

3.2.9 Other Rural Water Supply Development Initiatives

The RRA identified a number of parallel development aid projects and programs currently being implemented in NTT and NTB. Kimpraswil should ensure that our project activities are coordinated with other ongoing and planned activities at provincial, district and sub-district level in order to avoid duplication and overlap.

(1) UNICEF

Coordination could be channeled through the KHPPIA program funded by UNICEF, in collaboration with local government, to implement the Communication Information Education (CIE) program, which is especially aimed at changing behavior patterns through health education to improve sanitation and waste water disposal practices. The RRA showed that many sanitation facilities have been installed at locations where no water resources are available.

(2) AusAID

The Australian Agency for International Development has recently completed a long-term program funding the FLOWS in NTT, the ESWS Project in NTB and other rural development projects, including the Women's Health and Training Program. A new water supply project is proposed to be implemented in Flores based on a feasibility study to be undertaken in early 2002.

(3) CARE

This is an international NGO, which has been working in NTB for about 25 years and in NTT about 10 years. CARE has installed water supply and sanitation facilities in many villages, including several of those surveyed by the JICA Study team. Some CARE activities were undertaken as part of AusAID projects in NTB and NTT.

(4) WVI and CCF

World Vision Indonesia and the Christian Children's Fund are also international NGOs. Both programs are located in NTT, including Desa Kondamara, Sonimanu, Oebau and Bolok. The focus of their programs is health, income generation, nutrition and sponsorship for basic education. Either of these NGOs might be considered for integrated health education in water use, hygiene and sanitation.

(5) GTZ / KFW

German Technical Cooperation is one of the implementing agencies funded by the German government. It is active in both NTB and NTT. They have four types of project being implemented in NTT (Kabupaten Alor and Kabupaten Sumba Timur) including community empowerment through dry land farming, improvement of health systems (SISKES), provision of technical assistance for decentralization, and improving health services through rehabilitation of hospitals in 12 districts. Furthermore, a drinking water project in Sumba is planned.

(6) IBRD

The Second Water Supply and Sanitation for Low-Income Communities (WSSLIC 2) Project will be a 5-year, $77.4 million project funded by International Bank for Reconstruction and Development (IBRD) to improve water supply and sanitation services in about 2,000 rural communities in six provinces of Indonesia. The project will be implemented from next year with the Ministry of Health. Communities will be responsible to finance a portion (at least 4% in cash and 16% in kind) of capital cost and 100% of the O&M cost of the water system. NTB has been selected as one of the provinces for the initial project phase and some listed communities are duplicated in the JICA studied villages.

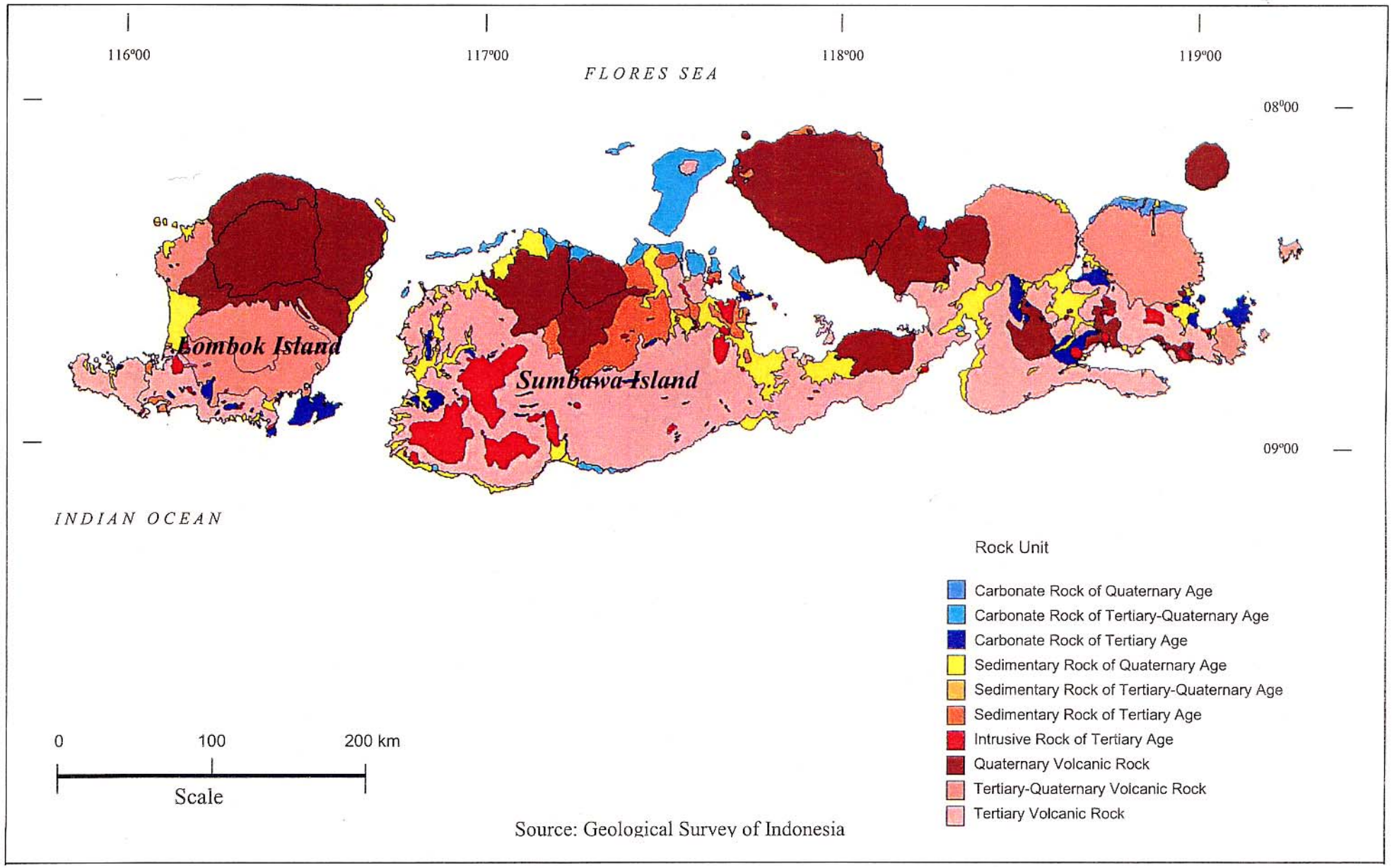


Figure 3.1.1. Simplified Geological Map of Nusa Tenggara Barat

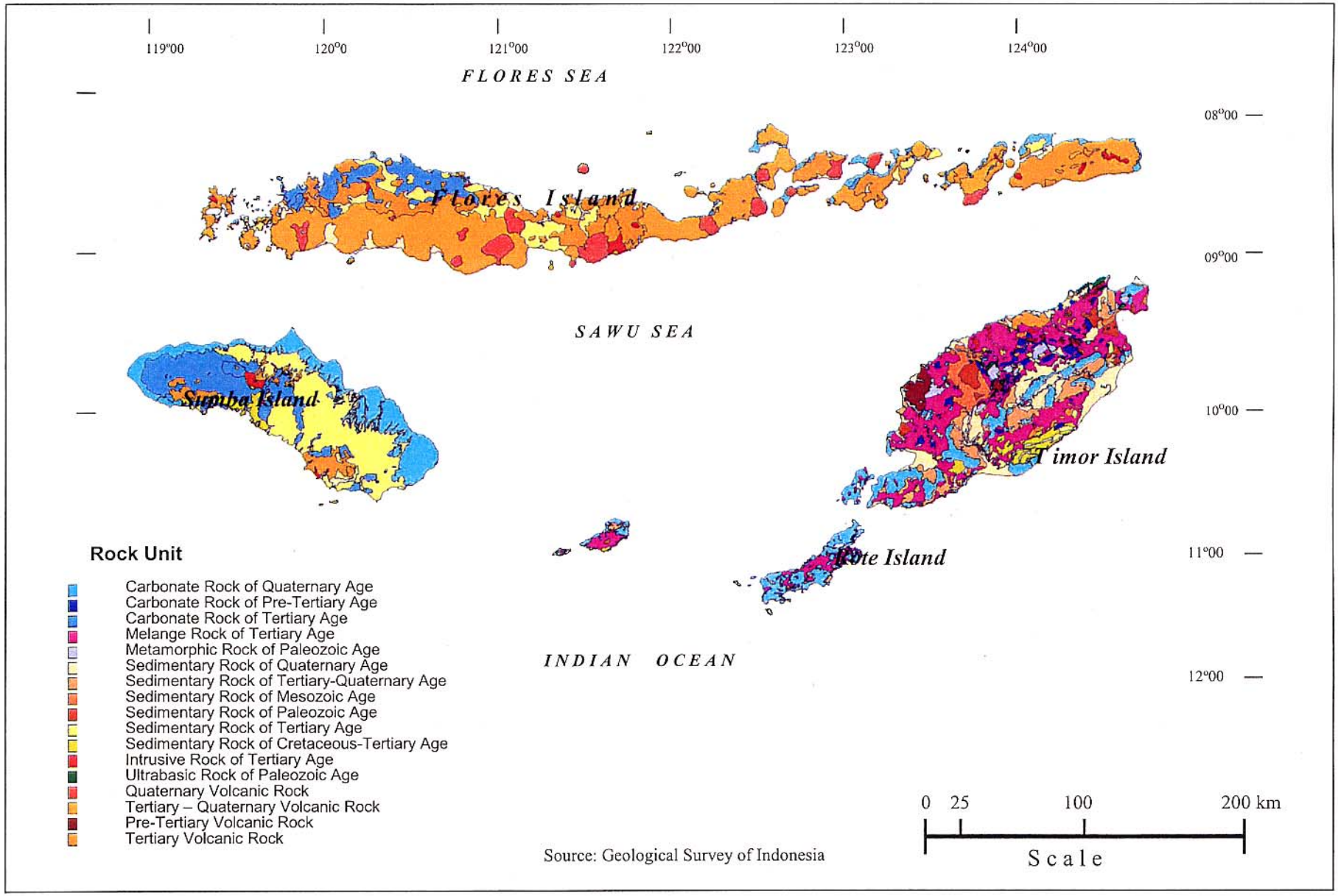


Figure 3.1.2 Simplified Geological Map of Nusa Tenggara Timur

Chapter 4 PRESENT CONDITIONS OF THE STUDY AREA

4.1 Rural Water Supply

4.1.1 Background

Human beings need water to live, so habitations only develop where there is water. Thus all villages already have a basic water supply. Indonesia has sufficient water to meet all the human and animal needs of the nation and to support agricultural requirements. The challenge is to develop the available water resources required to provide a safe and reliable level of service to the people, at a cost they can afford.

Contrary to the beliefs of many aid agencies and NGOs based in developed countries, the provision of improved drinking water supply facilities is not the top development priority in rural communities in Indonesia. They already have water, usually from the well or spring that was used by their mother and their grandmother. As small girls they became accustomed to going to the well to wash the clothes, bathe and collect enough water for drinking and cooking, every day of their lives. They are much more interested in new generation services and facilities such as electric power for light and television, a health center in the village, schooling for their children and sufficient bulk water to maintain the irrigation system.

The necessary engineering skills, technology and equipment are readily available to overcome all the collection, treatment, pumping, storage and distribution difficulties that are likely to arise in a rural environment. The problems usually lie in the areas of funding, administration, regulation, bureaucracy and the co-ordination of the activities of the many agencies involved in the sector. Rural water resource development is not technically difficult, but making it happen in Indonesia can be both frustrating and time-consuming.

4.1.2 Water Sources and Supply Systems

(1) Wells

The predominant source of water in all the villages selected for study in the JICA program is hand-dug wells. Most villages with an average population around 2,000 have some 100 wells, i.e. generally one between every four households. The majority is fitted with simple pulleys, ropes and buckets; there are very few hand pumps. There are also a number of hand-dug tube wells equipped with very small electric pumps that supply individual houses and toilets. There are no

deep boreholes equipped with turbine pumps in water supply service in any of the JICA Study villages. In some areas the water level falls seriously in the dry season and the quality sometimes becomes saline in coastal areas, but the incidence of total well failure is negligible.

(2) Springs

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. The DPU and donor aid agencies have developed some of the larger spring sources to provide piped supplies to groups of 'downstream' villages. In these instances the management, operation and maintenance of the facility has subsequently become the responsibility of the local PDAM (Perusahaan Daerah Air Minum or Regional Drinking Water Enterprise).

(3) Institutional Support Services

There are no effective GOI institutional services available to provide management, technical operational or maintenance support services to village water supply facilities or water users' associations.

It is unfortunate that most donor aid agencies only provide capital/construction finance, leaving long-term O&M responsibility to local government, which does not, in fact, have any institution at province or district level with the responsibility and 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.

Leaving responsibility for the long-term management, operation and maintenance of simple water supply installations to village water users' association would appear to be superficially beneficial as the users should have a vested interest in maintaining the system, but unfortunately the evidence does not support this. The high incidence of community managed facilities with broken pipelines, by-passed public hydrants feeding small diameter flexible hose pipes running continuously to waste, and tanks with their lids torn off standing empty is endemic and discouraging.

4.1.3 Problems with Rural Transmission Mains

Thirty-three piped water supply systems were found serving at least one village in the 44 villages originally surveyed. Some village 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.

(1) Surface Laying

Many pipelines have been 'surface laid'. This may be expedient in the case of low cost projects constructed by the villagers themselves in rocky areas, providing steel pipe is used. But few village initiatives can afford steel pipe. Surface laying cannot be accepted for PVC pipe, which becomes brittle when exposed to sunlight and thus easily damaged by animals and falling rocks.

(2) Installation Faults

Inadequate supervision often permits poor installation practice to pass unnoticed.

- Insufficient trench depth and cover.
- PVC pipe laid on rock without sand bedding.
- Poor jointing practice.
- Pipe stressed to accommodate excessive changes of direction.
- Lack of pressure testing before acceptance.

(3) Vandalism and Invasion

The predominant cause of pipeline failure is physical damage caused by persons seeking water in situations where they believe they have a right that was denied them by the system. Unfortunately it is common practice for persons who feel disadvantaged to dig up transmission mains, use a sharp heavy tool, or a hot steel rod in the case of PVC, to penetrate the pipe. They then push a small diameter pipe or garden hose into the hole. The annulus leaks and their flexible pipes are sub-divided to supply many adjacent users, all without valves or faucets, all leaking to waste continuously. When one person has done this successfully, three more follow the example, then ten etc until the village public hydrants and house connections receive no water at all. In extreme cases the exposed brittle

PVC pipe is physically smashed and the system becomes derelict. More sophisticated drilling and tapping into steel pipelines is not unknown.

4.1.4 Meters and Payment

Systems operated by PDAMs 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 (which is often caused by vandalism to the transmission pipeline by their fellow villagers). Whether due to the small amount of water actually supplied or the lack of serviceable meters and poor bill collection, the revenue from the system deteriorates progressively until the PDAM is in a loss situation. Where there is no revenue there can be no maintenance, where there is no maintenance there will be poor service and where there is inadequate service there will be no revenue and so it goes on around the circle.

4.1.5 Project Acceptance

Most people already have a sufficient supply of water within a few meters of their home, free of charge (except perhaps at the height of the dry season). 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 200 m to pay for water from a public hydrant when it is available free of charge from the well in their own compound. In many cases households will not connect to PDAM service lines due to the cost of connection, lack of confidence in the level of service that will be provided, and the monthly usage charge. Muslim ethics establish the principle that water is a gift from God and should therefore be provided free of charge, especially in gravity systems. The people will readily pay for fuel to run electric generators for lighting and television, but not for pumping water. Of course they say that they will pay, because they know that answer may get the project implemented, knowing that once constructed it cannot be taken away again, even if they subsequently fail to pay.

The only way around these difficulties 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. They must have a sense of

feeling that it is their project. There must be a written Village Action Plan (VAP) for all phases of the project cycle. If the project cannot be constructed by direct labor, contractors must employ local labor and use local materials as far as possible. Local users must be selected for training in management and maintenance and as operators of the completed system.

4.1.6 Present Technology and Facility Management

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 from 0.8 m to 2.5 m in diameter to an average depth of around 10.0 m, with extraordinary examples reaching 30.0 m and even 47.0 m in one case in Timor Barat. Linings range from the traditional buis beton to brick, masonry and even no lining at all in some cases.

Bored wells of 150 mm diameter are routinely developed to similar depths using hand augers and manually operated rotary or percussion rigs. Villagers are also able to select and install small electric pumps feeding simplistic delivery systems and they can design and construct quite sophisticated broncapterings (Any small structure built to 'capture' a water source).

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.

4.1.7 Water Supply Facility Construction, Operation and Maintenance Institutions

(1) Construction, Reconstruction and Rehabilitation

The construction, reconstruction, extension and rehabilitation of water supply facilities at village level (and all other levels) was 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.

(2) Management, Operation and Maintenance

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

assumed responsibility for the O&M of large urban facilities in provincial and district capitals. They have subsequently been directed to take over smaller urban systems and regional gravity systems that serve several communities. Currently the depressing failure statistics for even the simplest water supply installations, operated and managed by the user communities themselves, has caused provincial governors and bupati to increase the pressure on PDAMs to progressively extend their services to rural areas.

4.2 Socio-Economic Conditions and Water Use of the Villages

4.2.1. Introduction

Many people do not enjoy basic needs, including the availability of a safe and reliable supply of potable water. Problems exist in terms of access to resources, poor quality of water and insufficient quantities for basic hygiene requirements. In support of JICA's program to address some of these needs, an interview survey was carried out in the 44 villages listed for the Study. Village was collected for use in the selection of villages for water supply projects and to develop a database of project indicators as background information for improvements in the health and general welfare of rural communities.

The interview survey analysis is in line with other definitive statements on the development needs in rural villages of Indonesia. However, as noted in the Dublin-Rio Principles for Water Resources Management, it is essential that the communities identify their own needs and that all developments are in accordance with the wishes of the people, especially the principal potential users, the women.

4.2.2 Methodology

(1) Interview Survey

The methodologies used in the interview survey included household questionnaires, observation and focus group discussions (FGD) with formal and informal leaders in each village. The sample size for random sampling was based on the total present population in each village. For villages with less than 500 households the random sample for interview was 20, for 500 up to 1,000 households the sample was 25, from 1,000 to 1,500 the sample was 30, and for villages with more than 1,500 households the sample was 35. Based on the above, the sampling for villages in NTB was 25 to 35 households per village and in NTT 20 to 25 households.

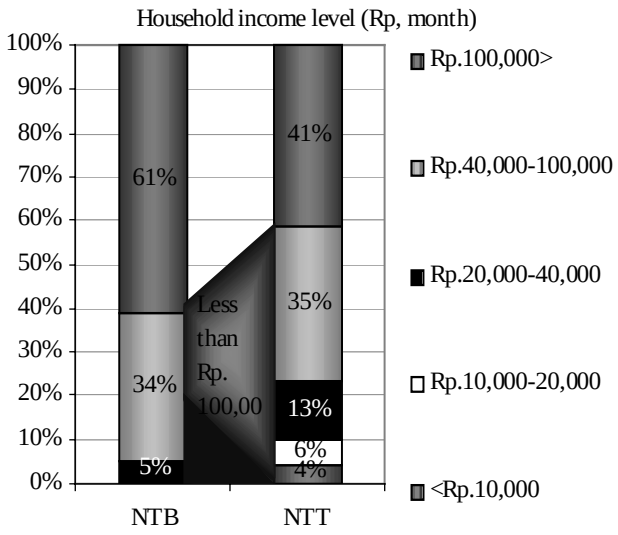
The FGDs were conducted to enable the survey team to get an overview of the knowledge, attitude and practices of water use, hygiene, level of participation, willingness to pay for water, and to identify any social conflicts in each village. The step-by-step program for the survey was established at a preparation meeting between the study team and the local contractor. This meeting set up the survey schedule and developed the methodology for the local contractor to use in training the field surveyors. The designed questionnaires were tested and revised before the interviews were conducted in the field. The results have been analyzed and a profile of each village has been completed (see Appendix 13).

(2) Rapid Rural Appraisal (RRA)

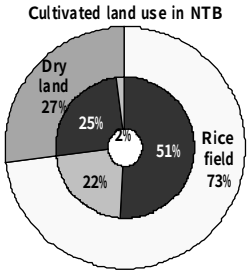
Community consultations through Rapid Rural Appraisal (RRA) were undertaken with representatives of seven villages on six islands in the project area. RRA is a term given to a range of approaches and methods that emphasize local knowledge and enable local people to make their own appraisal and analysis. Community mapping was employed to gain a situational analysis of each community (see Appendix 16). Focus Group Discussion (FGD) methodology was employed in discussions with participants to analyze the present situation of institutional, water, health and gender issues (see Appendix 15).

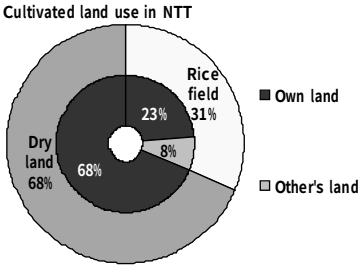
4.2.3 Socio-Economic Conditions

The majority of the people in both NTB and NTT are subsistence farmers and small coastal fishing communities. The production of sufficient food to meet household requirements requires their concerted efforts of time and energy. There are vast differences in assets and wealth in both provinces. The household income for one month was asked as shown below.

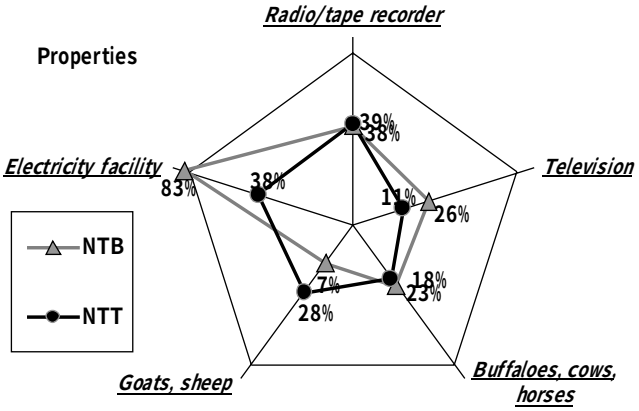


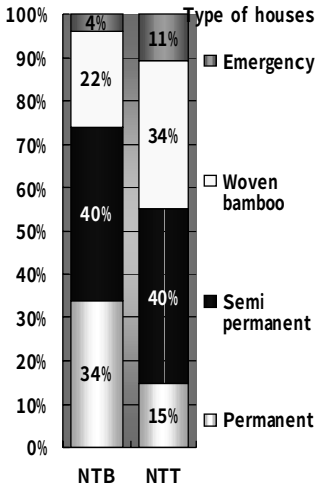
Families with income less than Rp.100,000/month represent about 60% of families in NTT compared with about 40% in NTB. One of the reasons for the lower income level in NTT is noted as the difference in agricultural production. Rice fields are predominant in NTB (73%), whereas dry land farming predominates in NTT (68%). As a social background to these income gaps, weaker and poorer groups often operate under the influence and protection of a powerful patron. Part of their production goes to maintain this relationship.





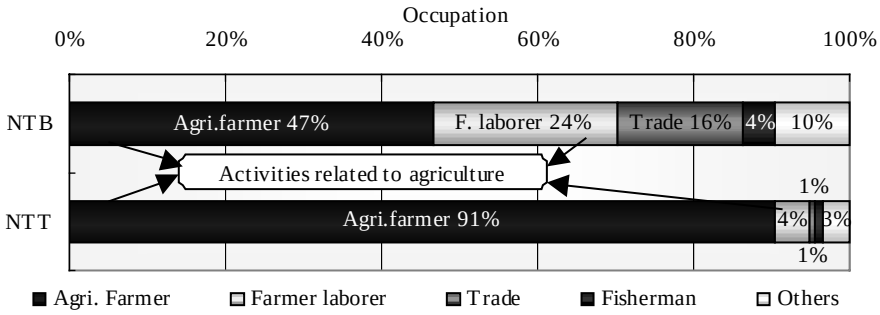
Poverty impacts on people's health through poor housing (see graph below), lack of access to clean water and sanitation facilities, health services and limited access to health/hygiene information such as that provided in schools and/or on the radio and television.





The poor living conditions are also demonstrated by the indicators of properties that are owned by a family such as radio/tape recorder, television, animal husbandry and electricity facility (see graph above).

The techniques and the technologies necessary to enhance their principal productive activities of agriculture, livestock management and fisheries are also lacking. Increased production, for example by improved seed, crop diversification and better farm to market transportation facilities, would enhance household incomes, creating the potential to improve family nutrition levels.



Markets are limited and are dominated by middlemen from outside the communities. Some communities operate largely outside the cash economy, although they may own substantial assets such as livestock in NTT or produce pottery and tobacco in NTB. The outcome of this is that in many villages and hamlets there is limited cash available for investment in water supply and sanitation facilities or for their continuing O&M. Cash contributions are likely to be small and some consideration should be given to how payments can be made through new income generating activities (IGA).

If water collection time is reduced, more time will be available for crop production and domestic and leisure activities. Labor availability will also be increased by improving health levels. People will lose less time to illness and in caring for those who are sick, and they will have more energy for work and other activities. There is the potential for strengthening existing IGAs or introducing new ones. It should be ensured that women, not only men, participate in these activities and have equitable access.

To increase the productive and income generating activities of the people there is a need for,

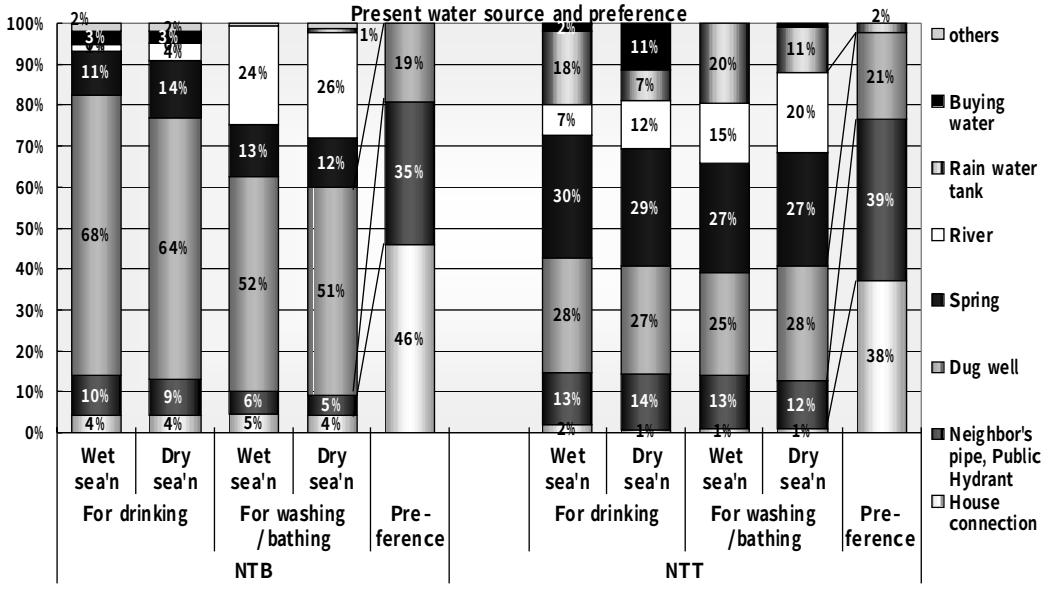
- improved production and the identification of new IGAs,
- the establishment of mechanisms for water user groups to earn income through revolving loan funds at village level,
- the employment of short term trainers in necessary skills,
- skills training to increase production quantity and quality, and
- training in improved agricultural, livestock and fisheries techniques.

The opportunities listed above would help increase the socio-economic conditions in rural villages and enable communities to pay for the O&M of water supply facilities.

4.2.4 Present Water Use

(1) System Management

The present water supply systems in both provinces are predominantly hand-dug shallow wells. Other facilities include small piped gravity systems carrying untreated water from springs, rivers and lakes to public hydrants and some house connections. The households often have a variety of water sources available to them, each with a different use (i.e. for drinking, washing/bathing, etc.). The use of these sources varies seasonally as shown in the graph below. Many people do not enjoy the present facilities and would prefer an improved water supply system such as a house connection or public hydrant.



Women have primary responsibility for water collection, carrying 10-40 liters of water at once, and usually making 3-4 trips per day. Access to water resources varied, the distances traveled per day are about 1 km in NTB and 5km in NTT. Improves water supply facilities will reduce the time and energy allocated to water carrying chores, allowing more time for productive, domestic and community activities or for leisure.

		NTB	NTT
Water collector	Women	82%	78%
	Girls	10%	12%
	Men	6%	7%
	Boys	2%	4%
Ave. times of collection / day / hhd.		3.8 times	3 times
Amount of water at one time		1 bucket	1-2 buckets
Average distance to the water source		146 meter	851 meter

There are many water supply systems, which have been built but no longer function or are only partially operational. In other places the systems only supply part of the population and have never been extended. While some of the reasons for this situation are technical, other complex issues relating to the lack of a community-based water system management organization (i.e. a WUA) are frequently underlying causes. These issues need to be addressed before creating a new system or rehabilitating an existing system. The problems are likely to be more complex and difficult to resolve when a system is rehabilitated; because the facilities already exist, local conflicts may be longstanding.

A community based management organization should be a flexible concept, not a fixed standardized formula which must be rigorously imposed. The concept must be sufficiently flexible to adapt to local conditions and community needs. The community requires time, training and support to enable it to develop the capacity to contribute to the selection, design, construction, operation and maintenance of a new water supply project. In many cases they will also have to solve serious social problems, usually connected with the need to pay for water.

(2) System Maintenance

In several of the villages surveyed, the people had not even tried to repair the hand pumps or the simple water supply systems which had been provided free of charge; they had simply reverted to using their traditional water sources when the new system broke down. Parts of some water supply facilities, including photovoltaic cells (Desa Kondamara), generators and piping (Desa Ile Padung) were taken and converted to other uses. It was found in Desa Ile Padung, Piong, Ranggu, Poto, Kawuwu and other villages that the value placed on social interaction at traditional water sources while bathing, washing clothes etc., was greater than using the newly built facilities which were closer to their houses.

Sanitation facilities were also not repaired and were under utilized, for example in Poto, Kawuwu, Batu Nampar, Bagik Papan. In the past, the GOI was usually the facilities provider. Like many NGOs and other charitable organizations, it frequently constructed water supply and sanitation facilities without any consultation or involvement of the local community.

(3) System Operation

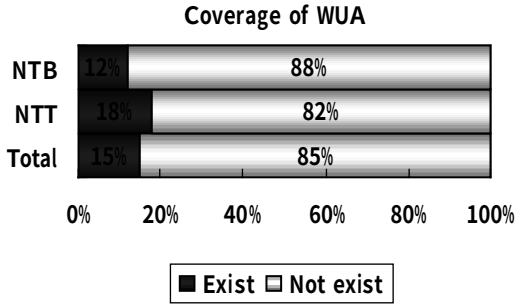
Where there is no real community demand and local involvement in all stages of project selection, implementation and management, the facility is very often viewed by the villagers as something which is an additional imposition on their

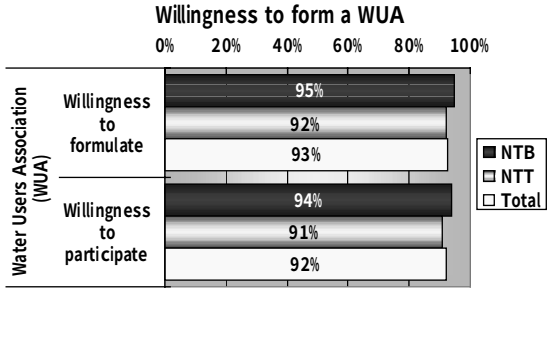
community or something which is still owned by or in the interests of the Government or the donors. They do not have any feeling of responsibility for the operation and maintenance of the facilities. When the people in the villages were asked by the survey teams, during both the interview survey and the RRA, who owned various type of facilities, they frequently responded that they did not know, or that it was owned by a government department or the agency which built it. There was frequently no formal hand-over of the system and the community did not have an opportunity or the necessary knowledge to inspect and accept or reject the completed project.

The quality of design and construction was often very poor. In several villages, the facilities that had been built have never provided water to the community. Supervising agencies often fail to even make sure that the system operates properly before authorizing the final payment to the contractor and allowing him to leave the site. The community never has the power or the authority to take any action in the matter.

4.2.5 Establishment of Water Users' Associations

A common approach to the provision of water supply and sanitation facilities has been to build the infrastructure and leave it without any organization or individual accepting responsibility to manage or even look after it. It is GOI policy to establish a WUA (Water User's Association) to assume responsibility for new





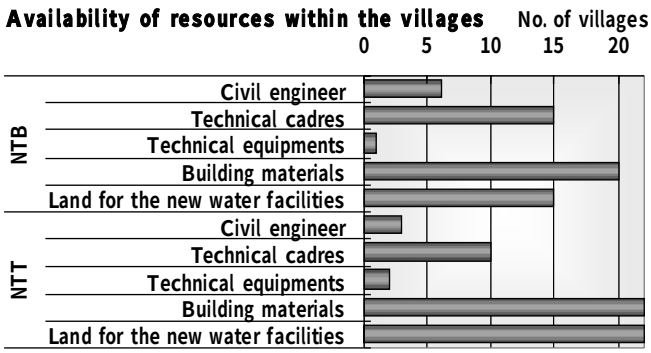
infrastructure facilities. Only 15% of WUA in the two provinces are said to currently exist. In reality most WUA were left to fend for themselves without any follow-up support for the O&M of the system, or assistance in resolving the social problems and conflicts that emerged. In several villages, the LKMD was expected to assume responsibility for water management; unfortunately this village organization was very often not active. Because of the limited existence of functioning WUA, most of the interviewed households (93%) in the surveyed areas are willing to establish and participate in a WUA for improved water supply systems.

At village level there should be a coordinating and management body composed of WUA members who represent the various social groups in the community. Women should be encouraged to take executive roles in the WUA as well as being Water Users' Group (WUG) members. Where involvement by women is difficult to obtain, discussions are required to develop other strategies. At least it should be possible for each WUA/WUG to have two or three women members for mutual support. As an alternative, women might want to form their own group with complimentary tasks to the Men's Group. The WUGs, under the coordination of the WUA, could include a repair and maintenance team, and a health and sanitation working group. An income generation group could be established to manage health and hygiene education and the mobilization of IGAs for water fee payment. In order to mobilize a WUA it must be established at the lowest level if it is to be effective. This means that each WUG should consist of women who actually live in the hamlets that are served by the system and should be users themselves.

A selection of relevant people with the necessary skills for O&M and health/hygiene promotion at village level should become members of both the WUGs and the WUAs. The function and operational procedures of the WUG/WUA need to be clearly defined and understood by all members of the community. The Community Field Officer needs to determine specific tasks and responsibilities and to work with the community to develop their own regulations for the management and operation of the system.

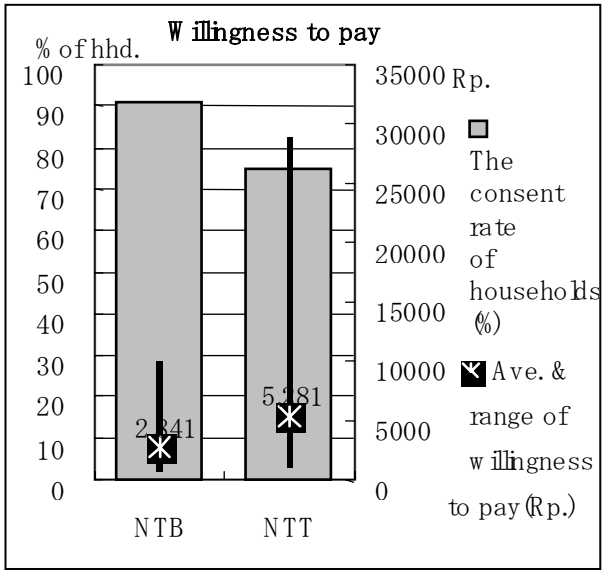
4.2.6 Affordability and Willingness to Pay

Community contributions through labor, local materials or cash during the construction of new water supply facilities is a way of increasing the community's sense of ownership and the sustainability of the program. Actually the following graph shows that many villages would donate their own land and building materials for the new water facilities.



Based on the interview survey in the 44 villages, most of the households (83%) are willing to pay for the operation and maintenance of the water supply system, if the system is implemented in their villages. This means that most of the households understand the importance of the payment for O&M of the water supply system, and are willing to pay for a system that meets their needs.

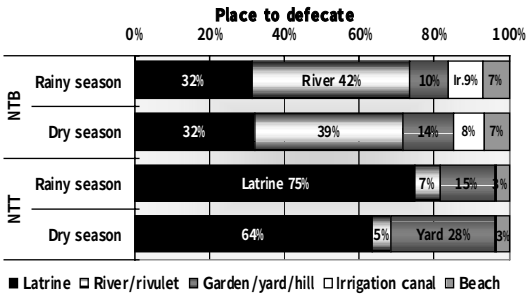
The amount to pay for water is estimated at Rp. 3,600 per month per family on average. As shown in the graph, there is a large regional variation. In NTB, it ranges from about Rp. 1,000 to 10,000, with an average of Rp. 2,800. In NTT the range is from about Rp. 1,000 to 29,000 with an average of Rp. 5,300. It is interesting that the income level in NTT is much lower than NTB, but they are willing to pay much more. Income is therefore not the only determinant of willingness to pay, even though it is often assumed to be limited to be in the range of three to five per cent of income. If a project is to be financially sustainable, the demand must come from the community. A trust building campaign will be necessary in some cases. There is strong evidence that the willingness to pay is very much influenced by the level of community motivation.

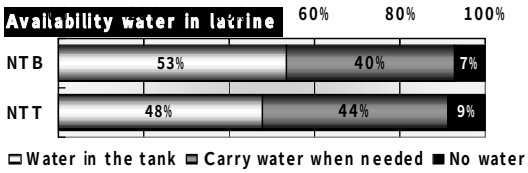


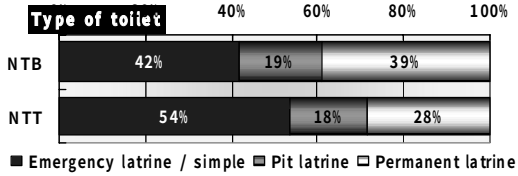
4.2.7 Health and Morbidity

In the 44 villages surveyed, latrines were either lacking or were very basic especially in NTB as shown in the following graphs. Domestic animals frequently roamed near homes and unfenced water sources. Human and animal feces lying exposed on the ground become hosts for worms and other insects which further pollute the environment with their own droppings. Diseases are very often spread by insects. Most of the existing water sources were not protected from animals. In some locations public toilets have been built but there is no mechanism for maintaining or cleaning them. Some public facilities such as health clinics, mosques and schools did not have adequate water supplies or latrines. A lot of pit latrines were inspected; there were no covers to prevent insects entering and leaving. In other cases there were covers but they were poorly fitted and would not have prevented insects such as flies and mosquitoes

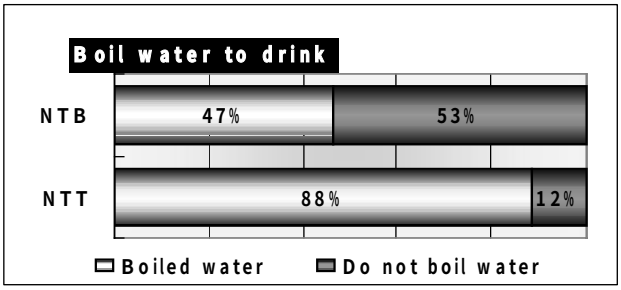
from entering and breeding. The conditions mentioned above all contribute to the high morbidity rate in both provinces.



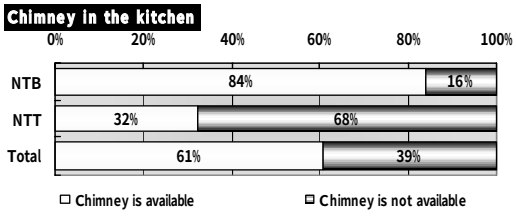


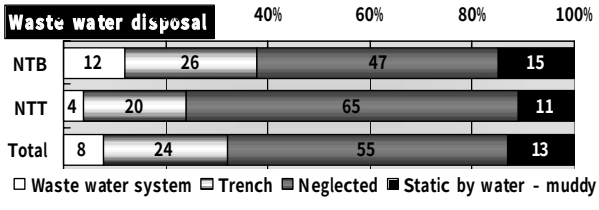


From the interview survey, poor hygiene practices and environmental health behavior are evidenced as shown following graphs and tables. Half of the households in NTB do not boil water to drink. Hand-washing practices are poor. About 68% of the surveyed households' kitchens in NTT are not equipped with hand-washing facilities. Wastewater management is generally neglected (55% of families), or inadequate. The life styles, which relate to health and hygiene, vary greatly not only between provinces but also between district and village, and the influence on health is also expected to vary. So, it is necessary to promote health education in consideration of the poor in terms of these aspects of hygiene behavior and environmental health to improve their living standards.



Descriptions	% of households
Wash hands with soap	7%
Wash hands after defecate	13%
Wash feet before going to bed	9%





Most of the surveyed villages showed a lack of health and hygiene education; There was no feed back of information to communities regarding water quality which might have enabled the villagers to be aware when their water resources

were polluted. Extra precautions could then be taken to reduce the contamination. The responsibility for routine water testing lies with Sanitarians in the Health Clinics. However, their capacity to serve the many hamlets within their work areas is very limited. No information was available as to when water testing was carried out, no health and hygiene education was provided and no results of water testing were made available to the community.

Morbidity statistics are about 30% from acute respiratory infections, 17% from malaria, 14% skin diseases, 13% from diarrhea, 6% eye infections and 6% intestinal worms. These latter conditions are consistently reported by the communities themselves. Many people do not seek medical attention unless they are very sick, because they are not used to using Government health services. They rarely use the modern western medical system due to their inability to pay. Illness such as diarrhea is accepted as a part of daily life and treatment is not sought. The cause of death is often uncertain and deaths, especially of young children, may not be reported. When they need medical services they prefer to use Dukun (traditional healers) rather than government clinics.

4.2.8 Social Issues Which Need to be Considered

(1) Social Conflict

The failure of water supply systems and the lack of maintenance are often caused by social conflict between different parties. For instance, when traditional owners of the water sources have not been consulted or have failed to reach agreement over the allocation of water, the original owners resent the use of what they considered ”their” water by others. This was seen in the interview survey at Desa Ndetundora and Desa Ngorerea Kabupaten in Ende, Desa Ile Padung in Kabupaten Flores Timur, Desa Batu Nampar in Kabupaten Lombok Timur and Desa Kawuwu in Kabupaten Bima.

Learning from the experiences above, there is a need to identify the owner or traditional user of all water sources or land over which the facilities pass and to negotiate and obtain formal agreement on the sharing of the resources, the rights and responsibilities of all parties. The agreement should be sealed with an Adat (traditional culture) ceremony attended by all parties.

(2) Project Status and Handover

In some villages, the decision as to who should receive and own the facilities was decided by powerful members of the community such as the Kepala Desa. This

was often based on political influence or family and clan identification. When supplies by-passed other hamlets which needed water, the inhabitants felt neglected and tried to take the water or disrupt the supplies. Where support from Kepala Desa had not been obtained before a project was implemented, community members often interfered with the project during construction or shortly after completion (Desa Batu Nampar, Ranggo, Piong, Kondamara and Ile Padung).

(3) Social Culture

There are many different ethnic groups in the region. Most are patrilineal and organized by lineage into family, clan and tribal groupings. In Sumba for example, men's prestige is a central element in a strongly hierarchical social life. Earning prestige may take the form of gathering and redistributing wealth, or of undertaking actions that are perceived as heroic by the villagers. Primitive cultures are still strong. Mentally most are passive, preferring to be reactive rather than to take the initiative. Until the present time, "King" behavior is still strong and might possibly be used as a channel to mobilize the community. In Kabupaten Flores Timur and Sikka the traditionally strong beliefs regarding water sources still exist, therefore the traditional ceremonials must be observed before any water supply activity is implemented. Most of the villages in NTT are dominated by traditional cultures that are very much influenced by Adat leaders and landowners.

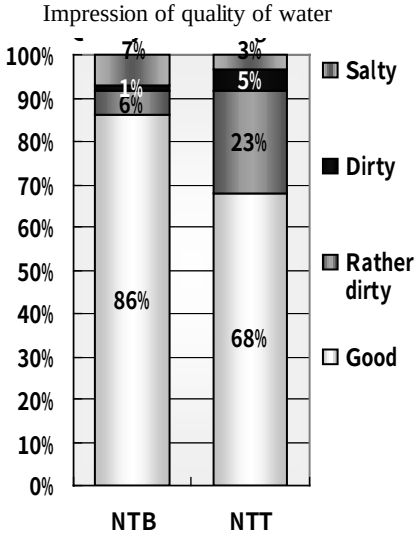
(4) Existing Water Management

The interview survey, using FGD, showed that quite often people already have rules about the use of water and hygiene practices related to water management. However, while existing traditional knowledge and rules cannot be ignored, they are not necessarily the best ones. Project interaction with the community is essential to enable people to review their traditional regulations and develop new rules if necessary. While the project might provide some improved knowledge and understandings, communities also need to be able to assess the relevance to their situation.

(5) Heath and Hygiene Issues

Cultural perceptions of what is good and what is bad for health, what is hygienic, clean, dirty and unhygienic shape people's behavior. Beliefs differ between households, local communities, ethnic groups and social groups. Perceptions about the transmission of diseases also vary. Breaking cultured traditions,

offending the spirits, seasons, various foods, poor hygiene habits and poor environmental sanitation were some of the responses when people were asked to give reasons for disease. People sometimes preferred well or spring sources over rainwater from tanks and pipes, since wells and springs were perceived to be cleaner. In fact according to the interview survey, as shown following graph, 78% of the households said that the water quality for drinking is relatively good even though the reality is not so. Dirt was identified as an important indicator of danger to health. Water which has an odor but is in fact less contaminated will be ignored in preference to water that does not smell but may be contaminated by livestock. Intensive education is required regarding personal habits, attitudes and practices, and there is an urgent need for major changes in personal behavior.



4.3 Water Sources

4.3.1 Introduction

Water sources of the 44 villages were first surveyed. Five water sources in principle were observed in each village. The field survey was followed by relevant field investigations at sites for further consideration of village selection for projects. Based on these investigations, water sources for 44 villages were evaluated.

This section presents the water sources development potential.

4.3.2 Field Investigations and Laboratory Tests

The field investigation and laboratory tests performed consist of the following activities. Among those, Vertical Electrical Sounding, test well drilling and pumping tests; and water quality tests were subcontracted to local contractors. The team carried out the others.

- Field reconnaissance (at 220 water sources of 44 villages)
- Vertical Electrical Soundings (at 400 points in 20 villages),
- Test Well Drilling and Pumping Tests for the Wells (6 test wells),

- Pumping Tests for Existing Water Sources (4 pumping tests),
- Water Pressure and flow investigation in Existing Distribution Pipes(19 measurements in 7 villages),
- Supplemental Flow Measurement of Springs in a dry season (8 springs in 8 villages),
- Water Quality Tests (224 samples)

4.3.3 Water Sources Development Potential of 44 Villages

The water source development potentials for designated 44 villages are described in the subsection. Among several water sources in a village, the most prospective water sources are presented. There are a number of villages where no suitable water sources were identified as explained below.

(1) Nusa Tenggara Barat

1) Kabupaten Lombok Barat, Lombok Island

Five target villages (Kuranji, Bajur, Sembung, Duman and Peresak) were in Kabupaten Lombok Barat.

PDAM transmission pipes pass through these villages (Kuranji, Bajur, Sembung). This PDAM water is available to those villages as a water source. In the northern part of Duman, M.A. Trawasan is located halfway up Mt. Menitig. M.A. Pura Petong is located in the north of Peresak. These springs, originating in young volcanic products, are also available as water sources.

(i) Kuranji (NTB#1)

Water Source: A PDAM distribution line

Volume: Approximate 25.7 L/sec in 200 mm dia. pipe

Quality: Within Indonesian standards

(ii) Bajur (NTB #2)

Water Source: A PDAM distribution line

Volume: Approximate 66.7 L/sec in 300 mm dia. pipe

Quality: Within Indonesian standards

(iii) Sembung (NTB #3)

Water Source: A PDAM distribution line

Volume: Approximate 170 L/sec in 400 mm dia. pipe

Quality: Within Indonesian standards

(iv) Duman (NTB #4)

a. Upper

Water Sources: Water from M.A. Trawasan at a higher place than the existing broncaptering

Volume: More than 30 L/sec in the wet season, approximate 4 L/sec in the dry season

Quality: Coliform bacteria was detected at M.A. Trawasan. Other items were within the Indonesian Standards.

b. Lower

Water Source: A PDAM distribution line

Volume: Approximate 2.1 L/sec in 150 mm dia. pipe

Quality: Within Indonesian Standards

(v) Peresak (NTB #5)

Water Sources: M.A. Pura Petong for a western portion, several springs or PDAM transmission main for an eastern portion

Volume: M.A. Pura Petong yields 23.9L/sec

Quality: Coliform bacteria was detected.

It was finally confirmed that the villagers are not interested in a water supply system. No project is required.

2) Kabupaten Lombok Tengah, Lombok Island

Four target villages (Jelantik, Labulia, Setanggor and Rembitan) were in Kabupaten Lombok Tengah.

The geology of these villages is of Pliocene Tertiary – Pleistocene Quaternary age and Miocene Tertiary age. The permeability of the rocks is low. Aquifers are limited to weathered zones only and overall hydrogeological conditions are poor. No reliable groundwater sources are available in this area.

(vi) Jelantik (NTB #6)

Water Sources: A planed PDAM regional system or an existing tube-well

Volume: Yielding capacity of the tube-well not known, interpreted as 'poor'

Quality: Water from the tube-well is 'good'

A PDAM regional system of Kab. Lombok Tengah is planed to cover this village. No short-term project is possible.

(vii) Labulia (NTB #7)

No developable water sources were identified. The same PDAM regional system as the above is planed to cover this village.

(viii) Setanggor (NTB #8)

No developable water sources were identified. The PDAM regional system same for Jelantik is planed to cover this village. No short-term project is possible.

(ix) Rembitan (NTB #9)

No developable water sources were identified. The PDAM regional system same for Jelantik and Setanggor of Kab. Lombok Tengah is planed to cover this village. No short-term project is possible.

3) Kabupaten Lombok Timur, Lombok Island

Three target villages (Bagik Papan, Selaparang and Batu Nampar) were in Kabupaten Lombok Timur.

The geology of Bagik Papan and Selaparang consists of Quaternary young volcanic products. Many of the springs on the volcanic mountain slopes are already utilized for irrigation and water supply schemes. M.A. Balas-I is already in use for a water supply system in Desa Bagik Papan and M.A. Lemor supplies a PDAM regional gravity system, which includes Desa Selaparang.

The geology of Desa Batu Nampar consists of volcanic rocks of Tertiary age. Aquifers are limited to weathered zones only. No reliable water sources are available in the village.

(x) Bagik Papan (NTB #10)

Water Source: M.A. Balas-I

Volume: Approximate 8.0 L/sec in the wet season, 8.0 L/sec in the dry season

Quality: Coliform bacteria was detected. Other items were within the Indonesian Standards.

(xi) Selaparang (NTB #11)

Water Source: M.A. Lemor

Volume: Approximate 355 L/sec in the wet season, 250 L/sec in the dry season

Quality: Within the Indonesian Standards. No coliform bacteria were detected.

(xii) Batu Nampar (NTB #12)

No developable water sources were identified. A new PDAM system already exists. No new projects are required.

4) Kabupaten Sumbawa, Sumbawa Island

Three target villages (Labuhan Mapin, Labuhan Lalar and Poto) were in Kabupaten Sumbawa.

The geology of Labuhan Mapin consists of unconsolidated Quaternary deposits underlain by tuff breccia of Miocene and Tertiary age. The hydrogeological condition is "good". M.A. Remas located more than 10 km south of the village, is being used for a PDAM regional system supplying water to several nearby villages, including Labuhan Mapin.

In Desa Labuhan Lalar, limestone of Tertiary age is distributed in the south of the village. The limestone may bear groundwater. Desa Poto is located on a low alluvial plain, river terraces and hilly areas. Groundwater may be available in the alluvial deposit.

(xiii) Labuhan Mapin (NTB #13)

Water Source: M.A. Remas

Volume: 6.9 L/sec in wet season, but not all springs were collected by the broncaptering. 11.0 L/sec in dry season, when all springs were captured.

Quality: Coliform bacteria were detected. Other items were within the standards.

(xiv) Labuhan Lalar (NTB #14)

Water Source: JICA Test Well TW-01

Volume: 3.5 L/sec

Quality: All items tested were within Indonesian Standards.

(xv) Poto (NTB #15)

Water Source: JICA Test Well TW-02

Volume: 0.8 L/sec

Quality: Na, Cl and SO_4 exceeded the Indonesia Standards. EC recorded 814 mS/m indicating TDS more than 5000 mg/L that exceeds the standards.

An insufficient volume of unsuitable quality water is all that was available from borehole TW-02. No water sources were available.

5) Kabupaten Bima, Sumbawa Island

Three target villages (Piong, Labuhan Kenangga and Kawuwu) were in Kabupaten Bima.

Desa Piong is located at the very end of the foothills of Mt. Ramu, formed in the Pleistocene Quaternary age, which forms a good aquifer. Six tube wells were developed by P2AT for irrigation purposes. The tube wells yield about 20.0 L/sec with SC 5.0 – 34.0 L/sec/m. A new deep well can be developed for a water supply system.

Desa Labuhan Kenangga is located on a very end of the foothills of Mt. Tambora. M.A. Nanga Nae, located 600 m to the southeast of the village, is being used as a source for piped water. A water supply system has been completed.

The geology of Desa Kawuwu consists of volcanic rocks of Miocene Tertiary age and terrace deposits. The terrace deposits, mainly comprised of boulders, are a good aquifer. M.A. Mpabeda is already the source for a piped system in the northern village. This spring will continue to be utilized as a water source for an improved and extended system.

(xvi) Piong (NTB #16)

Water Source: A new borehole is to be constructed. The hole should be located at the southern end of the residential area of the village, drilled to a depth of 70 m approximately.

Volume: The maximum requirement 2.0 L/sec can be supplied

Quality: No saline intrusion is anticipated. Water quality testing is recommended following construction of the well.

(xvii) Labuhan Kenanga (NTB #17)

Water Sources: M.A. Nanga Nae

Volume: 103 L/sec

Quality: Coliform bacteria was detected.

It was confirmed that there was no water supply problem in the village. No projects were required.

(xviii) Kawuwu (NTB #18)

a. Lower

Water Source: A new borehole is recommended, that should be located at the area of confluence of the main river and a tributary, in the southeast of the village, to a depth of 10 m approximately. A centrifugal pump at the surface suites the well.

Volume: The maximum requirement of 0.7 L/sec can be supplied.

Quality: Bacteria may be detected. Water quality testing is recommended following the well construction.

b. Upper

Water Source: M.A. Mpubeda

Volume: Approximately 1.5 L/sec in the wet season, 0.5 L/sec in the dry season

Quality: Coliform bacteria were detected. Other items were within the Indonesian Standards.

6) Kabupaten Dompu, Sumbawa Island

Four target villages (Ranggo, Jambu, Hodo and Kwango) were in Kabupaten Dompu.

The geology of Desa Ranggo consists of terrace deposits underlain by volcanic rocks of Tertiary age. Volcanic breccia can be good aquifers.

Desa Jambu is surrounded by undulating hills, on a coastal plain. Three groundwater development project (P2AT) tube wells were drilled near the coast 6.0 km to the south of the village. They show a good production rate (15.3 – 21.3 L/sec).

Desa Hodo is located at the very edge of the foothills of Mt. Tambora. M.A. Hodo, at the coastline, yields 294 L/sec. No habitants were observed. No projects were identified.

The geology of Desa Kwangko consists of the older andesitic volcanic products of the Pleistocene Quaternary, originating from Mt. Tana Mera. A tube well in the village, already supplies an existing water supply system.

(xix) Ranggo (NTB #19)

Water Source: Boreholes including the JICA Test Well TW-03

Volume: 2.8 L/sec is available from TW-03.

Quality: Within Indonesian Standards

The volume from TW-03 was not sufficient to satisfy the maximum demand of 7.37 L/sec. More boreholes are required. In the course of the study (September 2001), P3P NTB – the counter part of the Team started a tendering procedure, without any notice to the Team, for the re-construction of the gravity pipeline from Water Treatment Plant of Dompu. A new JICA project is now not required.

(xx) Jambu (NTB #20)

Water Source: JICA Test Well TW-04

Volume: 1.5 L/sec

Quality: Mn, Na and Cl exceeded the Indonesia Standards. An EC of 341 mS/m was recorded, TDS converted from ES exceeds the Standatds. The water is saline. Water quality is not suitable for drinking purposes. No project are possible.

(xxi) Hodo (NTB #21)

Water Sources: M.A. Hodo

Volume: 294 L/sec

Quality: Unacceptable

M.A. Hodo is a major spring on the seashore, a minor tourist attraction and a stopping-off place for the travelers. There is no community and no village. No projects are required.

(xxii) Kwango (NTB #22)

Water Sources: PDAM Deep Well

Volume: 1.5 L/sec

Quality: Within the Indonesian Standards

Water is available at existing deep well. No project are possible.

(2) Nusa Tenggara Timur

1) Kabupaten Sikka, Flores Island

Five target villages (Mekendatung, Kokowahor, Hepang, Bloro, Watuliwung, and) were in Kabupaten Sikka. The geological conditions and the very dry meteorological condition indicate that water sources in this region are very limited in those villages. Among those a privately owned P2AT borehole was identified in a village Desa Kokowahor. Detail of the well was not known.

(xxiii) Mekendatung (NTT #4)

No developable water sources were identified.

(xxiv) Kokowahor (NTT #5)

Water Source: P2AT IKI-05.

Volume: Approximate 4.5 L/sec.

Quality: Within the Indonesia standards

The borehole P2AT IKI-05 was monopolized by a hamlet where the borehole is located. No attempt to solve the problem is expected. No project is possible.

(xxv) Hepang (NTT #13)

Water Source: JICA Test Well TW-5

Volume: No appreciable production was obtained.

Quality: The pH exceeds the standard.

Geology was found to be very permeable to depth. No substantial groundwater is available in the hillside. No project is possible.

(xxvi) Bloro (NTT #14)

No reliable water sources were identified. No projects are recommended.

(xxvii) Watuliwung (NTT #15)

Water Source: JICA Test Well TW-06

Volume: No appreciable yield was obtained.

Quality: Fe exceeded the Indonesian standard.

An existing P2AT borehole is located some 500 m toward the coast. The hole was once used for drinking purposes and the pumping system is still operative for irrigation purposes. The villagers gave up drinking the water because it tasted 'no-good' due to high Na content. Only unpalatable water is available near coastal areas and no substantial groundwater is available at higher levels. No projects are possible.

2) Kabupaten Flores Timur, Flores Island

Two target villages (Sinar Hading and Ile Padung) were in Kabupaten Flores Timur. The two neighboring villages are underlain by older volcanic products of Pleistocene Quaternary age. In Desa Sinar Hading, there are no tube wells, though a hot spring was identified. In Desa Ile Pading, three springs were identified. One of these, M.A. Wai Langu, produces 30.0 L/sec, which is sufficient for both villages.

(xxviii) Sinar Hading (NTT #6)

Same as Desa Sinar Hading. See below.

(xxix) Ile Padung (NTT #7)

Water Source: M.A. Wai Langu in Desa Ile Padung

Volume: Approximately 59 L/sec in the wet season, 20 L/sec in the dry season

Quality: Within the Indonesian Standards. Coliform bacteria were not detected.

It was reported that an agreement has been reached between Desa Sinar Hading and Ile Pading on co-using the spring.

3) Kabupaten Ende, Flores Island

Five target villages (Watuneso, Borokanda, Bheramari, Nggorea, and Ndetundora-I) were in Kabupaten Ende. Potential and developable water sources were identified in each village. For the cases of Desa Borokanda, Bheramari and Nggorea, usable springs were identified in neighboring villages. In Desa Ndetundora I water sources are available, a social issue may prevent the development of a new water supply system.

(xxx) Watuneso (NTT #8)

Water Sources: springs in another village about 7 km

Volume: 2L/sec available for the village

Quality: Coliform bacteria was detected.

The spring is located in a mountainous area about 7 km distant. Proper maintenance of the long pipeline is required. This is not accepted as a viable, sustainable solution. No project is recommended.

(xxxi) Borokanda (NTT #9)

Water Source: Springs in other Desa Embria

Volume: 2.0 L/sec. Considerable seasonable fluctuation is possible

Quality: Coliform bacteria was detected.

As the spring is located in another village, water supply facility has to be constructed in this village too, which is out of Scope of the Study. Water volume may not be sufficient for two villages. No projects are recommended.

(xxxii) Bheramari (NTT #10)

No reliable and developable water sources were identified. No projects are possible.

(xxxiii) Nggorea (NTT #11)

Water Source: M.A. Maurongga in a neighboring Desa Raporenda

Volume: 10.0 L/sec

Quality: Coliform bacteria was detected.

As the spring is located in another village, water supply facility has to be constructed in this village too, which is out of Scope of the Study. No projects are recommendable.

(xxxiv) Ndetundora-I (NTT #12)

Water Source: Springs

Volume: in a rang from 0.4 – 6.0 L/sec

Quality: Coliform bacteria was detected.

A PDAM water supply system was once constructed, is now no longer operative. The villagers are unwilling to have a water supply system. No projects are recommended.

4) Kabubaten Sumba Barat, Sumba Island

Three target villages (Patialadete, Welebo, Weerame) were in Kabupaten Sumba Barat.

Desa Patialadete and Desa Pulupanjang have no developable water sources. In Desa Weerame, abundant underground water was located in a limestone cave. In Desa Welebo there is a developable spring from the viewpoints of volume and quality, but a very traditional village uses the source exclusively for other purposes. Development of this spring may instigate social conflicts.

(xxxv) Patialadete (NTT #16)

No reliable and developable water sources were identified. No projects are possible.

(xxxvi) Welebo (NTT #17)

Water Sources: M.A. Wee Karara

Volume: 3.0 L/sec

Quality: Coliform and bacteria were identified. Other items are within the Indonesian Standards.

The spring is being used exclusively by a very traditional village and consecrated. Bringing water from the spring will instigate social problem. No projects are recommended.

(xxxvii) Weerame (NTT#18)

Water Source: M.A. Wee Paneru

Volume: More than 9.0 L/sec

Quality: Coliform bacteria were detected. Other items were within the Indonesia Standards.

5) Kapubaten Sumba Timur, Sumba Island

There are two target villages (Kondamara, Pulupanjang) were in Kabupaten Sumba Timur. In Desa Kondamara, a spring yielding some 30 L/sec is available. A malfunctioning water supply system was identified using the spring. No reliable water sources were identified in Desa Pulupanjang.

(xxxviii) Kondamara (NTT #19)

Water Source: M.A. Lailama

Volume: 28 L/sec in the wet season, 25 L/sec in the dry season.

Quality: Coliform bacteria were detected. Other items were within the Indonesian standards.

(xxxix) Pulupanjang (NTT #20)

No reliable and developable water sources were identified. No projects are recommended.

6) Kabupaten Kupang, Rote Island

Three target villages (Oebau, Sonimanu and Nasakdale) were in Rote Island. All villages are located in a raised coral limestone terrain, which can bear cave water.

In Desa Oebao there is a cavern from which cave water can be lifted. In Desa Nasakdale a spring yielded some 5.0 L/sec. Half of the water may be developable, subject to confirmation of capacity in the dry season. In Desa Sonimanu, although three springs were developable, pumping costs may be excessive due to high pumping head.

(xl) Oebau (NTT #21)

Water Source: Cave water in limestone

Volume: 5 L/sec confirmed by a pumping test

Quality: Coliform bacteria were detected. Other items were within the Indonesian standards.

(xli) Sonimanu (NTT #22)

Water Sources: M.A. Vuvuno

Volume: 5.0 L/sec

Quality: Coliform and bacteria were identified. Other items are within the Indonesian Standards.

A pumping height of 80 m is necessary. This requirement is deemed unrealistic for a village with a total population of only 600.

(xlii) Nusakdale (NTT #23)

Water Source: M.A. Meakoen

Volume: More than 2 L/sec in both the wet and the dry season

Quality: Coliform bacteria were detected. Other items were within the Indonesia Standards.

7) Kabupaten Kupang, Timor Island

Two target villages (Tarus and Bolok) were investigated. In Desa Tarus there is a spring (65 L/sec) that is presently utilized by PDAM. The spring can be further developed.

In Desa Bolok there is a P2AT borehole with a local water supply system, which is now inoperative. The P2AT borehole and the associated system could be re-activated and extended. .

(xliii) Tarus (NTT #24)

Water Source: M.A. Tarus

Volume: 25.0 L/sec (official record)

Quality: Coliform bacteria were detected. Other items were within the Indonesian standards

(xliv) Bolok (NTT #25)

Water Source: P2AT borehole BPM-22

Volume: 9 L/sec, confirmed by the pumping test

Quality: Within the Indonesian standards

A comprehensive regional water supply system has been constructed with funds from various sources. The system, using M.A. Oenesu located in neighboring Desa Oenesu, supplies water via a 10 inch dia. delivery pipe through our target hamlets in Desa Bolok down to the harbor area. New projects are therefore not required.

Chapter 5 WATER SUPPLY DEVELOPMENT PLAN

5.1 Selection of Villages for Preliminary Basic Design

5.1.1 Criteria for the Selection of Villages

(1) Village Identification

The Study Team surveyed all 44 villages during the period from April to June 2001. The conclusions are summarized in Tables 5.1.1 to Table 5.1.6.

(2) Village Boundaries

Local government administrative boundaries are changing rapidly, in particular many sub-districts have been sub-divided and village borders are being adjusted, primarily reduced, continuously. It was decided that the study has remained committed to the named village, even in cases where the area and the potential population to be served have been reduced dramatically. In some cases water sources selected for development during the study by the preparatory mission are now located in a different village. In other cases the main concentration of the needy population is no longer within the nominated village boundaries. These circumstances have led to the cancellation of some otherwise viable projects.

(3) Requirement

It is obvious to state that the primary criteria for the development of new water supply facilities is that there must be a requirement. This was not the case in all of the nominated villages. There was one location where there was no community living in the area and in many cases a piped supply system was already being provided by other agencies (Kimpraswil, P3P, PDAM, NGOs or the community themselves).

(4) Demand of the People

The second most important selection criterion is that the people themselves must request and welcome the proposed project. In several instances the community was quite satisfied with the prevailing situation and did not want a water supply project.

(5) Community Participation

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. Very few of the study villages actually have a formally established WUA (Water User' Association) in place, but the team was able to obtain verbal assurances from women's groups in all villages that they would form WUGs, a WUA and prepare VAPs (Village Action Plans) if and when JICA committed to implementing a water supply scheme in the village. Assistance and support in this area must be an integral part of the Scope of Works for the final design phase of this project.

(6) Water Sources

Technical criteria for the study require that

- only springs and wells that can be protected from contamination and percolation are permitted for development,
- all selected sources must provide a reliable stable quantity, sufficient to meet the required demand at all stages of the seasonal cycle,
- the water must meet the minimum standards for all quality criteria, and
- the selected source must be located within the same village boundaries as the potential user community. Some minor relaxation of this criterion was allowed where the Study Team was assured that a source was of no potential value to the community in which it was located (it was of low level, or other adequate sources had already been developed) and the Kepala Desa confirmed that there was no objection.

(7) Facility Design Considerations

The long-term sustainability of the proposed facilities, coupled with the ability of the community to pay pumping and O&M costs, were taken into consideration, particularly in cases where alternative development schemes were available for consideration. The following situations were not recommended for the preliminary basic design.

- Excessively deep boreholes requiring shaft-driven turbine pumps.
- Cases where excessive pumping from a low-level spring would clearly be uneconomical and beyond the community's ability to pay.
- Very long exposed transmission mains that would pass through hamlets too small to justify a supply facility.

- Impractical pipeline routes through rocky areas where maintenance and sustainability could not be assured.
- Projects that, although technically possible, would be too large in scope, cost or sophistication to be considered as appropriate technology in a rural setting.

5.1.2 Selected Villages

Application of the above criteria and considerations reduced the initially nominated 44 villages to the 25 as shown in tables 5.1.1 through 5.1.6. Type IV villages in the tables are not recommended for the further studies for any of several reasons: there is no water source suitable for a sustainable water supply system, there is already a PDAM/community water supply system, there is no demand from the inhabitants, no inhabitants, or social tradition problems. In fact, 28 schemes were originally recommended for the preliminary basic design, as two distinct projects were recommended in three of the larger and more diverse villages.

These 28 projects were categorized into three groups.

- Type I 4 recommended projects which met all the above criteria. No procedural, administrative or technical problems was foreseen. Preliminary basic design could proceed immediately.

- Type II 14 projects for which additional information, such as test boreholes and pumping tests, and willingness to pay by inhabitants was required before preliminary basic design could be recommended.

- Type III 10 recommended projects that would likely be handed over to the local PDAM for long-term management for which an O&M plan was required.

5.1.3 Villages not Selected for Preliminary Basic Design

The 19 villages (Type IV villages) originally excluded from the preliminary basic design studies are listed below.

Villages not Selected for Preliminary Basic Design

JICA #	Village	Reason for Exclusion
NTB 6	Jelantik	Next phase of PDAM regional gravity system awaiting funding
NTB 7	Labulia	Next phase of PDAM regional gravity system awaiting funding
NTB 8	Setanggor	Groundwater source in adjoining village
NTB 9	Rembitan	PDAM supply lacks regional pumping capacity
NTB 12	Batu Nampar	New PDAM piped system recently installed
NTB 17	Labuhan Kenanga	No project required, present situation acceptable to the community
NTB 21	Hodo	No community to serve
NTB 22	Kwangko	Operative PDAM system, no project required
NTT 4	Mekendatung	No source identified
NTT 8	Watuneso	Available spring source in adjoining village
NTT 9	Borokanda	Available spring source in adjoining village
NTT 10	Bheramari	No suitable source identified
NTT 11	Nggorea	Available spring source in adjoining village
NTT 12	Ndetundora I	PDAM regional gravity system due for construction next year
NTT 14	Bloro	Partial system already operating, no other suitable source identified
NTT 16	Patialadete	Community will not permit development of available spring source
NTT 17	Welibo	Community will not permit development of several sacred springs
NTT 20	Pulupanjang	No suitable source identified
NTT 22	Sonimanu	Available spring too low to permit economical pumping

5.1.4 Villages Subsequently Excluded from Preliminary Basic Design

During the course of the preliminary basic design studies additional information was obtained from test borings, pumping tests, meetings with local government officials and more detailed field studies (particularly with regard to existing systems). Further discussions with PDAMs (Chapter 6 of this Report) clarified the situation with regard to the O&M of village systems entrusted to their care. Follow-up visits to Kepala Desa to present the team's recommendations and proposed technical solutions often elicited different opinions from those given during our initial village surveys. Several Kepala Desa wished to alter (usually increase) the target area and many strengthened their reluctance to commit their communities to paying for pumped water into rejection of our proposals. The incipient preference for (free) gravity supplies and the avoidance of PDAM connection costs and standing charges for poor service hardened into formal rejection in a number of cases; the community preferring to continue using their traditional shallow wells free of charge, rather than walk 200 m to pay for water from a piped supply. The changes in the list of 28 projects selected for the preliminary basic design are shown in Table 5.1.7. Therefore, the team's studies

were canceled in a further eight villages. The remaining 17 villages have 19 viable projects as shown below.

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			

5.1.5 Project Duplication

(1) International Financing Institutions

Reference has already been made to the duplication of 15 of the NTB villages in the Study and the World Bank long-term on-going WSSLIC Program. A formal meeting was held under the auspices of BAPPEDA Tk. I NTB to clarify this duplication of villages between the two projects. Districtss have agreed to include these duplicated villages in the Study.

The initial phase of the ADB funded RWSS program provided water supply and sanitation facilities in some 2,500 villages. The team is not aware of any duplication. The team members learned from PDAM Kupang that the so called industrial water supply scheme for NTT # 25 Desa Bolok is in fact already fully completed but not operational. The project was funded by ADB and many other sources, designed primarily by Kimpraswil-NTT and implemented primarily by P3P NTT with input from PDAM Kupang.

(2) Bilateral Donors

Many bi-lateral donor countries are currently active in the rural water supply sector in Indonesia. AusAID (Australia) has been very active in the rural water supply sector in Nusa Tenggara in recent years. Several large projects have been completed, some are still in progress and new programs, of which we are not

aware, are in the planning stage. The Team is aware that CIDA (Canada) has an on-going rural water program because we visited Labuhan Kenanga shortly after their study team had rejected a potential project in the village.

Representatives of GTZ/KFW (Germany) obtained a copy of the same sketch map showing PDAM Mataram's selected development areas, from BAPPEDA Tk. I NTB, as was given to the JICA Preliminary Mission (Desa Kuranji, Bajur, Duman, Sembung and Peresak). The team is also aware that they have a major comprehensive rural development project (including water supply) which covers 60 villages in each of Kabupaten Sumba Timur and Sumba Barat. The team had a discussion with them and GTZ/KFW stated that they would consider the results of the JICA Study.

(3) NGOs

The number of International NGOs and local NGOs backed by international donors cannot even be counted. They become active when money is available, carry out projects at short notice and very quickly. They are able to pick and choose projects in the field within very flexible 'country program' guidelines and often return without notice to rehabilitate previous projects which have become unserviceable. A number of the selected small village gravity projects include the rehabilitation of old NGO systems. (Bagik Papan, Duman, Kawuwu, Weerame, Nusakdale)

(4) GOI

At the time of drafting this Interim Report (November 2001), as far as the Team is aware, no GOI funded construction work is currently under way or planned in any of the selected villages. However, 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.

Our proposed viable project for the village of NTB # 19 Ranggo has already been superceded by P3P NTB which is undertaking an alternative project for the same village in the 2001 provincial development budget. The Team has been advised that PDAM Mataram's priority distribution extension projects for NTB # 1 Kuranji, NTB # 2 Bajur, NTB # 3 Sembung or NTB # 4 Duman have been forwarded for consideration for inclusion in the 2002 budget. The detailed designs have already been prepared by a local consultant for improvement to the

main gravity supply line to NTB # 11 Selaparang. PDAM Lombok Timur is waiting for budget for this improvement. PDAM Sumbawa has a plan for the further development of the Regional system including NTB # 13 Labuhan Mapin. PDAM Kupang has both the financial and the technical capability to continue operating, maintaining and extending the financially viable NTT # 24 Tarus system, etc.

5.2 Design Criteria and Practical Guidelines

5.2.1 Introduction

The Design Criteria adopted for the Preliminary basic designs are based on "*Petunjuk Teknis Pembangunan Sarana Penyediaan Air Bersih dan Penyehatan Lingkungan Pemukiman Perdesaan",* issued by Cipta Karya, Dec 1995, with some adjustments to allow for the practicalities of population distribution, social mores, type and location of the selected source and topography in each specific location.

5.2.2 General Principles

In addition to formal design criteria, this section of the report contains a number of practical guidelines and recommendations. It is hoped these will lead to the detailed design and construction of facilities that will be readily accepted by the potential users, be economical in terms of O& M costs and above all, sustainable within the rural Indonesian environment and cultures. The more general considerations include the following.

- The overriding 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. Villages and PDAM do not have access to foreign currency.

5.3 Population to be Served

5.3.1 Service Areas and Coverage

The service areas to be supplied by each new system were determined by discussion between representatives of the village, who nominated the hamlets they thought most needy, and the study team who sought areas where the population was sufficiently concentrated to provide a target that could be served efficiently. No problems or disagreements arose, but a number of the selected service areas were subsequently adjusted to match the topography for gravity systems and the limitations of the available water resource. "Coverage" within the selected service areas was then considered to be 90%.

5.3.2 Present Population

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. There are several reasons for this.

- Some villages do not in fact enumerate "people"; they count "heads of family". (Kepala Keluarga or K/K). The multiplier applied to obtain total population varies; a figure of 5 is common, but not universal. Family size is falling quite rapidly, even in rural areas, but some families involving multiple marriages are quite complex. The national average from the most recent census (2000) is 4.17.
- Many rural workers are recruited for construction projects and domestic service opportunities overseas. This tends to create sudden reductions in resident populations after each "recruiting agent's" visit.
- Transmigration initiatives are still being promoted by the GOI in some areas, notably in Kabupaten Bima. This causes large variations in community populations. The team was surprised by a sudden increase of over 300 people in the population of Desa Bagik Papan between the initial survey visit and the preliminary basic design fieldwork. This was attributable to the totally unexpected return home of a group of "Transmigration Refugees".

Such large sudden fluctuations in population cannot be predicted or allowed for in regular growth predictions. The determination of the present populations in service areas which did not coincide with hamlet or village boundaries was, at best, somewhat subjective.

5.3.3 Planning Period

A planning period of ten years was adopted for Preliminary basic design purposes. The "design year" is 2011.

5.3.4 Population Growth Rates

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.

Adoption of only the most recent year's (2000) growth rate over the whole of the planning period would produce anomalous results in a number of cases where the growth figure for 2000 was not in line with the overall trend. The more sophisticated method of calculating the decline in the rate of growth for each separate year of the planning period for each community was considered to be unnecessarily complex for such small communities where variations in the base population figure far outweigh the effect of such minor variations in the growth rate. The population growth projections adopted for design purposes are summarized in Table 5.3.1.

5.3.5 House Connections and Public Hydrants

Standard practice in Indonesia states that the ratio of house connection/public hydrant users ranges from 30:70 to 50:50. This was not found to be the case in many villages. Most villages are comprised of several hamlets; those at lower elevations tend to be on the roadside where the people are exposed to outside influences, are more prosperous and sophisticated, and demand house connections. Whereas people living in hamlets at higher elevations tend to be more rural and are quite satisfied with a public hydrant service. It was sometimes necessary to calculate the water demand separately for each service area, rather than for a village as a whole.

However, there were two different Kepala Desa who insisted on house connections for all their people and another who said that 100% public hydrant was all that was required. The house/hydrant ratios 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.

5.4 Technical Guidelines

5.4.1 Demand Calculations

- The maximum hourly demand was set high at 2.0 times the average hourly demand, recognizing the social characteristics of clothes washing and bulk water collection from public hydrants.
- 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.

5.4.2 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 available 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 electric power generation requirement, are preferred.
- Regardless of the actual depth of the borehole, the intake/foot valve should be set at the minimum depth consistent with the reliable year round availability of potable water.
- 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. It is likely that the maximum hourly demand will fall within the pumping period. 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.
- There should be a means for the pump attendant to know when the reservoir or storage tank is full.
- Pumping installations must be protected from the weather in a securely fenced and locked facility. In most cases a 'guard-house' or simple accommodation for the attendant should be provided.

5.4.3 System Storage

(1) General

- It is GOI policy that storage facilities should NOT be provided on village water supply systems and the use of elevated tanks is prohibited in principle. 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, access covers must be robust and securely locked. Washout valves are prime targets for unauthorized connections.
- Concrete reservoirs are often poorly constructed; steel tanks require painting and maintenance.

(2) Gravity systems

Where flow from a broncaptering or a pressurized PDAM pipeline is continuous (24 hours/day) it should be possible to design a system in which the water stored in the public hydrant tanks is sufficient to meet the maximum hourly demand.

(3) 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 only.

5.4.4 Chlorination

Village water supplies are not chlorinated in Indonesia. The people will not drink chlorinated water and will certainly not pay for it. They consider the taste of chlorine to be a pollutant and there have been threats of violence against operators who 'pollute' the people's water with chlorine. There are also some medical concerns, arising from the fact that once chlorination has been established in a rural community's water system it must never be stopped. Static village populations develop immunities to the background levels of the specific bacteria, which exist in their traditional water sources. If the bacteria are eliminated by chlorination the people's immune will decline, leaving the community vulnerable if chlorination is discontinued. Inevitably it would be discontinued eventually in a village context, for any one of the following reasons, resulting in a diarrhea epidemic, severe dehydration and even deaths amongst children.

- The initial supply of calcium or sodium hypochlorite will not be replaced due to a lack of planning, a lack of funds or simply because supplies cannot be delivered regularly and reliably to remote village sites.
- Mechanical failure or deliberate vandalism of the chlorination equipment.
- Inattention or physical intimidation of the operator.

In addition, it is unlikely that the dosage will be effectively maintained, monitored and adjusted on a routine basis at village level.

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 taken 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.

5.4.5 Pipelines

- 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. Welded spun-steel pipe is preferred over bolted/jointed pipe for larger diameter lines. GSP should be specified for smaller diameters and service lines. ACP must not be used.

- Roughness coefficients 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.

5.4.6 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 (PDAM main supply line, broncaptering or borehole).
- All service connections to public hydrants, public taps and house connections should be 25-mm diameter GSP. 25-mm stop valves must be provided in all cases. For estimation purposes, at this preliminary basic design stage, the 'average' service connections and public hydrants 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. 25-mm 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 (Puskesmas) and Mosques (Masjid).
- The use of simple public taps (Kran Unum) is encouraged in areas where the population is widely scattered. This is particularly appropriate along rural roadsides and where distribution mains pass through very small hamlets that would otherwise not benefit from the project. However, these facilities are difficult to administer in systems where payment is based on the actual quantity consumed.
- For estimation purposes, no demand allowance has been made for supplies to public taps on the understanding that direct house connections will come into use gradually in the months and years after project completion, progressively replacing the use of public taps (and some public hydrants) without increasing the total demand. An allowance of 10 m of 25-mm dia GSP, one stop valve and a service meter (in the case of PDAM administered systems) have been included for material estimation purposes.

5.4.7 Public Hydrants and Public Taps

- The detail 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. When detailed siting is completed, the proposed layout in each service area should be checked to confirm that the scale for public hydrants is approximately one per 125 persons i.e. per 25 families or households.
- In general terms it is preferable to site public hydrants on higher ground so that water carriers walk up to the supply from their houses with empty buckets and return downhill with heavy full buckets. Higher level tanks can also act as intermediate storage for lower house connections.
- 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 (The 3.0 m^3 size should be adopted as standard in most cases). The design must be robust, generally in accordance with a standard sketch, which will be developed and agreed prior to detailed design. Spring-loaded faucets should be specified.
- 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 length of all faucet pipes must be kept to a minimum and a concrete bench must be provided to avoid the practice of 'hanging' heavy buckets on the faucets.
- A clothes-washing area must be included in the design, adjacent to most public hydrants, as required by the WUA.
- Provision must be made for the collection of all spilled water and wastewater from washing areas. The design of each public hydrant and public tap must include simple gravity provisions for the removal and local sanitary disposal of wastewater (e.g. properly designed and constructed soak-away pits).
- 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, but access to the inside of the tank through the roof lid should be made as difficult and inconvenient as possible to dissuade unauthorized access.

- A main drain outlet should not normally be provided, it is always misused as a connection point for unplanned house connections and improvised extensions to the system which run to waste continuously, emptying the tank and denying service to regular users. The service outlets can be constructed to provide a washout facility if necessary.

5.4.8 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.

5.5 Preliminary Basic Designs for Selected Villages

The quality, quantity and hydrogeological details of all selected sources are discussed in detail in Chapter 4 and Appendices 3 and 5 of this Report. Design details and supporting Site Layout Drawings for the completed Preliminary basic designs are provided in Appendix 10. The following describe the findings and recommendations of the Preliminary basic design studies for all of the 28 recommended projects originally selected, followed by a tabulated summary of the new components recommended for projects now proposed for implementation (see Table 5.5.1).

For the four projects to be supplied with treated water from PDAM systems of 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.

5.5.1 NTB # 1 Kuranji (Preliminary Basic Design completed)

A bulk supply will be taken from a single connection point on the existing PDAM 200-mm PVC pipeline that passes through the village. A main stop valve and a

bulk meter must be installed. A 360 m x 75-mm distribution main will carry the supply across flat land to the target areas of Dusun Mapak Belatung and Mapak Dasan. No storage is proposed as the supply is continuously pressurized from PDAM reservoirs. The distribution network will supply 17 metered public hydrants and 10 public taps, which will be sited by the village WUA, and has been designed to supply up to 114 metered house connections. The system will be owned and operated by PDAM Menang Mataram as an extension to the existing municipal system for the provincial capital city.

5.5.2 NTB # 2 Bajur (Preliminary Basic Design completed)

During the field studies for the preliminary basic design, the Kepala Desa asked for a small addition to the target area originally selected during the initial village survey. Bulk supplies will be taken from two separate connections to PDAM pipelines that pass through the village. A 100-mm distribution main will carry the supply from a PDAM 250-mm PVC pipeline to Dusun Bajur and a 50-mm distribution main will carry the supply from a PDAM 200-mm PVC pipeline to Dusun Poak Dodol. Main stop valves and bulk meters must be installed at both connection points. The topography is basically flat. No storage is proposed as the supply is continuously pressurized from PDAM reservoirs.

The distribution network will supply 35 metered public hydrants and 15 public taps, which will be sited by the village WUA, and has been designed to supply up to 490 metered house connections. Both systems will be owned and operated by PDAM Menang Mataram as extensions to the existing municipal system for the provincial capital city.

5.5.3 NTB # 3 Sembung (Preliminary Basic Design completed)

A bulk supply will be taken from a connection point already installed by the PDAM on the 400-mm PVC pipeline, which passes through the village. A main stop valve and a bulk meter must be installed. Seventy-five-millimeter PVC service lines will be installed to supplement the existing PDAM 40-mm service network. No storage is proposed as the supply is continuously pressurized from PDAM reservoirs. The new distribution network will supply 17 metered public hydrants and 10 public taps, which will be sited by the village WUA, and has been designed to supply up to 134 metered house connections. The system will be an

extension to the existing municipal system for the provincial capital city, owned and operated by PDAM Menang Mataram.

5.5.4 NTB # 4 (a) Duman (Upper) (Preliminary Basic Design completed)

The existing broncaptering of M.A. Trawasan, selected during the rainy season, is not suitable in the dry season. A new higher level site has been selected for a new broncaptering of the same source. Seventy-five-millimeter and 50-mm steel pipe will carry water by gravity to a series of small service reservoirs, which also act as BPTs, sited on high ground above each of six downstream communities. Each BPT must be fitted with a stop valve and a float valve. The use of simple public taps is strongly recommended to provide a supply to the many small hamlets and individual houses along the pipeline route.

The existing network of flexible pipes leading from many small sources to individual houses and toilets should be canceled, although some of the tanks could be reusable. Thirty-three new public hydrants and 10 public taps are required and the system has been planned to accept up to 123 HC. The new system will continue to be owned and operated by the village WUA. The service connections need not be metered.

5.5.5 NTB # 4 (b) Duman (Lower) (Preliminary Basic Design completed)

A bulk supply will be taken from a single connection point on the existing PDAM 150-mm PVC buried pipeline, which passes some 1.8 km south of the village. Main stop valves and bulk meters must be provided at the connection point and at the village boundary. The 100-mm transmission main crosses two existing bridges. No storage is proposed as the supply is continuously pressurized from PDAM reservoirs. The distribution network will supply 18 metered public hydrants and 10 public taps, which will be sited by the village WUA, in the three lower hamlet and has been designed to supply up to 116 metered House Connections. The system will be owned and operated by PDAM Menang Mataram as an extension to the existing municipal system for the provincial capital city.

5.5.6 NTB # 5 Peresak (Preliminary Basic Design canceled)

An inordinate amount of time was spent meeting with village officials, investigating the accessibility and availability of alternative sources, arranging and

participating in liaison meetings with PDAM staff and adjoining Kepala Desa. It was agreed that PDAM Menang Mataram should continue to supply the extreme eastern hamlets around the golf course from their small M.A. Golong system (which is already fully committed). It was also agreed that this system should be permanently isolated from the tenuous and unsatisfactory distribution network that reaches back across the center of the village to the equally unsatisfactory existing connection to the PDAM network in Desa Narmada.

It was originally agreed that the central hamlets of the village would be supplied by a new pumped system, to be owned and operated by the village, from one of several spring sources in neighboring Desa Suranadi. A similar scheme was also proposed using the PDAM's spring and major reservoir at Montong. Had any of these proposals gone ahead, the two Kelompok (informal management group) that own and operate the small hydraulic ram systems in the west of Desa Peresak were prepared to abandon their facilities and join the main village system.

However, both the preferred springs in Desa Suranadi are privately owned and access through good quality sawah would have been difficult, and that from PDAM Montong even worse. Although the Team did in fact overcome all these obstacles, the village officials lost interest in the negotiations, foreseeing potential long-term payment problems and being unsure of their villagers' willingness to pay pumping costs. When we finally asked the village management committee (LKMD) what they wanted JICA to do, they rejected all pumped solutions even though there is no reliable gravity source available.

Without the proposed new village supply, rehabilitation of the two small systems in the west would have necessitated replacing the existing hydraulic rams with pumps (incurring new pumping costs). The Kelompok declined our proposals, leaving no demand for any JICA project in Desa Peresak.

5.5.7 NTB # 10 Bagik Papan (Preliminary Basic Design completed)

The existing source, known as Balas I, at 172 m.asl, has many raisings. A landslide blocked the old CARE Australia broncaptering. This has now been cleared but the structure is extensively damaged. A new broncapterings is proposed to capture a number of arisings some 500 m further up the valley. The existing transmission main, which is predominantly steel and well buried, was tested by flowmeter at a number of points along its 3.0-km length. The losses were less than 5% so the line is considered to be serviceable and reusable. Some obvious minor leakages and the exposed pipe-bridge over the main irrigation

channel must be repaired. The final 200 m of 50-mm PVC pipe leading into the existing concrete tank in Dusun Dasinimbu should be replaced with 75-mm GSP.

A new 30 m^3 reinforced concrete reservoir should be constructed slightly above the circular concrete tank in Dusun Dasanimbu, which is currently in use as a public hydrant. It requires some minor repairs but is basically reusable. There are a few public hydrants in the top three hamlets that are suitable for repair and reuse.

Distribution will be by gravity through 75-mm and 50-mm buried uPVC pipe to a total of 30 PH (25 new) and 5 public taps, which will be sited by the WUA. The system has the capacity to accommodate up to 127 HC, most of which are likely to be in the more developed lower Dusun Bagik Papan. The use of public taps will provide a supply to the small hamlets and individual houses along the pipeline route. The village will retain ownership and management of the extended system, which will not be metered, although their record in maintaining the previous system is not encouraging.

5.5.8 NTB # 11 Selaparang (Preliminary Basic Design completed)

The PDAM regional gravity system based on the very large M.A. Lemor in Desa Swela (350L/sec, 412 m.asl) originally supplied six communities including Selaparang and the large district capital town Pringgabaya. Demand has now outstripped the capacity of one section of the transmission main and very little water reaches Desa Selaparang, which is at a higher elevation (200 m.asl) than other communities on the system. The PDAM has already obtained a remedial design, which is awaiting implementation. It contains proposals that will benefit some 20,000 persons in the six communities, including Selaparang.

The most important feature is the laying of a parallel large diameter transmission main from a node point where the existing buried steel pipe to the first BPT on the system reduces diameter, causing the critical flow 'bottleneck'. The team recommends implementation of this proposal, although the diameter is more than would be required for Selaparang alone. From this point all facilities proposed for implementation by JICA have been designed/sized for Selaparang alone and have been incorporated into the existing network in such a manner as to ensure that Selaparang receives a stable and continuous gravity supply.

A duplicate BPT will be constructed alongside the existing PDAM BPT at 310 m.asl, dedicated to supply Selaparang only. A new pipeline will be installed directly to a new 60 m^3 reservoir sited just above the village. From there a new

distribution network will be constructed to supply 15 metered PHs, 10 public taps and up to 549 metered HCs.

The existing system in the village, including a number of HCs, is already owned and operated by PDAM Lombok Timur who will continue to manage, maintain and extend the network.

5.5.9 NTB # 13 Labuhan Mapin (Preliminary Basic Design completed)

The only problem with the system was that the remote high level broncaptering of M.A. Remas was damaged and no longer captured the majority of the plentiful source. PDAM Sumbawa itself has rectified this, although we are not aware of the sustainability of the repair work. This relatively old successful regional gravity system originally served six communities, with Desa Labuhan Mapin in the central location. PDAM Sumbawa has recently developed a separate gravity source for the downstream communities and the ferry port. The existing distribution main passes through three small communities in two village above Labuhan Mapin, which have inadequate distribution networks and would have been better targets for a JICA project in this area. Labuhan Mapin has a comprehensive PDAM administrated distribution network of metered public hydrants and house connections, which is now operating satisfactorily.

The 5.0 km x 150 mm Distribution Main from the lowest BPT at an elevation of 90 m.asl shows a flow of 11 L/sec at the end of the dry season, with no appreciable leakage. The maximum hourly flow required for Labuhan Mapin is only 5.2 L/sec so the supply is sufficient even after allowing for possible additional distribution by the PDAM in the two intermediate village.

The only work required is the construction of seven new PHs, and the rehabilitation and extension of the existing facilities in the residential area. PDAM Sumbawa will retain ownership and continue to maintain and extend their regional gravity system in the area.

5.5.10 NTB # 14 Labuhan Lalar (Preliminary Basic Design completed)

A successful test well was constructed under this project above Dusun Liang. This will be developed into a production well with an anticipated yield of 3.5 L/sec from a pumping water level of 5 m.bsl. A single electric submersible pump, powered from the PLN O/H line on site, will pump to a new ground level reinforced concrete reservoir at an elevation of 40 m.asl. Distribution will be by

gravity through a 2.5 km x 100-mm dia distribution main to 24 public hydrants, 5 public taps and up to 188 house connections at 0-15 m.asl in the main coastal hamlet. The village WUA will own and operate the new system. The service connections will not be metered.

5.5.11 NTB # 15 Poto (Preliminary Basic Design canceled)

As has been reported in Chapter 4, the test well drilled under this project located saline water of unacceptable quality. No other source is available, no project is possible. PDAM Sumbawa has a regional system under construction in a neighboring village. Subsequent phases of their project will eventually supply Desa Poto.

5.5.12 NTB # 16 Piong (Preliminary Basic Design completed)

A new production well will be constructed in the village at a drawdown level of 6 m.asl with a yield of 2.0 L/sec. A single electric submersible pump, powered from the PLN O/H line, will pump to a new ground level reinforced concrete reservoir at an elevation of 32 m.asl. Distribution will be by gravity through a 230 m x 75- mm dia distribution main to 13 public hydrants, 5 public taps and up to 133 house connections at 0-20 m.asl. The village WUA will own and operate the new system. The service connections will not be metered.

5.5.13 NTB # 18 (a) Kawuwu (Lower) (Preliminary Basic Design completed)

A new 2.5-m diameter shallow well will be bored away from the village in riverine geological conditions. It will be sealed and fenced. A yield of 0.7 L/sec is assumed at a pumping water level of 87 m.asl. A small electric submersible pump will raise the water through a 890 m x 50-mm steel pipe to the two existing 6.0 m^3 concrete tanks and one 2.0 m^3 PH in the residential area at some 110 m.asl. Three additional PHs and two public taps are required. The existing tanks will require new fittings. Float valves and stop valves must be fitted to all tanks. Up to 17 house connections are anticipated. The facilities, which will be owned and operated by the village WUA, will not be metered.

5.5.14 NTB # 18 (b) Kawuwu (Upper) (Preliminary Basic Design completed)

The existing PVC pipeline from M.A. Madalipa to the Ompu Beda BPT is serviceable apart from the final 100 m which should be replaced with GSP. The

BPT itself requires some minor rehabilitation. A main stop valve should be installed. The two 5 m^3 existing concrete tanks require replacement fittings and three new PHs are required, together with the necessary additional 25-mm service connections. The village will continue to own and operate the rehabilitated system.

5.5.15 NTB # 19 Ranggo (Preliminary Basic Design canceled)

As was reported in Chapter 4 of this Report, the test drilling carried out under this project was extremely successful. However, the Team learned at a very late stage that our counterparts P3P NTB have reactivated a pipeline project which was canceled 'incomplete' in 1997 (as reported in the Progress Report) to supply 2.5 L/sec to the main Dusun Ranggo by gravity from PDAM Dompu's WTP. Most of the distribution system and many of the public hydrants constructed under the earlier project are still serviceable and available.

5.5.16 NTB # 20 Jambu (Preliminary Basic Design canceled)

A test borehole was sited in a potentially favorable location adjacent to the main target population. Before the test drilling was commenced, the boundaries of Desa Jambu were changed, transferring both the selected borehole site and the main population into a new village. The test borehole was re-sited in a less advantageous location to serve the residual population much closer to the shoreline but, as has been reported in Chapter 4, the yield was very small, saline and unacceptable. No projects were possible.

5.5.17 NTT # 5 Kokowahor (Preliminary Basic Design canceled)

The field studies for the preliminary basic design found that the private owner of the borehole, originally constructed by P2AT, has connected a submersible pump to the PLN power supply and is selling water to tank trucks. He refuses to supply water to the village, as their payments are insufficient to meet the electrical costs. P2AT confirms that it has no agreement with the landowner.

No other source is available. The transmission line, booster pump station, reservoir and the distribution system in the village all appear to be serviceable but cannot be tested without a supply. The village has a potential supply and a distribution system already in place. The social problems are the responsibility

of the local Government. This location was never a viable JICA project; no engineering project is required.

5.5.18 NTT # 6 Sinar Hading (Preliminary Basic Design completed)

There is no suitable source in Desa Sinar Hading; the village is dependent on supplies from the neighboring Desa Ile Padung. This has been the cause of serious disputes in recent years. The team convened a major meeting of all relevant local Government departments at Bupati level in Larantuka to relieve the JICA team of responsibility for local social issues. A PEMDA (local government senior officer) delegation held a village meeting to confirm that Desa Sinar Hading would accept and pay for water pumped from Ile Padung through a joint system to be owned and operated by PDAM Flores Timur. A bulk meter and a stop valve at the village boundary are essential conditions of the inter-village agreement.

A reservoir site has been selected, 60 m.asl, supplied through a 100 mm pumping main from M.A. Wae Langu in Desa Ile Padung. A simple gravity distribution system will feed 5 metered public hydrants, 10 public taps and up to 207 metered house connections throughout the lower hamlets. A few of the inhabitants of the highest level Dusun Abahading (those living above the reservoir site) will still have to carry water, but for a much shorter distance than is presently the case (reduced from as much as 2.5 km in some cases, to a maximum of 200 m).

5.5.19 NTT # 7 Ile Padung (Preliminary Basic Design completed)

The same PEMDA delegation also met with the villagers of Ile Padung, to confirm that a pumped system from the lower elevation M.A. Wae Langu, recommended by the JICA Team, was acceptable to the people and that they would allow water to be transferred to Desa Sinar Hading.

It is proposed to reconstruct the original AusAID system using basically the same pump station site and arrangement, but with a much larger pumping sump. There is no PLN power supply in the village. Kepala Desa and the Ketua Utama PDAM jointly asked JICA to provide a 'dual-use' generating set that could power the water pumping facilities by day (8 hr. pumping duty) and provide lighting for the village in the evening. The team has not yet acceded to this request in the light of the previous AusAID experience. Four surface-mounted diesel engine-driven pumps are recommended, but the request should be reviewed positively when the social problems in the village have been finally resolved,

bearing in mind that the system will be owned and operated by the technically competent PDAM and not by the villagers who destroyed the previous facilities.

The pumping mains will be routed at a higher elevation to supply a reservoir above each village. The eastern pipeline continuing across the boundary to the high level Desa Sinar Hading reservoir. A main stop valve and a bulk meter must be installed at the village boundary. Float valves are required in all three reservoirs. A total of seven metered public hydrants and up to 180 metered house connections will be supplied by gravity. There are many serviceable public taps remaining from the previous projects, especially in Dusun Riang Tobi. It is proposed that 15 of these taps should be metered and incorporated in the new distribution system. There are also very large quantities of reusable pipe in several diameters stockpiled in the village. A percentage reduction has been made in the material quantities required for service lines at smaller diameters.

Bupati Flores Timur has already ruled that the combined pumped system supplying Ile Padung and Sinar Hading will be owned and operated by the PDAM

5.5.20 NTT # 13 Hepang (Preliminary Basic Design canceled)

As has been reported in Chapter 4, the test drilling carried out under this project found very little water at an unacceptable depth. No JICA project possible.

5.5.21 NTT # 15 Watuliwung (Preliminary Basic Design canceled)

The village owns and operates a borehole which they use primarily for irrigation. It is available to supply drinking water and the system is serviceable. However, the people prefer to buy water from tank trucks at Rp. 9,000/m^3 as they say the taste of the borehole water is not acceptable (high sodium content). This dormitory community for Maumere never had any need for a JICA project. An alternative test borehole was drilled at a higher level under this project, but no water was found.

5.5.22 NTT # 18 Weerame (Preliminary Basic Design completed)

The village already enjoys the luxury of plentiful water supplies from a number of large springs. Several piped gravity systems have been constructed by NGOs, mostly in the more southerly and remote areas of the village. M.A. Wee Paneru is in fact a large underground river that has not yet been developed. It is conveniently sited to supply the more densely populated areas along the main road

at the northern limit of the village. A viable project, but this relatively affluent agricultural community has no water shortage.

The opening above the source should be sealed. Direct drive diesel engine centrifugal pumping facilities should be installed in a combined guard house/ pump station adjacent to the source. A site has been selected for a 26 m^3 high level reservoir from whence a 280 m distribution main will lead to a conventional gravity distribution network alongside the main road in two directions and down the village road to the local padang and village center. Particular attention must be paid to the very large high school complex in the extreme northwest of the village.

The proposed new system will meet the existing pipeline from M.A. Wee Rame at the Puskesmas. The connection of the two systems is proposed. Public taps should be provided in many areas, in addition to conventional public hydrants, although the Kepala Desa has asked for 100% house connections. The village is prosperous, with many technically trained young graduates looking for opportunities. Their ability to operate and manage a pumped system is probably better than most.

The system will supply eight new public hydrants and ten public taps, which will be sited by the village WUA. The combined Wee Paneru and Wee Rame systems, which will have the capacity to accommodate up to 259 house connections, will be owned and operated by the village.

5.5.23 NTT # 19 Kondamara (Preliminary Basic Design completed)

The 50-mm buried PVC pumping main, the 12 m^3 concrete reservoir, and the eastward distribution main to Dusun Menangadu remain serviceable and reusable. However, it is proposed to replace the existing pumping main with 75-mm GSP to reduce the severe pumping head losses and pumping costs which would be incurred in the existing pipeline. The original source, M.A. Lailama, is only available to Desa Kondamara if a piped supply is assured to the principal users, Dusun Menangadu. However, the method of abstraction needs careful consideration; the pumping sump developed by the previous project was not effective. A new caisson within the main header tank for the village irrigation system is possibly the best option. Direct drive diesel engine centrifugal pumps should be installed, inside or adjacent to the existing guardhouse. The reservoir capacity is sufficient.

The system, which will supply 15 public hydrants, 20 taps and 73 house connections, will be owned and operated by the village.

5.5.24 NTT # 21 Oebau (Preliminary Basic Design completed)

A reservoir site has been selected at the top of Dusun Oekupi (126 m.asl) supplied by pumping from the cave water in the village. A 50-mm pipeline will distribute water by gravity through the village and down to a BPT at 73 m.asl just above the hamlet Oemenge, where the system will split. One branch will go directly across the river to supply Dusun Letuak, the other will pass through Oemenge and on to the village boundary, supplying the string of hamlets along the boundary with Desa Sonimanu (Puan Utara, Lolale and Oebandale), being careful to keep the pipeline route inside Desa Oebau. Although the adjoining lower elevation Desa Sonimanu is also a JICA village, in which the team was unable to identify a suitable source, Camat Pantai Baru advised us that transferring water across this particular border was not recommended. The unmetered system will supply 10 new PHs, 10 public taps and up to 13 HCs. Desa Oebau will own and operate the new system. This is one of the few really rural locations in which a JICA project is urgently needed and will be both beneficial and appreciated.

5.5.25 NTT # 23 Nusakdale (Preliminary Basic Design completed)

The proposed project will basically reconstruct the canceled NGO gravity system using the same source, M.A. Meakoen. A very large tree that dominates the spring should be removed and the existing failed intake structure must be demolished. A new, deeper broncaptering should be constructed to a configuration that leaves a separate supply available for clothes washing and use by nearby inhabitants. The straightforward unmetered gravity distribution system, supplying six public hydrants and up to nine house connections in two main contiguous hamlet will be owned and operated by the village. Ten public taps should be installed where the distribution main passes through small hamlets. As for Oebau above, this is another very rural location in which a JICA project is urgently needed and will be both beneficial and appreciated, although the recommended system is only a reconstruction of an NGO system which was not maintained by the villagers.

5.5.26 NTT # 24 Tarus (Preliminary Basic Design completed)

Reservoir sites and outline pipeline routes have been selected for two new separate systems to supply some of the high-level widely scattered rural hamlets in the southwest and southeast of the village. However, in order to maintain the

sustainability of the new systems, it is necessary to assure the continued operation of the existing PDAM revenue–earning, low-elevation distribution and truck filling operations. The existing pumping station should be rehabilitated to accommodate the pumping facilities of all four systems, using the same source. It is proposed to specify electric submersible pumps for the two new JICA systems to reduce the opportunity of their being used to support the deteriorated PDAM facilities.

The spring area needs a low-level cover and it may be necessary to increase the diameter of the very short connection pipe between the source and the pumping tank. The new metered rural systems will supply a total of 13 metered house connections, 10 public taps and up to 636 house connections by gravity from reservoirs at 47 and 41 m.asl. All systems in Desa Tarus will be owned and operated by PDAM Kupang, which already has a financially viable water supply system supplying the majority of the population in three adjoining village.

5.5.27 NTT # 25 Bolok (Preliminary Basic Design canceled)

The Team was advised that PDAM Kupang has taken over the newly constructed Regional water supply system, based on M.A. Oenesu, which will supply Desa Bolok and the port. The system has been tested and regular operation will commence shortly. There was never any requirement for a JICA project.

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" ---------- Existing 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	Sinar 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 accepted	**IV**
9	Borkanda	Ende	1,607	1,488	M.A. Rowa Aewromba in next Desa	None	No project accepted	**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 accepted	**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 5.1.7 Changes to Recommended Projects During Preliminary Basic Design

JICA #	Village	Change	Reason	Action Taken
NTB 2	Bajur	Minor increase in target area	Requested by Kepala Desa	Change accepted
		Use two separate PDAM connection points	Requested by PDAM Technical Division	Change accepted
NTB 5 (c)	Peresak (West)	WUAs managing both small existing hydraulic ram systems rejected the proposed rehabilitation	Increasing capacity requires pump installation Community not willing to pay pumping costs	**Sub-project canceled**
NTB 5 (d)	Peresak (East)	Community rejects all four alternative sources	Community not motivated to pay pumping costs	**Preliminary Basic Design canceled**
NTB 13	Lb. Mapin	Rehabilitation of broncaptering no longer required	PDAM has already done the work themselves	No action required
NTB 15	Poto	No suitable source identified	Test drilling results totally saline	**Preliminary Basic Design canceled**
NTB 19	Ranggo	No JICA project required	P3P is reconstructing gravity pipeline from Dompu WTP	**Preliminary Basic Design canceled**
NTB 20	Jambu	Desa boundaries and 'target' population much reduced Test borehole re-sited. No suitable source identified.	Low yield and high salinity in revised test hole location.	**Preliminary Basic Design canceled**
NTT 5	Kokowahor	No JICA project required	Source not available. Distribution system exists	**Preliminary Basic Design canceled**
NTT 13	Hepang	No source available	No potential aquifer found by test drilling	**Preliminary Basic Design canceled**
NTT 15	Watuliwung	No source available	No potential aquifer found by test drilling	**Preliminary Basic Design canceled**
NTT 18	Weerame	Completely new reduced target area	Requested by Kepala Desa, to serve disadvantaged areas	Change accepted
NTT 21	Oebau	Complete change of target area	Requested by Kepala Desa to reduce pumping requirement	Change accepted
NTT 24	Tarus	Rehab. of existing PDAM pumping station added	To reduce likelihood of 'cross-connection' to JICA system	Included in Preliminary Basic Design
NTT 25	Bolok	No JICA project required	New regional system completed by Kimpraswil/PDAM	**Preliminary Basic Design canceled**

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
							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	Oebau	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 5.5.1 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	Labuhan Mapin	Spring	-	-	-	-	-	-	-	-	-	-	29	7	-	446	-	1,810	8,460	454
14	Labuhan Lalar	Borehole	1 x 4.0 kW	-	-	2,800	-	-	2	4	1	40	42	24	5	188	1,350	2,720	4,290	-
16	Piong	Borehole	1 x 1.5 kW	-	-	-	590	-	-	-	1	20	19	8	5	133	-	3,270	2,970	-
18 (a)	Kawuwu (a)	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	Oebau	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

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

6.1 Health & Hygiene Education Plan

6.1.1 Existing Situation (Health, Water Supply and Sanitation)

(1) Health Status

Poor health conditions, poor sanitation and hygiene practices are widespread throughout the project villages in both NTB and NTT Provinces. The results of the survey interviews and Rapid Rural Appraisal (RRA) undertaken during this Study have provided evidence that inadequate water quantity/quality, poor hygiene practices and poor sanitation contribute significantly to the high morbidity rate in these regions.

Further, the results indicate that the prevailing health conditions, hygiene behavior, sanitation and water usage are primarily responsible for high infant mortality rates and the death of children under five years, mainly caused by diarrhea. The reported major diseases (and their incidence) in these areas are: acute respiratory/acute infection (30%); skin disease (14%); gastro-intestinal infections (9%); diarrhea (13%); eye infections (6%); and worm infestations (4%) (see Table 6.1.1).

(2) Major Reasons

We have concluded that the underlying reasons for this poor health status within the communities are: (1) a lack of proper nutrition and nutritional education; (2) a lack of proper health and hygiene education; (3) a low level or lack of health care services, particularly primary health care services (PHC); (4) unhygienic environmental and poor sanitary conditions; and (5) questionable water quality and the inappropriate use of water or water treatment, e.g. boiling water before drinking for at least 10 minutes (Interview Household Survey).

(3) Hygiene and Sanitary Practices

The present condition of the target areas requires that special attention to be given to the people's poor hygiene practices. This includes personal hygiene, such as washing of hands before eating and after defecation, washing the face, daily bathing and washing of feet before going to bed. This current situation is due to lack of knowledge and understanding about health, hygiene, sanitation and water usage. For example, the data from NTB show that the percentage of people defecating in the rivers is about 40%; those who defecate within the close household environment

(garden) is about 12%; about 32% defecate in pit latrines (individual pit latrine); about 7% on the beach; and about 9% defecate in irrigation canals.

The situation in NTT is different: about 69% defecate in pit latrines; about 21% in the garden; about 6% in the river; about 2% on the beach; and about 2% use a public latrine.

(4) Waste Water and Garbage Disposal

In general, wastewater and garbage disposal in the target areas is poor because as many as 55% of families neglect these items, 24% dispose of wastewater in open drains or trenches. However, wastewater mostly ends up in rivers or irrigation canals. Assessed field data also show that about 56% of the household garbage is dumped at the front or the back of the house. The remaining 44% is dumped mostly into rivers, garbage bins, trenches or in mountain areas.

(5) Clean Environmental Practices

Good domestic hygiene practice encourages people to reuse water where possible (for example to use wastewater for garden irrigation) to keep the environment clean. Based on observations during the survey interviews in NTB, domestic environmental cleanliness is still poor. As many as 64% of the surveyed households have many rats and about 88% suffer from mosquitoes. Only 23% of the family members wash their hands before eating, 17% of the family members wash their hands after defecating and 11% wash their feet before going to bed.

In NTT, about 17% of the surveyed households have rats and about 70% suffer from mosquitoes. In addition only 33% of the family members wash their hands before eating and only 7% wash their feet before going to bed.

Furthermore, there is a high incidence of domestic animals living in the target villages. Data shows 45% of the animals mentioned live in stables attached to the house. About 40% of the households have stables attached to the house and about 15% of the households have stables separate from the house by a distance of up to 10 meters.

All these factors have considerable impact on the prevailing health conditions.

(6) Current Water Usage

In general, water supply in the target areas is provided through small systems including piped and non-piped systems, shallow ground water, springs or rivers. Most of these systems have been constructed by individuals or community groups. However, many rural communities are satisfied with water obtained from shallow

wells and from spring water, without a piped system. Water provided from dug wells accounts for about 57% of the total families surveyed. About 16% take water from springs and about 4% use river water as primary water supply. About 3% obtain water from rainwater tanks and about 4% buy water. About 15% obtain water by sharing dug wells with their neighbors. About 17% obtain water from public wells and about 25% obtain water from their own dug well (See Table 6.1.2).

Assessed data on water usage shows that about 35% of the households surveyed drink water directly without boiling it and the remaining 65% of households surveyed boil the water (10 minutes) before drinking.

6.1.2 Objectives

(1) Community Needs

Currently in the provinces of NTB and NTT, there is a need to improve access to and management and utilization of water supplies. Many people in the community do not enjoy basic needs such as an adequate water supply. The problems that exist include poor accessibility to water resources, poor quality of water and insufficient quantities of water for basic hygiene requirements. The water resources in NTB and NTT are not properly managed and there is very little incentive or motivation for people to improve or maintain existing systems. The poor current status of community health is closely related to the low level of available water supply services and lack of effective water utilization. There is a direct relationship and dependency between water supply services and health/hygiene promotion.

(2) Objectives

Therefore the objectives of the Health and Hygiene Education Program are to improve the knowledge, attitude and practices of rural communities toward water usage, sanitation and hygiene, as well as to reduce the incidence of diseases related to water usage such as diarrhea, skin diseases, eye infection and worm infestation at project sites.

(3) Target Areas

The target group will be those rural communities that will be the main beneficiaries of the water supply projects. The project intervention will concentrate on ten villages in NTB (Desa Kuranji, Bajur, Sembung, Duman, Bagik Papan, Selaparang, Labuhan Mapin, Labuhan Lalar, Piong and Kawuwu) and seven villages in NTT (Desa Sinar Hading, Ile Padung, Weerame, Kondamara, Oebau, Nusakdale and Tarus).

The main focus of the education activities is health, hygiene and sanitation taking water distribution by means of house connections and public taps into consideration. The Health and Hygiene Education program implementation will commence at the neighborhood level (RT level) to identify each community's needs through a participatory community approach using the participatory rural appraisal process (PRA). The prevailing development status and further development needs will be identified and enhanced, together with the community at hamlet and village levels in order to obtain their full participation and to create a common understanding about the project objectives, activities and commitments (see Figure 6.1.1).

6.1.3 Strategies

An intensive public education and promotion campaign is essential to address the concerns listed above. A strategy and an implementation plan for health and hygiene promotion have been proposed and are incorporated into the recommended project to ensure effective health and hygiene outcomes.

(1) Lessons Learned from Similar Activities

During the design process, the design team reviewed a number of key lessons learned from similar sector activities. Major input was obtained through consultation with other international donor agencies such as GTZ-NT-SISKES, UNICEF, AusAID, Plan International and various other Government agencies having performed similar projects. A review of and site visits to previous and current water supply projects, and hygiene and sanitation activities in the eight villages of Desa Kawuwu, Poto, Bagik Papan, Batu Nampar, Bolok, Oebau, Sonimanu and Kondamara provided experiences that are worth mentioning. The lessons learnt from these projects have significantly influenced the design of project activities in the project villages. They encouraged the design team to develop a more effective and sustainable design approach for the implementation of projects that combine improved access to water supply with education and the promotion of improved water usage, hygiene and sanitation.

1) Participatory Approach

The design team has found an overwhelming confirmation that the success of water supply projects is very much dependent upon how effectively community participation is implemented, and whether the community is actively participating, especially at the earliest stages of the project activities. However, by using Participatory Rural Appraisal (PRA), PHAST and home visitation methods, the project mobilization, social preparation, problem

solving, awareness raising, information on choices, and facilitating a participatory approach will prove effective. This process will encourage the communities to actively assist and contribute to the implementation process; in fact, this will increase community participation and community ownership leading to a greater level of project sustainability.

2) Changing of Knowledge, Attitude and Practices

An important factor in the construction of this project is to generate changes in the knowledge, attitudes and practices of the people related to water usage, hygiene and sanitation. This will achieve considerable improvements in the health and well being of project beneficiaries. Community participation and social preparation are very critical processes in health, hygiene and sanitation promotion. The construction of water supply facilities and latrines alone will not guarantee to improve the health of the people. The project should reach further towards better utilization methods, better health conditions, hygiene and sanitation promotion programs that contribute significantly to an improved level of project sustainability.

3) Gender Issues

Due to the fact that women traditionally play an important role in water supply and sanitation, they have more interest in the development of water projects. Here, there is another lesson to be learned that women should not be treated simply as a special interest group. Without their participation, the success of the project will be at risk because in the case of a demand responsive approach, women are in the majority. Therefore, if women are not actively involved in the development process during all stages of the project, a significant portion of the needs of the target group will not be taken into consideration. The project will therefore encourage the participation of women, who will be given every opportunity to become involved and to actively participate in the decision making process at all levels.

(2) Implementation Strategy

The key elements of the implementation strategy for the Health and Hygiene Education Implementation Plan are outlined below.

1) Developing Community Awareness:

In order to increase community awareness, the communication of information and education on health, hygiene and sanitation must be started early, before the construction phase of the project and prior to the detailed design. During

the stage of social preparation, the IEC package must be initiated intensively through home visits, intensive group discussions at each prayer group, each neighborhood group, women groups, mosques, churches, during village meetings and cultural events (see Figure 6.1.2).

2) Information, Education and Communication (IEC):

The most important principle in communication is using simple language, simple messages, focusing on local specific problems and using examples or metaphors that will be appropriate and effective as a means of changing people's behavior.

3) IEC Manuals and Materials:

The provision of appropriate information manuals and materials and tools for effectively delivering IEC promotion must be properly designed. The types of IEC materials should include posters, pamphlets, brochures, flash cards and games made available at the village level. The effective implementation of a well-designed IEC promotion method will increase community awareness and community demand.

4) Capacity Building:

Through diverse training measures, the local government staff (IEC Task Force), community leaders and cadre personnel will be enabled to deliver the IEC package properly and effectively. Establishing a task force at sub-district and close to the implementation level is one of the effective strategies to increase program sustainability through strengthening the capacity of task force members. The task force will have the capacity not only to deliver but also to develop IEC messages on health, hygiene and sanitation by applying participatory methods. It is expected that the capabilities and skills of the team will be enhanced, and more importantly, be maintained so that they will continue their duties and functions in the community after the project has been concluded (see Figure 6.1.3).

6.1.4 Implementation Plan for Health and Hygiene Promotion

A four step implementation plan for Health and Hygiene Promotion is proposed to deliver the strategies: Step-1: Mobilization works (1) Preparation of manuals and guidelines, Step-2: Mobilization works (2) Social preparation, Step-3: People's education and sensitization, and Step-4: Participatory Monitoring.

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

i) Output

- Identification/production of appropriate IEC manuals and guidelines for hygiene and sanitation promotion in rural communities.

ii) Proposed activities

- Formation of an IEC Task Force at sub-district level
- Identification of current IEC manuals and materials
- Selection of appropriate manuals, materials and methods
- Preparation and production of IEC manuals and guidelines

An IEC Task Force will be formed at sub-district level in order to identify appropriate IEC manuals, materials and methods for hygiene and sanitation promotion. Initial liaison by the expert will be required in order to develop an understanding of the proposed project activities within the government departments. The IEC Task Force should include Environmental Health Volunteers (EH Cadres). The Community Health and Environmental Sanitation Specialist (CHES) and IEC specialist will facilitate the IEC Task Force. It is important that full representation is established in order to achieve a complete understanding of the current status of hygiene and sanitation and to facilitate awareness at the community level.

The identification and assessment of current local manuals, materials and methods of delivery for IEC in hygiene and sanitation promotion are regarded as an essential initial exercise in developing relevant manuals and guidelines for NTB and NTT. The identification and analysis of materials and methodologies is important to avoid duplication and to ensure an appropriate local focus. Special attention should be given to women as the target participants. The identification of manuals, materials and methods will focus on approaches that are considered appropriate for incorporation within a health and hygiene promotion program. Methodologies will incorporate participatory methods of delivery and the use of appropriate simple messages and language. The manuals and guidelines produced must be innovative and simple in their approach for both implementers and for the benefit of the target groups.

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

i) Out put

- Health and hygiene promotion in rural communities

ii) Proposed activities

- Training for the IEC Task Force, which will include Puskesmas staff (Sanitarian, Midwife, Communicable Diseases Officer), PMD staff, and religious leaders. Training and education of relevant staff, Women's Movement Organization members, formal/informal leaders and EH Cadres in IEC, in health and hygiene promotion including methods of delivery and appropriate development and use of IEC materials.
- Health Field Officers, EH Cadres and informal leaders will deliver IEC for hygiene and sanitation promotion in communities at 17 villages.

(3) Step-3: People's education and sensitization

i) Out put

- Intensive health and hygiene promotion in communities.
- Appropriate wastewater disposal, latrine and clean environment facilities to be available in each participating household.

ii) Proposed activities

- Health Field Officer, IEC Task Force, Health and informal leaders will deliver specific IEC in hygiene and sanitation awareness to rural women and children.
- Intensive training of implementers will be essential.
- Specific attention should be given to hygiene and sanitation promotion among women and children.
- Specific meetings should be held for the delivery of IEC materials to women and children (See Figure 6.1.4)
- Organize community mobilization for collection of local material for physical construction.
- Training community groups for implementing physical hygiene activities

- Train EH Cadres to construct latrines, wastewater disposal, garbage disposal facilities.
- Clean houses and local environment.

It is expected that EH Cadres will work cooperatively with formal and informal leaders to mobilize community members as well as WUGs.

(4) Step-4: Participatory Monitoring

i) Out put

- Evaluation and monitoring of community health and hygiene promotion.

ii) Proposed activities

- Identify and assess existing methods of evaluating the impact of health and hygiene promotion on community knowledge, attitudes and practices, and health.
- Select appropriate methods of evaluating the impact of health and hygiene promotion on community knowledge, attitudes and practices, and health.
- Adopt selected methods and evaluate impacts on project communities.
- Evaluate community health and hygiene awareness.

As part of the activities of the IEC Task Force, it is anticipated that a review of current practices in health impact monitoring and evaluation will be undertaken. The use of both quantitative and qualitative data collection methods will be explored. Methods such as that used for the WSSLIC Health Impact Study undertaken by the World Bank and GOI should be considered. It is recommended that communities participate in the development of the methodology, which should be based on a community self-assessment approach. Participation will ensure ownership, and communities will be motivated to take part.

The detail implementation plan is shown in Appendices 17 and 18 (Supporting Report No. 4), developed based on the IEC logical framework attached.

6.1.5 Organization and Staffing

(1) Organization

The main counterpart for the implementation of this IEC activity is the Health Office at district and sub-district level. Health and Kimpraswil will act as

coordinators for all related counterparts at district level, such as BAPPEDA, Community Empowerment Department and PDAM. For NTB, districts involved are Bima, Sumbawa, Lombok Timur, and Lombok Barat, while in NTT the districts involved are Sumba Timur, Sumba Barat, Kupang and Flores Timur.

The Health Department, through the Puskesmas, will play a major role in the organization, allocation of budget for health, hygiene and sanitation activity, while the Task Force will be working as a team under the coordination of the Sanitarian and Health Field Officer. The IEC promotion itself will be implemented intensively and directly in project villages by EH Cadres, the IEC Task Force and community leaders.

(2) Staffing

The staffing of the project will include experts and staff from different disciplines including community development, community health and sanitation as well as IEC. The team will comprise International and local experts. This combination will enhance the success of the project. The success of the project will also be enhanced by establishing good working relationships between the project personnel and other stakeholders from the community and government (See Table 6.1.3)

6.2 Operation and Maintenance Plans

6.2.1 Present Status of Rural Water Supplies

Experience of rural water supply in Indonesia (as well as in many other developing countries) is that despite large investments in both water supply and environmental sanitation (WS&ES), results have fallen short of expectations. Facilities frequently function for only a short time after initial completion. Results in terms of sustained effective use have been poor. It is therefore essential to consider the specific sustainability issues of the proposed investments and to ensure that the long term operation & maintenance arrangements receive appropriate attention in all phases of project implementation.

Indonesian and local (i.e. NTB and NTT) experience has been extensive. Particularly relevant experience in the Project region includes:

- Lombok Rural Water Supply & Sanitation Project (LRWSS) – AusAID funded, 1985 – 90, Coffey International, based in Central Lombok.
- Eastern Islands IKK Water Supply & Sanitation Project (EIIKK) – AusAID funded, 1987 – 90, Scott & Furphy Engineers, covered Sumbawa and Flores but

trial implementation was limited to Bima and focused on community participation in small piped water supply systems.

- NTB Environmental Sanitation & Water Supply Project (ESWS) – AusAID funded, 1991 – 97, Kinhill/ACIL/IDSS, covered the islands of Lombok and Sumbawa and included urban and village systems.
- Flores Water Supply & Sanitation Reconstruction & Development Project (FLOWS), AusAID funded, 1994 – 99, covered urban and rural areas in Flores and included piped village water supply systems (75 villages).

Accordingly it is appropriate that Project planning and implementation take account of previous experience and the lessons learned therefrom, particularly in relation to the sustainability of the proposed investments. The Development Policy for Small and Medium Scale Water Supply & Environmental Sanitation in Indonesia (Draft) summarizes many of the sector issues, lessons learned and the policy and strategy responses thereto.

The Draft Policy identifies the key strategy responses for future WS&ES projects, which include the following.

- The application of Demand Responsive Approaches (DRA) in planning, implementation and operation and maintenance of WS&ES projects. Government will act as a facilitator with responsibility for providing the policy settings and legal framework. Through facilitation, motivation and stimulation, communities will be assisted to make informed choices about facilities and services, to contribute to investment and the management of funds, and to be responsible for the sustainability of completed facilities.
- Human resource development particularly through increased effort on community strengthening through the application of DRA.
- Institutional Development recognizing the role of institutions in WS&ES but also providing for different levels of institutional/community involvement as appropriate in particular circumstances.

Monitoring and Evaluation (M&E) is also identified as a key element of implementation strategies with M&E proposals tailored to specific project requirements and focused on sustainability and effective use (rather than achievement of physical targets).

Accordingly, this chapter addresses the issue of operation & maintenance in accordance with the requirements of the Draft policy and the specific Project requirements and constraints.

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 water supply system operation and maintenance arrangements. It is essential to consider the specific sustainability issues for the proposed investments and to ensure that long-term sustainability issues receive appropriate attention in all phases of Project implementation.

The following chapter is structured broadly as follows:

- Strategy 1,proposed management arrangements & sustainability considerations
- Strategy 2, community management approach & establishment of WUA/WUG
- Implementation plan
- Detailed O&M arrangements
- Role(s) of local institutions and agencies

6.2.3 Strategy 1: Proposed Management Arrangements and Sustainability Considerations

The Project proposals include water supply systems for 17 villages (10 in NTB and 7 in NTT). In two of these villages separate systems are proposed making a total 19 systems to be implemented under the Project. Table 6.2.1 summarizes the proposed water supply systems, which are deemed feasible for inclusion in the Project proposal following completion of investigations, survey and preliminary design studies. The table also indicates the primary responsibility for O&M based on discussions with:

- Village communities and community leaders;
- Local government agencies (Camat, BAPPEDA, Kimpraswil, PDAM and others).

The allocation of primary responsibility for O&M does not indicate exclusive responsibility and indeed, sustainability considerations will dictate that relevant resources from local government and possibly the private sector are utilized to support the community and/or PDAM in system O&M.

Based on sustainability considerations there are a limited number of options for operation & maintenance of the proposed water supply systems. These include:

- Operation & Maintenance by PDAM;
- Operation & Maintenance by communities themselves through a specially constituted village organization;
- Hybrid arrangements involving communities, PDAM and possibly private sector resources.

Whilst the private sector is, in theory, a possible source of operation & maintenance skills, the situation in the Project region is that private sector skills are poorly developed and are unlikely to be a significant contributor to operation & maintenance except as a supplier of equipment and spare parts. [There is however merit in identifying opportunities for strengthening the private sector during implementation as, in the long term, this will increase the skills pool and enhance sustainability.]

Tables 6.2.2 to 6.2.4 indicates in general terms the advantages and disadvantages of the three identified approaches to operation & maintenance and considers their implications for Project implementation.

In reality, the appropriate management arrangements for a given water supply system can often be identified on the basis of the specific requirements of the proposed system. For example if a proposed system is an extension of an existing PDAM system then it is logical for the PDAM to take on management responsibility for the proposed system (subject to community agreement). Similarly a simple gravity system fed by a spring and serving a limited number of public hydrants, is best managed by the community, as the skills required for O&M are available within the community and the costs will be low. Such considerations have lead to the simplistic proposals for primary O&M responsibility in Table 6.2.1.

Before considering detailed management arrangements it is useful to undertake an assessment of the sustainability risk of the proposed systems. Table 6.2.5 indicates in simplistic terms the assessed sustainability risks for the proposed management arrangements and the water supply system technology (High sustainability risk means high risk of failure and thus of not being sustainable. Low sustainability risk means low risk failure).

The purpose of this assessment is not simply to highlight sustainability risk but to ensure that Project planning recognizes and responds appropriately to the assessed risks.

Essentially, the risk assessment assumes that pumped systems are more complex and have a moderate sustainability risk. Further, community management of

pumped systems will generally have a higher sustainability risk than PDAM management because of the limited skills and experience within village communities to arrange and implement essential repairs. The Project includes three PDAM managed pumped systems with moderate sustainability risk and six community managed pumped systems with high sustainability risk. Gravity systems are considered as having a neutral sustainability risk whether managed by communities or PDAM.

The Project will respond to these risks through:

- Careful attention to engineering design of pumped systems to ensure maintenance requirements are as simple as possible (refer to Chapter 5);
- Appropriate training of O&M personnel (for both PDAM and community personnel);
- Facilitating agreement between communities and PEMDA for PDAM to provide appropriate technical and logistical back-up support for community managed pumped systems.
- Implementation of M&E arrangements to monitor O&M performance during the initial years of operation (and to implement corrective action if required).
- Identification of constraints to PDAM O&M and negotiations with PEMDA in the event that serious constraints apply (refer to Section 6.3).

The proposed O&M arrangements are summarized for specific villages in Table 6.2.6. The management arrangements are classified follows:

- Type A – PDAM management;
- Type B – Community management with PDAM support; and
- Type C – Community management

These arrangements were discussed with stakeholders during field investigations and surveys and there is in principle agreement with communities and government for these proposals. Detailed arrangements require further development and formal agreement between relevant stakeholders.

The detailed arrangements for each of the Type A, B and C systems are set out in Section 6.2.6 below.

6.2.4 Strategy 2: Community Management Approach

(1) Background to the Community Participation

The past two decades have seen a growing awareness of the limits of development models based on government bureaucracies, which absorb vast resources without being responsive to local needs. One consequence has been a search for better participatory approaches to development. This has resulted in a growing interest and application of demand-responsive approaches with genuine community participation to enhance the sustainability of these interventions. Participatory demand-responsive approaches for water supply facilities means community participation in decision-making and management of key aspects of planning, design, implementation, financing, and operation & maintenance of water supply systems. In NTB and NTT, participatory approaches have been applied in various projects since 1983 by several donors including CARE International, AusAID, World Bank and GTZ.

This approach is enshrined in the Indonesian Development Policy for Small & Medium Scale Water Supply & Environmental Sanitation (Draft), October 2000. There is also recognition of a need for involvement of new organizations, including NGOs and the private sector, with skills in the implementation of participatory approaches to ensure effective implementation of the National policy and enhanced sustainability of sector investments.

(2) Characteristics and Constraints of Approach

Community participation describes the social processes whereby community members with shared interest are actively engaged to identify their needs, make decision and establish mechanisms to meet these needs. The advantage of the community participatory approach (when properly applied) is that communities develop a sense of ownership by committing themselves to the process of community activities thereby enhancing the sustainability of project outcomes.

Community management is a form of community participation in which the community takes the decision on all important aspects of an activity. In the case of water supply, this could include the planning, implementation and operation & maintenance of the proposed water supply system. For example:

The community decides on:

- technology choice
- form of social organization
- financing mechanism

The community is responsible for

- maintenance and repair
- local management organization
- water use regulation
- financing

There are however a number of constraints which apply to this Project. These include the specific requirements of the funding agency which impact on both the selection of water supply technology and the process for and financing of implementation. Specific technical sustainability issues and the requirements of GOI agencies (particularly at district level) also predetermine some of the outcomes of the planning and design process. For example in Section 10.2 there are recommendations in relation to the overall management arrangements. Similarly, the outcome of engineering studies limits the available options for community participation in planning.

Detailed planning for implementation will provide for maximum community participation within the Project constraints. For example:

- Communities can decide on the types of connections within the technical constraints imposed by the water source capacity and transmission/distribution system capacity.
- Communities can decide on local management arrangements within the overall constraint of the operation & maintenance arrangement proposed in Section 6.2.3.
- Communities cannot change the overall technology choice or the proposed operation & maintenance arrangements already established. However communities do need to be fully informed as to the reasons for the Project decisions and the implications for long term management (management, administrative and financial). They must agree to participate in the Project on this basis.

(3) Special Considerations for Approach

Notwithstanding the fact that community management approaches have been implemented in many rural water supply projects there have been many schemes which have not met expectations in terms of sustainable and effective systems. It is often difficult to change the behavior of communities and social constraints often result in a declining interest in management, operation & maintenance of systems after completion. In order to maximize the potential for the success of this project the following points must be incorporated into the project design.

(i) Firstly, intensive counseling and motivational activities for the community members should be incorporated in the community awareness and training activities. These activities should be designed to meet the specific requirements of individual communities in order to maximize ownership. For example if a

community water supply system is based on pumping then it is important that the community understand the implications of electricity costs for pump operation and budget accordingly to ensure financial sustainability.

(ii) Secondly, training needs to link water supply to health improvements through health and hygiene education. Community capacity developed through the implementation of water supply systems will empower the community in other community development decisions including implementation of improved sanitation. During implementation the Project should investigate sources of funding for sanitation improvements in order to ensure maximum health benefits are obtained from the water supply investments.

(iii) Finally, income generating activities (IGA) may be essential for the community members to both increase affordability to pay for water and also to fund other community development activities such as sanitation programs. Although the Project will focus on water supply, it is important that the established WUA/WUG remain empowered to play an active role in related village development activities after the completion of the Project's physical activities. According to the ESWS evaluation, the micro-finance development projects need to be carefully designed, properly resourced, and preferably based on existing organizations to be sustainable.

(4) Establishment of WUA/WUG

Community management require the establishment of a small elected or appointed group to undertaken the management tasks on behalf of the community. We propose the use of a Water Users' Association (WUA) at village level. The WUA will represent all village water users. Establishment of a WUA is envisaged regardless of the Type of system (Type A, B or C as per Section 6.2.3). Clearly the role of a WUA for a PDAM managed scheme will be different from that in a community managed scheme. Water Users' Groups (WUG) are proposed to represent the interests of village subgroups such as public hydrant users or other community subgroups. [Communities will decide on the need for and structure of WUGs.]

It is important that the WUAs particularly, and also the WUGs, are appropriately constituted, both to represent the broad interests of consumers and also to ensure that there are appropriate skills represented within the group to enable it to undertake its role. There must be appropriate representation from women on WUAs and WUGs.

1) Existing Community Organizations

Existing community organizations in the targeted communities have been analyzed. These are established mainly through the government structures and/or or religions organizations. They do not have the appropriate skills or experience for management of rural water supply. Existing community organizations include the Village Development Council (or LKMD: Lembaga Ketahanan Masyarakat Desa) that is expected to play a role in water management. The purpose of the LKMD is to assist the head of the village in the form of advice on the development plan or the arrangement of village programs and solution to problems, if any. However, in many cases the LKMD is inactive because of the constraints of culture and unsuitable capacity of members. Recently, under the decentralization process, a Village Representative Council (BPD: Badan Perwakilan Desa or Village Representative Council) has been introduced in rural communities to replace the LKMD. It is appropriate that the BPD be represented on the WUA but should not take on the role itself.

There are frequently key persons with significant potential to contribute to a WUA within the community. In some villages there are active women's group (PKK) and youth organizations, even though the effectiveness of these organizations is often heavily dependent on their influential leaders. Moreover, there is usually experience of the joint voluntary work by residents. In order to ensure the selection of a strong WUA, CFOs need to critically observe existing village structures and identify strong potential candidates. Particular effort may be required to ensure appropriate representation from traditionally under-represented groups, such as women.

2) Lessons Learned from Experiences

There are common problems associated with community management and establishment and capacity building of WUA/WUG, which have been experienced by previous projects. Drawing upon this experience will be invaluable for this project. A summary of identified problems is set out in Table 6.2.7.

3) Structure and Formation

The Water Users' Association (WUA) will comprise community representatives selected by interest groups representing men, women, different social/religious/ethnic groups, poor and non-poor elements of the community. The WUA will be formed during the implementation phase. The

WUA structure will include a chairman, a secretary, and treasurer, community coordinator, technical coordinator, representative of EH Cadres, and representatives of WUGs. Training will be provided covering, organization, leadership, financial administrative and technical matters, and on social and gender issues. The requirements for Type A systems will be different particularly in that there will be very limited requirements for financial management.

The final WUA formation will be legalized through a registration letter from the Camat. For Type B and C schemes a financial unit of the WUA will be formed as a Cooperative and notarized, and will be audited yearly by accountants from outside the community. The financial unit will open an account at Bank Rachyat Indonesia (BRI) with at least 2 representatives including the Treasurer to be designated as signatories to the account on behalf of the WUA.

The structure of the WUA and its key responsibilities are summarized in the following Table.

WUA/WUG Structure & Responsibilities

Item	WUA	WUG
Target Community	Villaage or part of village covered by Project. Could be joined with an existing WUA within the village if appropriate.	Each public hydrant and/or other subgroups of WUA as appropriate
Members	▪ Chairman (1) ▪ Secretary (1) ▪ Treasurer and deputy ▪ Community coordinator/customer relations ▪ Technical coordinator ▪ 3 Representatives from WUG ▪ 1 Representatives from EH Cadres	▪ Chief (1) ▪ Treasurer ▪ Operator/maintenance coordinator ▪ EH Cadres
Main Roles	▪ Own the assets of the water supply system on behalf of community. [1] ▪ Effectively manage assets of the water supply to deliver water supply services to consumers. ▪ Establish regulations for water management and use of assets including penalties. ▪ Hold regular meetings to consider appropriate matters related to water supply management. ▪ Keep record of meetings. ▪ Resolve problems identified by constituents and/or members. ▪ Ensure constituents are regularly informed about relevant water issues. ▪ Establish users charges. ▪ Collect user charges from consumers ▪ Establish and maintain bank accounts and financial records. ▪ Carry out periodical monitoring of systems and their performance. ▪ Conduct participatory planning and monitoring sessions with communities. ▪ Promote networking with other stakeholders.	▪ Effectively manage the operation of public hydrants and other appropriate assets. ▪ Resolve problems identified by constituents and/or members. ▪ Ensure regular and effective maintenance of public hydrants. ▪ Hold periodic meetings. ▪ Keep record of meetings. ▪ Report to WUA on important matters.

[1] Not required for Type A systems.

(5) Community Management for PDAM and Community Managed Schemes

As indicated above, both Type A (PDAM) and Type B and C schemes will involve community management through the creation of WUAs and WUGs. The objectives, roles and responsibilities of the community management arrangements will however be different in each case. The following table summarizes the key outcomes of the Community management approach for the three scheme types.

Community Management Objectives

Parameters	Objectives	
	PDAM Managed (Type A)	Community Managed (Type B & C)
Role of community management	Residents accept and understand the system proposals for overall management by PDAM. Community role is to liaise with PDAM on service levels during design and operation, and to provide detailed management for public hydrants.	Community has overall responsibility for management of system commencing with participation in planning and design decision-making through to operation and maintenance. Technical support from PDAM for Type B systems.
Role of WUA/WUG	WUA proposed to provide representation for community in discussions with PDAM on performance issues, tariffs etc. May provide services on contract basis (e.g. tariff collection). Collective effort strengthens community voice in discussions with PDAM and will enhance community interest in maintaining a quality system.	Fully responsible for all aspects of system operation and maintenance including setting and collection of tariffs, water use regulation, management of customer base, and physical system operation & maintenance.
Administration & Finance	Responsibility of PDAM. Community, through WUGs, responsible for tariff collection and payment for public hydrants. Individual connection customers pay set tariffs based on PDAM approved tariffs.	Community through WUA and WUG is responsible for financial planning, tariff setting, billing collection, financing of operation & maintenance as well as general management and administration.
Technical management	Responsibility of PDAM. WUG responsible for maintenance associated with public hydrants.	Responsibility of WUA and WUGs. Support from PDAM for Type B systems but cost is community responsibility.

(6) Facilitator of Community Management

Significant effort will be required to assist the communities to build capacity to undertake the tasks required of them. Specific details are provided in Section 6.2.6. In general terms this capacity building will be provided by the design and supervision of a foreign Expert. The Experts will engage appropriate local

organizations to assist in this work directly. Appropriate organizations will include local NGOs, local experts, and training organizations. Maximum use will be made of the wide range of available materials (curricula, training courses, training materials etc.) generated through current sector activities such as WSSLIC II (Water Supply and Sanitation Low Income Community - II) and other projects. A dedicated Community Field Officer (CFO) will be appointed by the Expert to work in each village to introduce community development approaches into the communities. The CFO's responsibilities will include assistance to communities with needs assessments, consultation to create awareness, calling at homes, organizing group meetings, facilitating community planning, promoting health and hygiene education, facilitating and mobilizing WUA/WUG members, providing on the job training, and so on. CFOs will be the key link between the project and the community. CFOs will be trained in their roles by the Project. The use of local CFOs will maximize the exposure of communities to the proposed methodologies. The use of local staff (at least from the same province and preferably the same island) will also ensure that the community process is sensitive to and appropriately adjusted to suit local cultural and community situations. Basically it is preferable that the CFO lives in the village during the week. It is proposed that the CFOs will continue their involvement beyond implementation for a period of approximately 1 year to assist with monitoring and evaluation. Previous project experience has made extensive use of CFOs but it is recognized that there can be difficulties in recruiting suitable staff in more remote areas.

(7) On-Going Community Monitoring and Support

Having regard to the long-term sustainability of the proposed water supply systems it is proposed to include some ongoing support and monitoring & evaluation after construction and commissioning of the proposed systems. This will take two forms. Some CFO will be engaged for a period of 3 monthes after completion of construction to provide support to the community and the WUA/WUGs in the regular operation of the system. One CFO will be responsible for the villages in each district. In addition, the Expert (using local resources from appropriate sources such as a major local NGO) will undertake periodic monitoring and evaluation visits. This will facilitate identification and appropriate follow-up in the event of emerging sustainability problems.

6.2.5 Implementation Plan

(1) Outputs

An implementation plan including the essential requirements for community participation in operation and maintenance has been proposed with a focus on maximize the sustainability of the proposed investments. The fundamental intent of the plan is to: 1) develop awareness, motivation and capacity of community members to have an equitable voice in decision-making, 2) enhance WUA/WUG members' capabilities, and 3) strengthen other existing sector institutions, including government, community and NGOs. Coordination between the Project and key agencies is required to ensure that the Project objectives are achieved and that appropriate and timely support is provided from relevant agencies.

Outputs and the Following Activities

Outputs	Activities
Mechanisms, processes and improved capacity for community members to have an equitable voice in decision-making and be empowered to actively contribute to the community development activities with active participation	Community members will: - clarify and develop their demands for the water supply systems; - decide technology choice, form of social organization, financing mechanism, community responsibilities, WUA/WUG members; - discuss WUA/WUG regulations and roles. - develop awareness on water management, gender awareness, self reliance, and interest for O&M; - be empowered for community development especially through involvement of participatory planning and evaluation.
Established WUAs and WUGs, and increased member's capabilities to sustainability manage the water supply facilities..	WUA/WUG members will: develop capabilities in organization, leadership, financial, problem solving, administrative and technical matters, and social and gender issues; - develop WUA/WUG regulations; - master participatory planning and evaluation skills; - carryout field trips to other WUA; - competently undertake their individual roles in water supply management; - monitor and evaluate their activities regularly.
Strengthened relationships between WUA/WUG members and their relevant stakeholders such as PDAM, Camat, PMD and BPD.	WUA/WUG members will: - organize workshops with related stakeholders for formal agreement at the social preparation stage; - organize regular meetings and discuss their roles; - report WUA/WUG activities regularly to stakeholders.

(2) Lessons Learned from Experience

There are many lessons to be learned from previous experience. From a review of literature from previous relevant projects in NTB, NTT and elsewhere, several key issues have been identified as particularly important for the implementation of this Project. These are detailed in Table 6.2.8.

(3) Process of Implementation Plan

The implementation plan is based on implementation in line with a demand-based community management approach and lessons learned from past experiences. The implementation plan is roughly divided into four steps;

(i) Step 1: Mobilization (1) - Preparation of manuals and guidelines (during basic design of implementation)

(ii) Step 2: Mobilization (2) – Social Preparation (3 months before construction)

(iii) Step 3: Supporting WUA/WUG (during and after construction average 3-6 months)

(iv) Step 4: Monitoring and evaluation through participatory approach (after the construction for at least 3 months)

The detail implementation plan is shown in Appendices 19 (Supporting Report No. 4). Moreover, there will be a strong emphasis on capacity building through training for comprehensive range of skills and training requirement are shown in Table 6.2.9 and Table 6.2.10.

Process of Implementation

Steps	Activities
Step-1: Mobilization (1)	▪ Explanation of the project (scope, implementation schedule, funding etc.) ▪ Preparation of manual and guidelines ▪ Baseline survey and needs assessment ▪ Clarification of demands, technical options (source, transmission & distribution system, connections), proposed management arrangements, community responsibilities, costs
Step-2: Mobilization (2)	▪ Review and confirmation of technical design assumptions, costs, management arrangements, community obligations ▪ Community consultation/awareness training on water management, water & sanitation for health, management arrangements ▪ Implementation agreements between village, PEMDA and Project
Step-3: Supporting WUA/WUG	▪ Consideration/establishment of WUA/WUG (Consideration/ establishment of WUA/WUG organizational and representational requirements, election of WUA/WUG members, initial training of WUA & WUG members, legally register WUA and WUGs, establish WUA bank account) ▪ Motivations and community empowerment ▪ O&M training for WUA/WUGs members ▪ Preparation of WUA/WUG regulations
Step-4: Monitoring and evaluation through participatory approach	▪ Operation and maintenance of water supply facilities ▪ Field-trip to other WUA ▪ Participatory planning to prepare Village Action Planning ▪ Participatory monitoring and evaluation ▪ End of cycle training

(4) Organizations

Community members will be facilitated and provided training and technical assistance by the Experts through the appointment of specialist sub consultants, including training organizations, NGOs, local experts and directly appointed CFOs for each village. Training will be given to several specific categories of people will an appropriate focus and intensity to suit their particular roles.

1) Project coordination staff and specialists:

Staff will be trained in project coordination, administration of this project, and how to manage a community management and community development approach. They will also be trained in the specific skills required for supervision, monitoring and evaluation.

- Workshop on project management
- Workshop on annual project planning and evaluation
- Training for accounting and logistic

2) Community field officer:

Training as well as regular meetings with refresher courses will be provided to field officers. The strategy will include the use of "training of trainers (TOT)" approach whereby CFOs will be trained to provide training and capacity building at the village level. They may receive training into 8 major areas:

- how to be effective trainers and facilitators;
- community organization, community management process and networking;
- awareness, self-reliance, and gender issues;
- community development and village action plan through participatory planning;
- water supply systems, technical matters and alternatives;
- accounting;
- participatory monitoring and evaluation, and
- health and hygiene education.

The field officer will receive one month of intensive training organized by the project and field training before being assigned to work in specific

communities. They will be trained in all stages of the project activity cycle so that they will be familiar with every stage.

6.2.6 Operation and Maintenance Arrangements

The proposed operation and maintenance arrangements for the three proposed operation models (i.e. Types A, B & C) are set out in Tables 6.2.11 to 6.2.13. These tables indicate the various activities, tasks, responsible organizations, timing and the role of the Project in operation & maintenance from Project inception through to long term operation & maintenance of the completed systems. A schedule of operation & maintenance activities is shown in Figure 6.2.1.

6.2.7 Role of and Coordination with Local Authorities/Agencies

There are a large number of organizations involved in the implementation and operation & maintenance of rural water supply. Coordination between the project and key agencies will be important to ensure that the project objectives are achieved and that appropriate and timely support is provided from relevant agencies. Coordination will be required at different levels for different objectives as indicated below.

- Project management will coordinate with central government agencies in relation to policies and standards, as well as in relation to other project activities particularly major aid-funded projects. The key agencies will be Kimpraswil and the Ministry of Health at this level;
- Project management will also coordinate with provincial agencies in relation to other programs and activities in the respective provinces. The key agencies will be BAPPEDA, Kimpraswil, P3P, and Heath Department.
- Technical specialists will need to liaise with central government agencies and centrally managed programs (e.g. WSSLIC, WASPOLA: Water Supply and Sanitation Policy Formulation and Action Planning Project) in relation to guidelines, standards, IEC (Information Education and Communication) /training program curricula and materials. The WSS (Water Supply and Sanitation) Secretariat established within the Ministry of Health will be a key focus in this regard.
- Project implementation staff will also coordinate with district, sub-district and especially village level government agencies in relation to the detailed

coordination of implementation activities through the project preparation, social preparation, implementation and monitoring and evaluation phases.

The following table summarizes the key agencies involved and their main responsibilities in relation to the proposed Project.

Project Liaison and Coordination

Agency/Organisation	Level	Role
BAPPEDA	Province District	▪ Coordinates all development activities at provincial and district level. ▪ Facilitates coordination between agencies at each level. ▪ Facilitates coordination between donor programs in a province or district.
Regional Secretariat	Province District	Responsible for day to day operation of government at provincial and district level. Specific departments responsible for policy, regulations, finance, revenue, etc.
Kimpraswil	Province District	▪ Kimpraswil at central level is responsible as counterpart agency for coordination with Project. ▪ Kimpraswil at provincial and district level is responsible for management of all public infrastructure (which includes water supply & sanitation) at respective levels.
P3P	Province District	P3P is the water supply & sanitation implementation organization responsible for management of project implementation for development budget projects (including those funded by foreign aid)
PDAM	District	Government owned enterprise for management of the operation of (urban) water supply systems in a district. Source of technical expertise in piped water supply systems. Promoted by many district governments as being responsible for all piped systems within their respective district. Able to provide technical support to community managed systems.
Ministry of Health	Central	Ministry of Health is generally responsibility for rural water supply & sanitation, water quality and for health promotion related to water supply & sanitation. The Ministry of Health provides policy direction and may have a role in implementation of major aid projects in the sector. Houses multi-departmental "Secretariat" for coordination of rural water supply & sanitation projects nationally.
Department of Health (Dinas Kesehatan)	Province District	Responsible for health services delivery at respective level. Includes policy, and budget allocation for water quality, water supply & sanitation, health promotion activities, and stimulant for sanitation programs.

Agency/Organisation	Level	Role
Department of Community Empowerment (formerly Office of Village Development - PMD)	Province District	Responsible to coordinate and provides policy direction for village development activities at respective levels.
Sub-district Government (Camat) ▪ Community Empowerment ▪ Health centers ▪ Religious Affairs ▪ TP PKK ▪ Education	Sub-District	Coordinate activities at district level. Relevant sections of Camat's organization have responsibility for community development, health, religion, women's affairs, education etc. Review of planning and budget allocation related to VAPs.
Village Government (Kepala Desa) ▪ Village Representative Council (BPD) ▪ LKMD/PKK	Village	Coordinates activities at village level BPD is formal representative body at village level for key community decisions. PKK is Women's Movement Organization at village level.

6.3 PDAM Institutional Assessment and Recommendations

6.3.1 Background

(1) Approach and Objectives

An assessment of the PDAM in the Project area was included in this Study when it became apparent that, for a number of reasons, PDAM would be involved in the operation & maintenance of at least some of the proposed water supply systems planned for implementation under the Project. Accordingly, this Section summarizes the field investigations and subsequent assessment of a number of PDAM undertaken during the period of September – November 2001.

Visits were made to the PDAM in each district in which Project water supply systems were recommended, regardless of whether or not it was perceived that there would be a role for the PDAM in Project implementation or subsequent operation & maintenance.

In addition to visits to these PDAM, visits were made to Project villages and to villages and towns currently served by PDAM water supply schemes, including some implemented under previous aid projects.

The objectives of the assessment were to:

(i) Understand the capacity of the respective PDAM to undertake an operation & maintenance role in the identified project villages, and to provide support to community managed systems with specific needs;

(ii) Identify capacity constraints that might impact on the ability of any of the PDAM to perform these roles;

(iii) Develop appropriate capacity building proposals to strengthen the PDAM in support of the proposed Project village water supply systems.

(2) PDAM in Project Area

A large quantity of data was collected from the relevant project PDAM. These data are presented in detail in Appendix 20. There are some inconsistencies and several gaps in the data. However, the data are more than adequate to allow analysis of key issues affecting PDAM performance and to enable conclusions to be drawn regarding the relevant issues that will impact on the proposed project.

A summary of key data is contained in Table 6.3.1. Together with the information obtained during field visits and discussions with PDAM management and staff, the data in Table 6.3.1 support the conclusions drawn in the latter part of this Section 6.3.

Whilst there were instances of a lack of data (Lombok Timur, Flores Timur, Sumba Barat), and there are also differences in the format of the data, in general there is a wealth of data available on PDAM operations. The data collection and analysis undertaken for this assignment is relatively comprehensive and enables conclusions to be drawn that could be useful for other projects. For this reason we have attempted to provide detailed information in Appendix 20 that may be useful to the PDAM and central and local government for future planning, particularly for possible external assistance from other bilateral and/or multilateral donors.

The PDAM included herein covers those districts that contained project villages based on the Progress Report in June 2000. These included PDAM Menang Mataram (Lombok Barat), Lombok Timur, Sumbawa, Dompu, Bima, Sikka, Flores Timur, Kupang, Sumba Timur and Sumba Barat. Since the Progress Report was completed, water resource investigations, survey and preliminary basic design work has been completed for all villages and a reduced list of 17 villages (covering 19 water supply systems) has been prepared for the recommended project (refer

Table 6.2.1). The revised list includes villages in the following eight district as follows:

- Lombok Barat;
- Lombok Timur;
- Sumbawa;
- Bima;
- Flores Timur;
- Sumba Timur;
- Sumba Barat; and
- Kupang

There are no recommended project villages in the Kabupaten Dompu or Kabupaten Sikka. However we have included Kabupaten Dompu and Kabupaten Sikka in the PDAM assessment for the sake of completeness.

6.3.2 Institutional Setting

A Perusahan Daerah Air Minum, or PDAM, is an autonomous water enterprise owned by a district government. The role of the PDAM (in accordance with the prevailing legislation and regulation) 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 capital investments usually being under the control of Kimpraswil. In reality, many PDAM in the Project provinces (and throughout Indonesia) do not make a profit and require ongoing government support, in various forms, for long-term sustainable operation. The reasons for this situation are easy to identify but the solutions are more complex, involving political and socio-economic considerations as well as institutional, financial and technical issues. Our analysis attempts to identify the key issues and constraints but it is not within the scope of this Project to address all of them.

There is a large volume of legislation covering the operation of PDAM. The most important of these are listed below. At the Jakarta Meeting to review the Interim Report the GOI advised that some of these regulations have been updated. Revised information will be incorporated when received.

1) Local Government

- District regulation regarding establishment of PDAM;
- District decrees concerning organization structure, directors and commissioners, and tariffs.

2) Central Government

- Law No 5/1962 concerning local government businesses;
- Law No 5/1974 concerning principles of local government;
- Regulation No. 14/1987 concerning the hand-over of public works assets to local government;
- Regulation No. 2/1998 concerning PDAM tariffs;
- Decree No. 7/1998 of the Minister of Home Affairs concerning management of PDAM;
- Decree No. 8/2000 of the Minister of State for Regional Autonomy concerning guidelines for PDAM organization and accounting systems.

District continue to receive financial support from central government for new water supply infrastructure investment. The implementation of such projects is usually undertaken through Kimpraswil with implementation responsibility being passed to Kimpraswil at the provincial level. Assets are handed over to the PDAM for operation & maintenance on completion. Investment funds may also be provided from provincial and/or district budgets with the implementing agency being Kimpraswil at the respective level. Such financial support is often provided for relative small investments such as the provision of pipes, fittings and meters for new house connections, or even for a meter replacement program.

Many PDAM have directors and staff who are public servants. Such staff are usually seconded from the district government and continue to receive a salary from the government. Honoraria and allowances are paid to these seconded staff by the PDAM.

PDAM are responsible for calculating and recommending appropriate water tariffs, but tariff increases require the approval of the Bupati and the Dewan Perwakilan Rachyat Daerah (DPR) or Representative Council, prior to implementation. Tariff increases are frequently delayed by political processes, with the result that tariff increases when eventually implemented, are infrequent and often quite large. While the process of political approval of tariffs is in accordance with the

legislation and regulations, there is a significant impact on PDAM performance which overall is detrimental to the district.

6.3.3 Key PDAM Capacity Constraints

In order to provide a logical structure to the analysis of PDAM capacity constraints, this section is organized according to the following headings:

- Institutional & policy framework;
- Organization & staffing;
- Service levels;
- Financial issues; and
- Technical issues.

6.3.4 Institutional and Policy Framework

The key issues related to the institutional and policy frameworks are as follows:

(1) Mission of PDAM – commercial entity of social policy agent?

There is frequently conflict or confusion between the mission of the PDAM as interpreted by the PDAM management and staff and the (social) policy of the local government. That is, between the role of the PDAM as a commercial entity (albeit government owned) and the social objectives of local government. The consequence of this conflict is that the PDAM are weakened financially and technically and their ability to deliver services is compromised. A weak PDAM is also less able to support local government in fulfilling its social objectives.

(2) Tariffs

Tariffs are a key issue. The PDAM seek to establish tariffs that are sufficient to meet operation & maintenance costs (including depreciation) and debt services (if applicable). This is an essential requirement for sustainability. The political arm of local government frequently fails to approve tariff increases with the result that the capacity of the PDAM to provide essential operation & maintenance services is constrained leading to reduced levels of service. The outcome is a deterioration of existing assets, further reduction in service levels, reduced customer satisfaction, damage to systems, increased debtors etc. In time this leads to a weak and ineffective PDAM and the need for increased subsidies to maintain services.

PDAM budgets must be premised on being able to effectively manage existing assets. Unless this is achieved, further investment is not effective, PDAM also have an obligation to improve their efficiency through appropriate measures such as improved systems, staff training and appropriate institutional infrastructure (eg. vehicles, maintenance equipment etc.).

(3) Limited Participation

While the PDAM are responsible for operation & maintenance of water supply systems, they are frequently excluded from key decision making in relation to the planning and implementation of extension and augmentation works or for new systems. The PDAM management advise that they are often put in the position of having to accept new assets which may not be appropriately planned and/or constructed, thus leading to higher maintenance costs. Such assets can result in a negative financial impact on the PDAM because operation & maintenance costs related to new investments exceed the corresponding revenue.

The emerging policy in local government to view PDAM as the center of expertise within the district for water supply services (urban and rural), is supported. The policy outcome would be enhanced by broadening the role of PDAM in planning, design and construction, even if only through improved consultation in the implementation process.

(4) Transparency in Social Policy Delivery

It is possible to achieve the PDAM mission and to support the social policies of local government through transparent mechanisms, which need not weaken the PDAM. Measures such as the provision of specific and transparent subsidies from local government to support community service obligations would enable the PDAM to plan for adequate maintenance. The use of tariff structures to assist in delivery of social policy, through cross subsidies, could be enhanced. The Draft Development Policy for Small and Medium Scale Water Supply and Environmental Sanitation in Indonesia (October 2000) acknowledges the need to remove the burden of community service (social) obligations from PDAM in order to encourage their strengthening and growth.

(5) Accountability and Efficiency

The current arrangements enable the PDAM to blame low tariffs and political decisions for poor performance. PDAM management is not held accountable. A transparent process would provide incentives for improved performance and management could be held accountable for performance outcomes. PDAM

management and the supervisory boards need to play a stronger role in educating local government economic planning managers and politicians in relation to these issues.

Management also needs to provide a stronger focus on efficient service delivery. There are many areas in which PDAM can achieve efficiencies at present but a lack of management discipline and the excuse of political interference appears to limit appropriate action. Improvement measures include improved staffing efficiencies, for example through increased use of computerized billing and accounting systems improved collection efficiencies and reduced unaccounted for water (UFW).

With the exception of Dompu, no PDAM has a Corporate Plan. The Corporate Plan for Dompu was an output from the AusAID funded ESWS Project and was prepared in 1994. However, all PDAM have recently received training in corporate planning and several are in the process of preparation. This work has been initiated under a program funded in part by PERPAMSI (Indonesian Water Supply Association).

(6) Benefits of Scale – mechanisms for support within provinces/regions

Even with suggested improvements it will remain difficult for smaller PDAM in NTB and NTT to be totally self-sustaining. The recent creation of new district will further weaken the existing PDAM and will create new PDAM that will be very difficult to sustain. Successful examples such as PDAM Menang Mataram, which covers the administrative areas of both Kotamadya Mataram and Kabupaten Lombok Barat, indicate the benefits of critical mass to PDAM sustainability and growth. In the absence of merging PDAMs across district boundaries, opportunities for strong PDAM to provide support to weaker PDAM either within each province or across Nusa Tenggara, warrant further consideration by provincial and district governments.

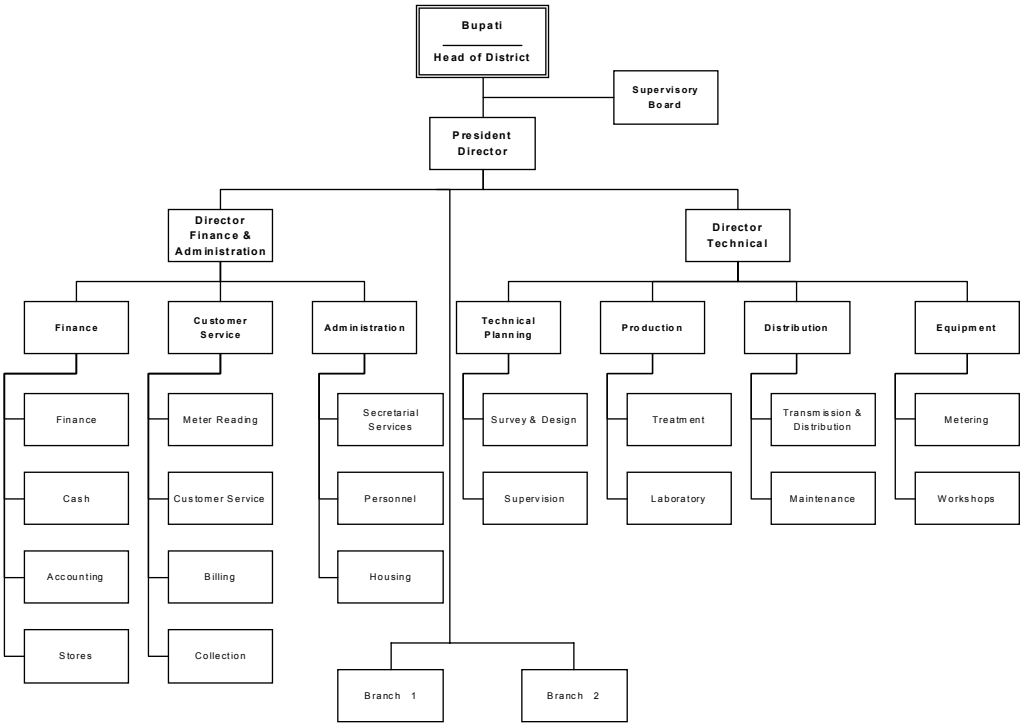
6.3.5 Organization and Staffing

(1) Organization Structure

All PDAM visited had similar organizational structures that were generally in accordance with established standards according to the size of the organization. There are four standard structures, however the PDAM in NTB/NTT sometimes diverge from the standards, adopting a structure with increased senior management applicable to a larger PDAM. These variations usually result in higher costs for PDAM management.

A typical organization structure for a medium sized PDAM (using PDAM Dompu as an example) is shown in the following Figure.

Typical PDAM Organizational Structure (DOMPU)



Key aspects of the organization are as follows:

- A President Director reports to the Bupati.
- A Supervisory Board provides guidance to the President Director who is supported by a Technical Director and a Finance/Administration Director.
- The administration and finance functions are provided through separate sections for Finance, Customer Service, and Administration.
- The technical functions are provided through separate sections for Technical Planning, Production, Distribution, and Equipment.
- Separate branch offices comprising both technical and finance/administration resources report directly to the President Director.

(2) Staffing Levels and Capability

Many PDAM are over-staffed based on Indonesian criteria, more so under any international best practice criteria. The average number of staff per thousand connections varies from Mataram as the most efficient at 6 to Sumba Barat at 37.

(In the case of Sumba Barat the situation is actually worse as a consequence of the current non-operation of the water supply system for Waikabubak – severly reducing the number of consumers.) Several mature and reasonably large PDAM have ratios of 13 – 18 (Sumbawa, Bima, Sikka, Flores Timur, Sumba Timur). These figures compare to a guideline figure of 10 (which pre-dates computerized billing and accounting systems). The overall staffing level for the 10 PDAM is 10.9 but this figure is dominated by the two largest PDAM, Menang Mataram and Kupang. PDAM Menang Mataram is the best performing PDAM and has the lowest number of staff per thousand connections by a factor of almost two. Clearly increased staff numbers do not translate to improved performance.

There is generally an imbalance in staffing between the staff numbers and workload for the finance/administration and technical roles. Generally there is an excess of finance/administration staff. For the 10 PDAM studied the total staffing by function may be summarized as follows:

- Senior management (Directors) 27
- Finance & administration 580
- Technical 476
- Total 1,083

There are many well-qualified and capable people in PDAM whose skills are not being effectively utilized, either through lack of specific training or lack of appropriate management focus and direction. It is also noted that in general terms there has been a marked increase in the skills of PDAM staff in recent years. However this is not being translated into improved performance. For the 10 PDAM studied the total staffing by education level may be summarized as follows:

- Tertiary qualification (degree or diploma) 109
- Senior high school 746
- Junior high school 117
- Primary school or less 111
- Total 1,083

A contributing factor to overstaffing is excessive reporting requirements. Our observations indicate that the best reporting is often produced by PDAM with very poor overall performance.

(3) Key Weaknesses

Management of PDAM needs to be strengthened to focus on services delivery to agreed standards and to be accountable to customers for meeting those standards. PDAM have a very weak customer service focus which is a contributing factor in the high level of debtors and the lack of growth in connection numbers (despite low coverage) in many districts.

Many PDAM managers advised that the Supervisory Boards were not effective. The acceptance of current poor PDAM performance supports this view. Further, the structure of Supervisory Boards is inappropriate in that they do not include a member with a business background nor a member who can contribute from the customers' perspective. In this regard it is noted for PDAM Kupang, an NGO representative has recently been appointed to the Supervisory Board essentially to represent consumer interests.

Financial and administrative reporting requirements are significant. Detailed reports are prepared monthly. The reports produced are time consuming, they are usually not analyzed, are often inconsistent and do not contribute to improved service delivery. Reporting should be streamlined to focus on key business performance indicators such as service standard indicators, UFW, accounts receivable, cash-flow etc. More effort should be devoted to correcting problems rather than simply recording them in reports.

Technical planning/management capability is weak due to continued reliance on development budget allocations and foreign donors. Apart from Menang Mataram, no PDAM has an hydraulic model of its network to analyze performance and plan system expansion. No PDAM had a recent comprehensive masterplan, even for the district capital town. (PDAM Menang Mataram has a masterplan in preparation.) No PDAM has comprehensive plans of their existing assets (as-built drawings etc.). This situation is supported by the continued reliance on external resources for planning, design and implementation support for new projects managed through Kimpraswil. Investment in new projects is mostly funded from foreign aid and/or loans from central government.

As an example all PDAM have a substantial percentage of non-functioning meters (from 17% to 50%). The customers pay a fee for meter maintenance and are entitled to have a functioning meter to ensure accurate billing. However, PDAM often seek development budget funds for meter replacement programs rather than utilizing the funds collected from consumers. In one instance (PDAM Sumba Timur) consumers were to be charged for replacement meters, which had failed prematurely because

inappropriate meters were procured. Recent changes to accounting systems are expected to eliminate this problem in future.

Maintenance is generally reactive rather than proactive. No PDAM had documented operation & maintenance plans or schedules for day to day O&M. While a lack of funds was frequently blamed for this situation there is clearly an opportunity to improve maintenance within existing resource constraints by improved resource allocation and changing priorities. Adequate transport facilities are an essential prerequisite for system maintenance.

Most PDAM make little use of private sector resources but there are exceptions. For example, PDAM Mataram and PDAM Kupang both utilize the private sector for construction of house connections. The smaller PDAMs do most of this work in-house. Construction of new facilities (usually through Kimpraswil) also uses private sector contractors. There are advantages in increased utilization of private sector resources in terms of balancing resources and workload. There are other areas for which private sector resources could be considered for example maintenance contracts on mechanical plant, meter inspection & testing, and even some administration functions such as billing & collection. Increased use of the private sector would assist in broadening the local sector skills base, which would be beneficial in the long term.

6.3.6 Service Levels

(1) Service Coverage

Coverage is low within the service areas of all the PDAM examined. The range is from 25% in Bima to 58% in Sumba Timur. All existing systems could support a significant expansion of the consumer base (and generate significant additional revenue) if UFW is reduced.

(2) Service Pressures and Continuity of Supply

System pressures are generally low and a 24 hour supply is not normally provided (except in the case of gravity supplies). Only in Mataram does distribution mains pressure approach design standards.

(3) Quantity of Water

The quantity of water sold averages 24 m^3/connection/month. The range is from 12.6 m^3/connection/month in Sumbawa to 28.7 m^3/connection/month in Kupang. The quantity in Sumbawa is much lower than in all other towns, with Bima, at

17.2 m^3/connection, the second lowest. The average figure of 24 m^3/connection/ month corresponds to about 160 L/c/day (assuming 5 persons per connection), which is more than adequate in accordance with Indonesian and other comparable international standards. However it should be noted that this includes non-domestic consumption, which would inflate the average figure, particularly in the major towns. The data is also based on PDAM sales figures, which use estimates for some 20% of consumers with defective meters.

(4) Water Quality

The availability of water quality data is limited but with a few exceptions the physical/chemical quality of the water is probably adequate. There are particular issues with some systems such as Dompu during the wet season. Bacteriological quality is suspect in some systems, particularly those at risk of polluted ground water inflow during periods of very low (or negative) distribution system pressure. Most systems are not chlorinated or chlorination is not consistently applied. Most customers continue to boil PDAM supplied water and government health agencies support boiling of drinking water as an essential health precaution.

6.3.7 Financial Issues

(1) Tariffs

Tariffs are too low and are not adjusted on a regular basis. Refer to Section 6.3.4 above. The changes in tariffs and average water bills have been significantly less than inflation over the past 5 years, a period when costs for PDAM, including electricity, chemical and spare parts, have risen substantially. For example in Mataram, tariffs have risen by an average of 7% per annum over the period 1995–2001 compared with average inflation of 17% per annum over the corresponding period. Delays in the approval of tariff increases have meant that increases, once approved, are often very steep. A move to regular tariff increases that are more closely aligned to inflation, would be more readily accepted by consumers.

In the case of PDAM Flores Timor there has been no increase in tariffs since 1992. In PDAM Kupang, there has been no increase in tariffs since 1994.

While there is no supporting research for the project district, anecdotal evidence indicates that affordability is not a major issue. Rather it is the perception of poor service delivery that impacts on the customers' willingness to pay the increased tariffs.

(2) Profit & Loss

Because of low tariffs, the cost of water production exceeds the revenue from water sales in all PDAM except Menang Mataram. PDAM Menang Mataram produced a profit (before tax) of 17% on revenue and 4.3% on equity for FY 2000. In the worst case of Sumbawa, production cost is 194% of the sale price. In other words a tariff increase of 94% is required for the PDAM to break-even. For the other PDAM, increases ranging between 18% and 53% are required for break-even.

Across the eight PDAM for which data was available, average sale price of water is Rp 790/m^3. This compares with the average cost of water at Rp 896/m^3. An increase in tariffs of 13% is required to achieve a break-even situation. (However, these average figures are highly influenced by PDAM Menang Mataram and PDAM Kupang because of their significantly larger size.) The required increase would be less if the key problems of accounts receivable (debtors) and water losses were addressed. While comparisons between production cost and sales price is a useful measure it is not intended to imply that break-even is an appropriate long-term performance target. A PDAM should earn a return on assets so that it can use the funds generated to finance system expansion and augmentation, and thus contribute to economic development of the district.

All PDAM except PDAM Menang Mataram have substantial accumulated losses. Menang Mataram has an accumulated profit of Rp 1.8 billion. Accumulated losses for many PDAM are substantial and are unlikely to ever be recovered. The worst cases (in relative terms) are Dompu, Sumbawa and Bima for which accumulated losses equal 732%, 610% and 345% of FY 2000 core business revenue, or 128%, 85% and 155% of total asset value respectively. The FY 2000 losses for Dompu and Sumbawa are also the highest indicating that the situation is not improving. PDAM Kupang, while still in a loss-making situation, is the second best performing PDAM, after Menang Mataram.

(3) Cash Flow

Most PDAM operate on a close to neutral cash-flow basis. For the 10 Project PDAM, the cash flow was negative by Rp 540 million, largely as a consequence of a Rp 1.0 billion negative cash flow for PDAM Menang Mataram. However, there are “hidden” subsidies, which reduce the cash outlays. For example, connections are paid for by consumers at actual cost but the materials for constructing connections are often provided to the PDAM through other sources such as the central or provincial government. In addition, many PDAM staff are public servants who still receive a government salary paid directly from the district budget.

Direct subsidies were provided by local governments to the PDAM in Sumbawa, Dompu, Flores Timor and Bima during FY 2000.

There is a lack of understanding of the financial position of the PDAM through confusion between cash flow and profit & loss. This is probably a consequence PDAM management being sourced from government. Government managers do not normally deal with many of the business processes including commercial profit & loss accounts and balance sheets in the operation of their government departments. Rather, cash flow is seen as a key measure of financial performance.

(4) Account Receivable (debtors)

All PDAM have significant debtor problems. In absolute terms the value of outstanding debt for eight of the PDAM (Menang Mataram, Sumbawa, Dompu, Bima, Kupang, Sikka, Flores Timur, Sumba Timur) range from Rp 210 million (Flores Timur) to Rp 1.9 billion (Menang Mataram) (data for Lombok Timur and Sumba Barat were unavailable). In relative terms, PDAM Menang Mataram is the best performing with the average age of accounts receivable being 2.4 months, compared with the worst case of Dompu at more than 13.1 months. Bima and Sumbawa are also very high at 9.2 and 9.7 months respectively. PDAM accounting systems allow a very optimistic treatment of debtors with bad debt provisions of only 50% for debtors of between 1 and 2 years, and 75% for debtors of between 2 and 3 years. Anecdotal evidence indicates government departments and public servants as the consumer group most prevalent amongst the major debtors.

The total account receivable (debtors) for the eight PDAM is Rp 6.8 billion which is equivalent to 4.0 months of business revenue. Bad debt provisions are only Rp 1.6 billion whereas a realistic provision is considered to be closer to Rp 4 billion.

(5) Assets/Equity

Asset valuations are overstated. There are numerous examples of non functioning assets which are kept on the PDAM books and continue to be depreciated but they have no economic value. Examples include vehicles and tools & equipment.

The equity of the PDAM comprises funds provided primarily through central government (often soured from foreign development assistance funds) as well as provincial and district funds.

(6) Loans

PDAM Mataram, Lombok Timur, Sumbawa, Dompu, and Kupang all have loans from central government. Menang Mataram also has loans from ADB. Sumbawa,

Bima and Kupang have cash-flow difficulties in meeting loan commitments. In the case of Menang Mataram it has Rp 7.1 billion of loans from central government (interest rate 11%) and Rp 3,5 billion from the ADB (interest rate 9%).

(7) Computerized Financial Management Systems

Many PDAM in NTB and NTT use a computerized management system known as SISKA which was developed as an output from the AusAID funded ESWS and FLOWS projects. It was designed to meet the needs of administration including connections, billing, accounting, reporting, inventory, payroll, budgeting, performance analysis etc. It is used to varying degrees by 9 PDAM in NTB and NTT. However, the system is not used to its full capacity in many PDAM. Mataram, Kupang and Sumba Timur use alternative software, different in each case.

6.3.8 Technical Issues

(1) Unaccounted for Water (UFW)/Flow Measurement

Water losses are high ranging from 20 - 50% for the 10 PDAM. There is no systematic approach to water loss reduction. Losses would be higher if system performance (pressure, hours of operation) was improved to normal service levels. The total cost of water losses for the 8 PDAM for which adequate data is available is estimated at Rp 8.1 billion annually.

The water loss data are, however, inaccurate. Accurate water production measurement is difficult with an almost total lack of bulk meters. In addition there is a high percentage of defective consumer meters (>20%) in the ten PDAM. No apparent priority was given to replacement of defective meters, even when there were stocks of new meters available. Meter test benches provided by AusAID, almost without exception, have not been used in recent years.

(2) Construction and Equipment Quality

We were frequently advised by PDAM staff of poor quality construction in the form of poor pipe jointing, lack of pressure testing, inadequate pipe depth etc. Most construction and major procurement is tendered and supervised by Kimpraswil rather than by the PDAM. There is evidence of poor procurement practices such as the purchase of low cost but ineffective consumer meters, even though the particular brands were known to perform poorly and to have a higher life cycle cost.

(3) Inventory Management, Workshops, Tools and Equipment

Workshops facilities are limited. Stores for spare parts and equipment are poorly established are operated inefficiently with no proper inventory management.

(4) Specific Technical Issues for Individual PDAM

The above issues are essentially generic, applying to at least several of the Project PDAM. However, there are some specific technical issues in various towns impacting on individual PDAM. Details are provided in Appendix 20.

6.3.9 PDAM Menang Mataram – Case Study

Whilst the preceding section tends to portray a negative picture of PDAM capabilities, the capacity of PDAM (and their predecessor agencies) has improved substantially over the past decade. However the fiscal crisis of 1997/98 has definitely had a negative impact, which has continued to the present time, effectively limiting the continued improvement of most PDAM during the past 4 years.

PDAM Menang Mataram is a good case study of continuous improvement not withstanding the difficult local economic environment. The following Table demonstrates this continued improvement over the period 1996 – 2001. Many other PDAM are at a disadvantage to Mataram in that they have neither the scale nor the good fortune in having an adequate supply of water, which can be distributed to consumers by gravity largely without treatment.

PDAM Menang Mataram – Selected Performance Data

Item	Year							
	2001	2000	1999	1998	1997	1996	1995	Annual Change (%)
Connections (total)	NA	32,121	27,325	24,850	21,782	17,878	14,961	17%
Number of Staff	NA	165	159	149	137	134	118	7%
Staff/1000 connections		5.1	5.8	6.0	6.3	7.5	7.9	
Branches (including Pusat)	10	10	10	10	10	10	10	NA
Profit & Loss (,000 Rp)								
- Income	NA	10,350,547	9,650,386	7,918,165	5,594,496	3,811,828	3,589,475	24%
- Expense	NA	8,935,022	7,317,964	5,920,304	5,372,200	4,432,960	3,725,013	19%
Net (before tax)	NA	1,415,525	2,332,422	1,997,861	222,296	-621,133	-135,538	NA
Balance Sheet (,000 Rp)								
- Net assets	NA	48,497,397	40,380,839	38,848,969	28,653,676	28,789,757	21,681,849	17%
- Equity	NA	33,001,416	13,562,437	12,629,265	12,629,265	1,506,388	1,506,388	85%
- Accumulated profit (loss)	NA	1,801,580	2,373,853	2,238,854	516,031	335,634	956,767	13%
- Return on equity	NA	4.3%	17.2%	15.8%	1.8%	-41.2%	-9.0%	NA
Base Tariff (Rp/m3)	345	300	300	225	225	225	225	7%
Water Distributed (m3)	NA	14,108,944	11,521,894	10,890,584	9,469,149	7,836,166	6,498,941	17%
Water Sold (m3)	NA	10,209,637	8,348,149	7,945,636	6,850,925	5,466,086	4,594,423	17%
Water Losses (m3)	NA	3,899,307	3,173,745	2,944,948	2,618,224	2,370,080	1,904,518	15%
Water Losses (%)	NA	28%	28%	27%	28%	30%	29%	NA
INFLATION								
Average National increase		17.2%						

Source: PDAM reports. Central Statistics Bureau.

It can be seen from the Table that the PDAM has managed to grow connections, water sales and assets by about 17%. At the same time, staffing has grown by only 7%. Revenues have grown by 24% compared with 18% for expenditure. The PDAM has moved from small losses in 1995 & 96 to modest profits from 1997 to 2000. There has also been a substantial increase in equity over this period. Tariff increases have been modest, averaging only 7% per annum compared with inflation of 17% per annum.

6.3.10 Impact of Project

Based on the proposals, which have evolved from the study, the role of the PDAM in the Project villages is summarized in Table 6.3.2.

The key conclusions from Table 6.3.2 are as follows:

- 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. Of these PDAM, Menang Mataram is very strong whilst the others have significant problems, particularly financial ones. However, the impact of the addition of the proposed villages on overall PDAM operations will not be significant.
- In addition 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.
- The incremental operation & maintenance costs estimated at Rp 150 million/year compares with the anticipated revenue of Rp 165 million/year. However for PDAM Flores Timur and Kupang the result is a net loss. For the worst case, PDAM Flores Timur, the incremental operation & maintenance costs estimated at Rp 34 million/year compares with the anticipated revenue of Rp 23 million/year. The net cost represents about 2.3% of the annual operating cost. For Kupang, the costs also exceed revenue but the net cost is less than 0.2% of the annual operating cost.

6.3.11 Priorities and Proposals for PDAM Capacity Building

Clearly there are significant problems that can be addressed through capacity building programs, either as part of the Project or through other multilateral and/or bilateral programs. The key areas may be summarized as follows:

- Clarifying and improving policy and institutional frameworks, including organizational mission and objectives, tariff policies, role in local government social policy, efficiency and accountability;
- Increasing efficiency in organization and staffing through improvements in staff ratios, and better resource allocation to priority activities including strengthening technical service functions;
- Improving service levels in key areas such as coverage, continuity of supply, pressure, quantity, and quality of water;
- Strengthening financial performance through improved business planning, budgeting and tariff setting, reporting and analysis, and debtor management;
- Strengthening technical operations including reductions in UFW, improvements in technical planning, introduction of inventory management systems, and planned preventative and periodic maintenance programs.

However, it is not appropriate for this Project, which has as its primary focus on rural water supply, to tackle all of these issues. The following table indicates the proposed capacity building activities to be addressed by the project. These recommendations are closely aligned to the Project focus and the specific roles of individual PDAM in the successful implementation of the project.

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.

Additional details of the proposed capacity building activities are set out below.

(1) Business Planning, Budgeting and Tariff Policy

1) Objectives

The objectives of this training are to assist PDAM management and staff to:

- Establish key performance criteria for PDAM;
- Assist in the development of realistic business plans to achieve the established performance criteria;
- Assist in developing budgeting models;
- Assist in the development of tariff models based on a range of scenarios;
- Identify key investments required for achievement of business plans;

In addition, training will be provided to key district planners and managers to understand the PDAM business and its implications for district development and financial budgets.

2) Outcome

The key outcome is to enhance PDAM sustainability and to maximize the value from existing assets and proposed investments. Budgets must be sufficient to ensure existing assets can be maintained. Funding has to come either from funds generated by the PDAM operations or through other sources such as operating subsidies or equity provided by the district. A strong PDAM is in the interests of the district and the key to a strong PDAM is efficient management of existing assets and resources.

3) Approach

The training will be provided primarily through workshops using actual PDAM situations for workshop activities. It is envisaged that training will be provided in part by bringing people together in their respective district as well as in one or more provincial centers, and also through on the job activities in the five selected PDAM. Comparative visits will be made to other PDAM including outside Nusa Tenggara.

The training will build on recent activities initiated by PERPAMSI under which most PDAM have already received some training in business planning and in performance benchmarking. Local experts will provide training, as part of the community development team with limited foreign specialist input.

(2) Tariff Setting

1) Objectives

The objectives of this training are to assist PDAM management and staff to:

- Establish tariffs which will enable PDAM to meet the established business plans and which are integrated with district policies;
- Assist PDAM in obtaining approval for and in implementation of revised tariffs.

Training will be provided to key district planners and managers in order that they gain an understanding of the process for tariff setting.

2) Outcome

The key outcome is enhanced PDAM sustainability through establishment of appropriate tariffs. Revenue must be sufficient to ensure existing assets can be maintained. Appropriate tariffs will help ensure a strong PDAM in the interests of the district.

3) Approach

Training will be provided through a mixture of formal training and workshops using actual PDAM situations for workshop activities. It is envisaged that training will be provided in part by bringing people together in their respective district as well as in one or more provincial centers as well as through on-the-job activities in each PDAM.

The training will build on the business planning budgeting and tariff policy training activities. Local experts will provide training as part of the community development team with limited foreign specialist input.

(3) Management Training for Rural Water Supply

1) Objectives

The objectives of this training are to assist PDAM to establish an organization structure and skills to facilitate the provision of support to village water supplies and the communities they supply or support. Key requirements are to:

- Establish or allocate an appropriate position for liaison between village communities and the PDAM;
- To provide training to relevant PDAM staff in relation to the particular issues associated with village water supply systems including working with WUAs;
- Ensure appropriate customer service provisions are in place for village communities, which have PDAM involved in their water supply systems.

2) Outcome

The training will aim to develop a partnership relationship between PDAM and the village communities and their representatives through the WUA. This requires a mutual understanding by WUAs and PDAM of their respective roles and responsibilities.

3) Approach

The training will be provided in association with training provided to WUAs and WUGs during the project preparation and social preparation phases of implementation. Additional support will be provided during the initial period of operation & maintenance. Local experts will provide training with input from specialist foreign staff as required.

(4) Operation and Maintenance Training

1) Objectives

The objective of this training is to enhance the skills of nominated PDAM specifically in relation to the water supply systems to be implemented under the Project. Training will be provided for PDAM staff in relation to Type A and Type B systems. As-built drawings and operation & maintenance manuals produced by the Project will be provided to the PDAM staff, who will be trained in their use and maintenance. The training will ensure that PDAM staff and management are provided with the detailed knowledge required to manage and support the Project water supply systems after commissioning.

2) Outcome

The key outcome will be trained PDAM technical staff with adequate knowledge to ensure operation & maintenance of Project water supply systems, particularly Type A systems, but also for Type B.

3) Approach

The training will be provided primarily through on-the-job training by the Expert's engineers responsible for construction supervision, and the preparation of operation & maintenance manuals. Specialist training may be provided by contractors responsible for provision of equipment such as pumps and motors.

The training will be providing progressively during the period of construction enabling local PDAM staff to develop a thorough understanding of the completed water supply system.

6.3.12 Capacity Building Resources and Program

This section establishes, in broad terms, the program and resources required for implementation of the above capacity building activities. These are integrated with

other activities in a consolidated and detailed implementation organization and program in Chapter 7.

The Business Planning and Tariff Setting activities are essentially independent of other Project activities. These two activities need to be held sequentially with the outcomes from the Business Planning feeding onto the Tariff Setting activity. The program is shown in the following Figure – Capacity Building Program Implementation Schedule. A second Figure – Capacity Building Program Resource Schedule, indicates the resources required for implementation.

For both of these activities the approach is to use a series of workshops at district and province level followed by an extended period during which the PDAM will prepare material. Follow-up workshops will be held to finalise products prepared largely by the PDAM. The program provides for on-going hands-on support for the PDAM by local specialists throughout this period.

While the overall program envisages that the work will be undertaken in two phases (refer to Chapter 7), consideration could be given to undertaking the Business Planning and Tariff Setting activities in both NTB and NTT as part of Phase I for reasons of efficiency and cost effectiveness.

For the other activities, namely management training for rural water supply; and operation & maintenance training for PDAMs, the training will be provided primarily by other Project staff either from the Social Development & Extension team or the Engineering team. The program and resources are also indicated in the following figures. These are shown for Phase 1 but will be repeated in Phase II.

Capacity Building Program Implementation Schedule (Phase I)

Activity & Tasks	MONTH																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Business Planning, Budgeting & Tariff Policy																				
Review of PERPAMSI Training programs and curricula																				
PDAM field visits - needs assessment & data collection																				
District Workshops for PDAM and PEMDA (5 No.)																				
Provincial Planning Workshops for PDAM (2 No.)																				
First Provincial Workshop																				
Second provincial Workshop																				
Follow-up hands on support & formal training																				
Activity Report																				
Tariff Setting																				
District Workshops for PDAM and PEMDA (5 No.)																				
Initial workshop (each kabupaten)																				
Follow-up hands on support & formal training																				
District planning																				
Follow-up hands on support & formal training																				
Activity Report																				
Management Training for Rural Water Supply																				
Training of PDAM management																				
Training of PDAM village staff																				
Operations & Maintenance Training																				
Construction Phase training (on-the-job)																				
O&M Manual training																				

Capacity Building Program Resource Schedule (Phase I)

Activity & Tasks	MONTH																				INPUT
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	(PM)
Business Planning, Budgeting & Tariff Policy																					
Management Specialist 1																					3.0
Management Specialist 2																					6.0
Finance/tariff Specialist																					6.0
WS Planning Specialist																					3.0
Training institutions																					[2]
Tariff Setting																					
Management Specialist 1																					3.0
Management Specialist 2																					6.0
Finance/tariff Specialist																					6.0
Training institutions																					[2]
Management Training for Rural Water Supply																					
Management Specialist 2																					[1]
Community Development Specialist [1]																					[1]
Operations & Maintenance Training																					
Design/Supervision Engineer [1]																					[1]
Supervisor [1]																					[1]
O&M Specialist [1]																					[1]
TOTAL																					33.0

Note:
[1] Undertaken with other duties - no additional resource allocation.
[2] Training institution inputs to be determined.

Table 6.1.1 Present Condition of Health and Hygiene in Target Area

No.	Villages	District	Target pop. (2011)	Main diseases	Place to defecate	%	Waste water disposal	%	Water use in house	
									Boil water before drinking %	Wash hands after defecating %
NUSA TENGGARA BARAT										
1	Kuranji	Lombok Barat	1,894	Skin, Diarrhea	River Others	65 35	Neglected Effective Others	80 17 3	40	25
2	Bajur	Lombok Barat	6,130	Skin, Diarrhea	River Latrine/Others	90 10	Neglected Trench Others	70 15 15	40	15
3	Sembung	Lombok Barat	2,225	ARI, Diarrhea	River Latrine/Others	81 19	Neglected Trench	55 35	52	65
4(a) 4(b)	Duman (Upper) Duman (Lower)	Lombok Barat Lombok Barat	3,078 1,926	ARI, Skin, Diarrhea	River Latrine	57 33	Neglected Effective /Others	78 22	78	22
10	Bagik Papan	Lombok Timur	3,182	ARI, Skin, Diarrhea	River/Garden Latrine	76 24	Neglected/ Trench Effective	84 16	23	37
11	Selaparang	Lombok Timur	3,996	Skin, Gast., Eye, Diarrhea	River/Garden Latrine	64 36	Trench/ Neglected Effective	65 35	25	13
13	Lb. Mapin	Sumbawa	3,570	Diarrhea, Skin, Malaria, Worms	Beach/River/etc Latrine/etc	81 19	Neglected Trench/Effective	42 58	60	37
14	Lb. Lalar	Sumbawa	3,136	Malaria, Diarrhea, Worms, Skin, Eye	Beach/River/etc Latrine/etc	70 30	Muddy/ Neglected Effective	63 37	56	45
16	Piong	Bima	1,662	Diarrhea, ARI, Malaria, Worms	River/Garden Latrine	97 3	Neglected	100	15	5
18(a) 18(b)	Kawuwu (Lower) Kawuwu (Upper)	Bima Bima	414 404	Malaria, ARI, Skin, Diarrhea, Worms	River/Garden Latrine	98 2	Neglected	100	25	18
NUSA TENGGARA TIMUR										
6	Sinar Hading	Flores Timur	1,294	ARI, Malaria, Skin, Diarrhea, Eye, Worms	Latrine Public wc	95 5	Neglected	100	27	0
7	Ile Padung	Flores Timur	1,122	Malaria, Skin, Eye, Diarrhea	Indv. wc Pub. wc	90 10	Trench Neglected	75 25	36	14
18	Weerame	Sumba Barat	1,616	ARI, Malaria, Worms, Eye, Skin, Diarrhea	Latrine	100	Trench/ Neglected Muddy	70 30	34	2
19	Kondamara	Sumba Timur	1,828	Malaria, ARI, Skin, Gast., Diarrhea, Worms	River/Garden Latrine	75 25	Neglected	100	26	6
21	Oebau	Kupang	632	ARI, Malaria, Diarrhea, Gast., Skin, Eye	Garden Latrine	90 10	Neglected	100	17	2
23	Nusakdale	Kupang	450	Malaria, Gast., ARI, Worms, Skin, Diarrhea	Garden Latrine	70 30	Neglected	100	23	3
24	Tarus	Kupang	3,977	ARI, Skin, Malaria, Diarrhea, Eye	Latrine	100	Neglected Muddy	90 10	21	6

Notes: Lb. Mapin : Labuhan Mapin, Lb. Lalar: Labuhan Lalar,

Skin: skin disease. ARI: acute respiratory infection. Eye: eye infection. Gast.: gastroenteritis.

Table 6.1.2 Present Condition of Water Usage in Target Areas

No	Village	District	Drinking Water Use												Average distance to water sources (m)
			HC*		PAH*		Public Tap		Dug Well		Spring		River		
			Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season	
NUSA TENGGARA BARAT															
1	Kuranji	Lombok Barat	-	-	-	-			90	90	10	10	-	-	75
2	Bajur	Lombok Barat	-	-	-	-	7	7	93	93	-	-	-	-	20
3	Sembung	Lombok Barat	3	3	-	-	3	3	49	47	46	47	-	-	48
4(a)	Duman (Upper)	Lombok Barat	8	7	-	-	40	31	33	20	18	29	-	15	150
4(b)	Duman (Lower)	Lombok Barat													
10	Bagik Papan	Lombok Timur	-	-	23	23	-	-	64	63	6	6	8	8	79
11	Selaparang	Lombok Timur	16	16	-	-	-	-	84	84	-	-	-	-	68
13	Lb. Mapin	Sumbawa	51	51	-	-	23	23	26	23	-	-	-	3	11
14	Lb. Lalar	Sumbawa	-	-	-	-	-	-	48	48	-	-	-	-	560
16	Piong	Bima	-	-	-	-	-	-	95	95	5	5	-	-	26
18(a)	Kawuwu (Lower)	Bima	5	5	-	-	45	45	-	-	50	50	-	-	92
18(b)	Kawuwu (Upper)	Bima													
NUSA TENGGARA TIMUR															
6	Sinar Hading	Flores Timur	-	-	-	-	-	-	50	50	50	50	-	-	100
7	Ile Padung	Flores Timur	-	-	-	-	-	-	-	-	100	100	-	-	1,075
18	Weerame	Sumba Barat	-	-	-	-	26	22	-	-	74	67	-	11	594
19	Kondamara	Sumba Timor	-	-	11	8	-	-	72	76	14	13	3	3	250
21	Oebau	Kupang	-	-	-	-	-	-	81	81	19	19	-	-	198
23	Nusakdale	Kupang	-	-	-	-	-	-	7	7	67	67	26	26	700
24	Tarus	Kupang	-	-	-	-	6	5	76	68	-	-	18	26	50

Notes:
HC: House Connection
PAH: Penampung Air Hujan (Rain Water Tank)
Lb. Mapin : Labuhan Mapin
Lb. Lalar: Labuhan Lalar

14 Labuhan Lalar 52% buy water

Table 6.1.3 IEC Hygiene Promotion Staffing Plan

Position	Activities Responsibilities	Interaction with Other Groups
Community Health Education Specialist	Develop and supervise the implementation of health and hygiene education programs to maximize improvement of water supply, hygiene and sanitation.	• Task Force: – Health Department – District office – Community Health Center, Sanitarian, Midwife and Communicable Diseases Officer • NGOs • Community empowerment officer – District - Sub district • Education Department: – District - Sub-district • Kimpraswil – District • Religious Department – Sub-district • Women Movement Organization (TP-PKK) – Sub-district.
IEC Specialist/ Training Specialist	Develop locally appropriate information, education and communication materials and methodology. Train the health field officer and task force. Supervise the training and workshops at different levels and maximize the effectiveness of delivery of IEC at the community level.	• Health Department – District – Sub-district (Puskesmas) • Task force at Sub-district • Community Leaders • Cadres - village • NGO – Province – District – Sub-district.
Health Field Officer	Assemble and present training materials in the classroom. Practical “in the field” and “on the job” activities. Ensure effective and appropriate delivery of IEC promotion. Ensure that the physical practices are demonstrated at each household and monitor attitudes regarding hygiene and sanitation on the spot. Report and perform administration of all field actions and achievements to project management.	• Health Office District – Community Health Center staff • Community Empower at Sub-district • Education Officer at Sub-district • Women Movement Organization – (TP PKK) Sub-district • Community level • All formal/informal leaders • Cadres • NGO • All communities • International agencies, UNICEF, GTZ, WSSLIC.

Table 6.2.1 Summary of Proposed Water Supply Systems

No.	Village	District	Design population (2011)	Source	Gravity/ Pumped	Project components	Primary O&M responsibility
NUSA TENGGARA BARAT							
1	Kuranji	Lombok Barat	1,894	PDAM pipeline	Gravity	New distribution system	PDAM
2	Bajur	Lombok Barat	6,130	PDAM pipeline	Gravity	New distribution system	PDAM
3	Sembung	Lombok Barat	2,225	PDAM pipeline	Gravity	New distribution system	PDAM
4(a)	Duman (Upper)	Lombok Barat	3,078	Spring	Gravity	Reconstruct distribution system	Community
4(b)	Duman (Lower)	Lombok Barat	1,926	PDAM pipeline	Gravity	New distribution system	PDAM
10	Bagik Papan	Lombok Timur	3,182	Spring	Gravity	Rehabilitate & extend CARE Australia system	Community
11	Seleparang	Lombok Timur	3,433	PDAM pipeline	Gravity	Improvement to PDAM regional system	PDAM
13	Lb. Mapin	Sumbawa	3,570	Spring	Gravity	Rehabilitate distribution network	PDAM
14	Lb Lalar	Sumbawa	3,136	Bore	Pumped	New system	Community
16	Piong	Bima	1,662	Bore	Pumped	New system	Community
18(a)	Kawuwu (Lower)	Bima	414	Bore	Pumped	New system	Community
18(b)	Kawuwu (Upper)	Bima	404	Spring	Gravity	Rehabilitate & extend existing system	Community
NUSA TENGGARA TIMUR							
6	Sinar Hading	Flores Timur	1,294	Supply from Desa Ile Padung (Spring)	Pumped	New system	PDAM
7	Ile Padung	Flores Timur	1,122	Spring	Pumped	Reconstruction of old system	PDAM
18	Weerame	Sumba Barat	1,616	Groundwater in cave	Pumped	New system	Community
19	Kondamara	Sumba Timor	1,828	Spring	Pumped	New pumping system, reconstruct/extend existing distribution system	Community
21	Oebau	Kupang	632	Groundwater in cave	Pumped	New system	Community
23	Nusakdale	Kupang	450	Spring	Gravity	Reconstruct existing system	Community
24	Tarus	Kupang	3,977	Spring	Pumped	Rehabilitate pumps, new transmission & distribution system	PDAM

Table 6.2.2 Management Arrangements for Village Water Supplies (WUA/WUG)

Managing Organization	Advantage/Disadvantage	Implications for Implementation
COMMUNITY BASED ORGANIZATIONS (WUA/WUG)	**Advantages:**	
	1. Community has strong vested interest in successful management	• Project planning to provide for community participation in planning and implementation from the beginning of the Project. • Community involvement must include decision-making. Training to be provided to ensure community decision-making is informed. • Formal community structures to be provided for sustainable management. • Women's involvement in decision making for planning, implementation and O&M to be included on Project planning. • Post project follow up M&E, feedback and support to be included – possibly through a local NGO.
	2. Community contributions of materials and labor can contribute to ownership of systems and commitment to on-going sustainable management by community	• Communities to determine appropriate arrangements for contributions of labor and materials. • Design of community structures to provide for transparent management arrangements. • Training in management to be provided as part of Project.
	3. Contributions of materials and labor can reduce cash costs for capital works and O&M	• Communities to determine appropriate arrangements for contributions towards capital and O&M costs. • Design of community structures to provide for transparent management arrangements. • Training in financial management to be provided as part of Project.
	Disadvantages:	
	1. Technical skills for O&M are limited	• O&M training to be provided as part of Project implementation. • Basic tools, equipment and spare parts to be included in Project procurement. • WUA/WUG agreements to include provision for charges to meet essential O&M costs.
	2. Affordability is limited and may not support systems requiring regular payment of electricity and/or fuel bills	• Project designs will avoid complex systems and particularly those requiring electrical and mechanical equipment where possible. • O&M cost estimates, including electricity and fuel costs, to be established during Project planning. Cost implications to be explained to communities as part of the planning and decision making process. • WUA/WUG agreements to include provision for tariffs to meet external O&M costs.
	3. External resources required for more complex O&M requirements (eg. Repair or replacement of pumps)	• Project planning will identify appropriate sources of external support and arrangements for their engagement (e.g. for ongoing electrical/mechanical maintenance of pumps and motors – PDAM and/or suppliers). • Communities to be consulted on the need for external support. Cost of external resources to be included in WUA/WUG agreements and tariff calculations. • Mechanisms for accessing external resources to be agreed by all relevant parties.

Table 6.2.3 Management Arrangements for Village Water Supplies (PDAMs)

Managing Organization	Advantage/Disadvantage	Implications for Implementation
KABUPATEN WATER ENTERPRISE (PDAM)	**Advantages:**	
	1. Established organization with political mandate for management of water supply systems.	▪ Agreement with PEMDA (Bupati) required particularly when costs will exceed revenue as this is not consistent with PDAM mission of being a profit driven commercial water enterprise. ▪ Subsidies/support funding, if required, to be identified and should be provided by PEMDA through transparent processes and not by imposing non-viable village systems on PDAMs.
	2. Pool of experienced staff with management and technical skills in water supply O&M.	▪ Clarify bureaucratic constraints (lack of funds, lack of clear responsibilities) to effective use of technical staff to support Project systems. ▪ Agreements to ensure PDAMs are aware of O&M requirements through O&M Plans based on specific Project proposals. ▪ Provide specific tools, equipment and materials for Project systems and ensure they remain available for the Project villages.
	Disadvantages:	
	1. PDAMs have limited interest in incorporating small systems within their jurisdiction because costs frequently exceed revenue – particularly for pumped systems.	▪ Cost and revenue to be calculated so that PDAMs understand the financial implications of O&M involvement before committing to accept management responsibility. ▪ Subsidies/support funding, if required, to be identified and should be provided by PEMDA through transparent processes and not by imposing non-viable village systems on PDAMs. ▪ Project planning and design to minimize the use of pumped systems or systems requiring treatment.
	2. Tariffs may not be affordable.	▪ Tariffs to be explained to communities as part of the planning process. ▪ Public hydrants provide the lowest cost option for communities when affordability is low. ▪ PEMDA to consider reduced different tariff levels/structures for village systems – as is currently done in some districts.
	3. PDAMs are perceived as government, imposing systems without consultation.	▪ Where a PDAM is proposed as the primary O&M organization, the commitments and obligations of both the community and the PDAM are to be clearly understood, documented and agreed with communities. ▪ Community participation to be provided through the planning and design phase and in the operation of public hydrants. Involvement of WUAs is proposed to provide "weight" in community dealings with the PDAM.
	4. PDAMs are often physically remote from villages and cannot effectively provide O&M services.	▪ Logistics as well as policy to be considered in Project decision making process. ▪ Project to consider provision of facilities for PDAMs, specifically allocated to use for O&M in Project villages. E.g. Spare pump sets, special tools etc.

Table 6.2.4 Management Arrangements for Village Water Supplies (Hybrid)

Managing Organization	Advantage/Disadvantage	Implications for Implementation
HYBRID MANAGEMENT ARRANGEMENTS – COMMUNITY & PDAM OR PRIVATE SECTOR	**Advantages:**	
	1. Provides opportunity to supplement village resources for more complex O&M tasks such as pump repair/ replacement, major pipe repair etc. Maximizes benefits of available skills and equipment.	▪ Secure PEMDA/PDAM and community agreement and estimate costs involved. ▪ Mechanisms for coordination between communities and PDAM to be established and encouraged. ▪ Prepare specific agreement to document roles and responsibilities of community and PDAM. ▪ Project to provide specialist spare parts and equipment to PDAM for O&M of village systems. ▪ Private sector resources and skills to be accessed as appropriate through maintenance agreements and supply of spare parts (scope likely to be limited). For example, Project to consider a global contract with private sector for specific O&M activities – e.g. electrical and mechanical maintenance. ▪ Encourage maximum uniformity of equipment to assist in spares inventory management and supplier service contracts. ▪ Encourage broader use of private sector resources during implementation to strengthen private sector capacity.
	Disadvantages:	
	1. Possible limited interest by PDAM and/or private sector because of small scale of activities	▪ Needs to be considered in detailed project planning and discussed with PEMDA/PDAM and private sector as appropriate. ▪ Prepare specific agreement to document roles and responsibilities of community and PDAM and private sector as appropriate.
	2. Remoteness of some villages is a deterrent to both PDAM and the private sector	▪ Needs to be considered in detailed project planning and discussed with PEMDA/PDAM and private sector as appropriate. ▪ Prepare specific agreement to document roles and responsibilities of community and PDAM and private sector as appropriate.
	3. Cost must be borne by communities in order to ensure sustainability	▪ Involve communities in planning to ensure the need for external resources is understood. ▪ WUA/WUG agreements to recognize the need for payment of costs through regular contributions (tariffs) from villagers.

Table 6.2.5 Sustainability Risk Assessment

Management	No of villages	Population	Source					
			PDAM piped system		Spring		Groundwater	
			Gravity	Pumped	Gravity	Pumped	Gravity	Pumped
NUSA TENGGARA BARAT (12 systems)								
PDAM	6	19,741	4	_	2	_	_	_
Community	6	11,876	_	_	3	_	_	3
NUSA TENGGARA TIMUR (7 systems)								
PDAM	3	6,393	_	_	_	3	_	_
Community	4	4,526	_	_	1	3	_	_
WHOLE PROJECT (19 systems)								
PDAM	9	26,134	4		2	3	_	_
Community	10	16,402	_	_	4	3	_	3

Moderate sustainability risk - 3 out of 19 systems

High sustainability risk – 6 out of 19 systems

Table 6.2.6 Summary O&M Arrangements

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

Table 6.2.7 WUA/WUG Lessons and Responses from Previous Project Experience

<table>
<tr><th>Issue</th><th colspan="2">Description</th></tr>
<tr><td>Common problems experienced on previous projects</td><td colspan="2">1. The newly elected WUA/WUG members often have other village organizational functions and do not have the time to carry out their assigned WUA/WUG tasks.
2. Forceful personalities often dominate the WUA/WUG.
3. Conflict between the decision-making role of the WUA/WUG and the authority of the traditional leaders. The Project imposes another leadership structure which existing leaders may not support.
4. Internal friction or conflict may occur among community people. Additional social conflicts will inevitably occur and cause delays.
5. Communities often change the design without reference to CFO and without documentation.
6. The handling of funds can be a focus for conflict. The treasurer position tends to drop out most often.
7. WUAs fulfill their responsibilities during the construction phase but fail to continue their work after commissioning. WUA/WUG members tend to break up shortly after their formation due to lack of regular activity.
8. WUAs/WUGs only become active when there is a breakdown or some problems. Otherwise WUA members feel there is no need to meet or even collect fees.
9. Water users fees have been set but not collected.</td></tr>
<tr><td rowspan="2">Important responses for the Project</td><td>Items</td><td>Related problems</td></tr>
<tr><td>▪ Full community participation and agreement in the setting up of WUG/WUA and drafting of their regulations.
▪ All participants must agree and understand their tasks and responsibilities as water users and as WUA/WUG members and any system of penalties for infringement of regulations.
▪ WUA members' selection in particularly chairman and treasure to be reviewed and confirmed quarterly during the construction stage based on critical observation/review by CFO.
▪ Early technical guidance required for communities regarding viable options.
▪ Study tours or cross visits should be used for team building and to break down cultural barriers.
▪ The Project needs to gain support of existing power structures in the villages: civil, traditional and religious.
▪ CFO roles and responsibilities need to be appropriately designed. CFO capacity in problem solving, communication, and counselling is critical.</td><td>No. 2 ,4, 5 & 9
No. 2, 5, 7, 8 & 9
No. 1, 2 & 6
No. 5
No. 7 & 8
No. 2 & 3
No. 4, 5 , 7 & 9</td></tr>
</table>

Table 6.2.8 Implementation – Lessons Learned

Lesson	Response	Source
Need for changing culture	▪ The involvement of women will be encouraged at every phase of Project planning & implementation. Women will be encouraged to become active members of the WUA and health awareness groups. Experience indicates that involvement of women in decision-making is still limited and there are problems in integrating gender and community management approaches with strong local traditions.	▪ WASPOLA & FLOWS
	▪ The Project programming must recognize the longer-timeframes needed for behavior change.	▪ FLOWS
Ensure the skill development for O&M	▪ Adequate time must be allowed for follow-up and technical supervision in the field in order to achieve adequate O&M skills.	▪ ESWS and FLOWS
	▪ The Project will ensure proper legal "hand-over" of water supply facilities provided to communities, to ensure that there is perpetual legal ownership by communities, and that responsibilities for O&M are clear.	▪ ESWS AusAID Evaluation
	▪ Utilize PDAM resources to provide support to communities in the O&M of more complex systems.	▪ ESWS AusAID Evaluation
Training needs for experts, field officers and other stakeholders	▪ Training is required for government staff, especially those in PDAM and village level institutions, to ensure they are fully aware of the Project scope, objectives and requirements.	▪ WASPOLA
	▪ CFOs play a key role in implementation and need to receive intensive training to equip them for their important role in community facilitation and capacity building for WUA/WUG members. Intensive training is also required for local engineers and supervisors in technical quality control.	▪ FLOWS
	▪ For monitoring and evaluation, difficulties arose using field officers for interviews and data collection as they were inexperienced in this role, and survey data sometimes needed to be clarified, cleaned, or re-surveyed	▪ FLOWS

Table 6.2.9 Summary of Training Requirements (Step 1 and Step 2)

Step	Items	Comment	Time	Responsibility	Participants
Step 1 Project Preparation	1. Orientation meetings	Explanation of the project (scope, implementation schedule, funding etc.)	2 days	Expert	Leaders Community
	2. Needs assessment	Baseline survey and needs assessment	2 weeks	Expert (NGO sub consultant)	Community
	3. Final selection of target communities and confirmation of village participation in Project	Clarification of demands, technical options (source, transmission & distribution system, connections), proposed management arrangements, community responsibilities, costs	5 days	Expert	Leaders Community members
Step 2 Social Preparation	1. Orientation:	Review and confirmation of technical design assumptions, costs, management arrangements, and community obligations	1 week	Expert	Leaders Community members
	2. Consultation / Awareness training	Community consultation / awareness training on water management, water & sanitation for health, gender awareness, management arrangements,	1 month	CFO	Community members
	3. Institutional management	Consideration / establish-ment of WUA and WUG organizational and representational requirements	3 days	Expert	Community members
	4. Workshop for formal agreement	▪ Workshop with PEMDA Implement formal agreement between village authorities, PEMDA and Project	3 times/ 1 month	Expert PDAM	Leaders Community members

Table 6.2.10 Summary of Training Requirements (Step 3 and Step 4)

Step	Items	Comment	Time	Responsibility	Participants
Step 3 Supporting WUA/WUG	1.Establishment of WUA/WUG				
	▪ Election of WUA&WUG	▪ Expert for community members ▪ Election of WUA/WUG members	2 weeks	Field officer	Leaders WUG members
	▪ Initial training of WUA & WUG members	Community meeting methods, networking, community management approach, and health and hygiene skills.	1 week	Expert Field officer	WUA members & chief of each WUG
	▪ Preparation of regulations	Define the responsibilities and roles for O&M	1 week	Field officer	WUA& community members
	▪ Establishment of WUA	▪ Legally register WUA and WUGs ▪ Establish WUA's bank account	1 week	Field officer	WUA members
	2. Motivation and community empowerment	Caretakers methods especially for women, and personal skills and self-confidence training for women	2 weeks	Field officer WUG member	Community members
	3. Construction supervision	Technical training for artisans	5 days	O&M expert	Artisans
	4. O&M training	▪ Administration, problem solving, regular meeting, minutes recording, ▪ Finance: Water charge, record-keeping, accountability ▪ Technical: adequate skills for monitoring, operation, maintenance, inspection and reparation of facilities	1 week	Expert Field officer	WUA/WUG members
Step 4 Monitoring & Evaluation	1. Monitoring:	▪ Participatory monitoring and evaluation methods ▪ Regular supervision	1 week Each month	Field officer WUA member	WUA/WUG members
	2. Field trip to other WUAs	Exchange experiences with successfully established WUAs	2 days	Field officer	WUA members
	3. Training for sustainability (participatory planning)	▪ Planning and implementation of sanitation programs ▪ Planning income generation activities, saving and loan management. ▪ Environmental protection of water source area.	1 week	Field officer	WUA/WUG & community members
	4. End of Cycle training:	The program evaluation and hand-over of facilities, planning for the continuation of the program.	5 days	Field officer	Community members
	5. Follow up:	▪ Technical problems ▪ Maintenance and operation of facilities and WUA	1 weeks	Project team	WUA/WUG Community

Table 6.2.11 Operation & Maintenance Plan – Type A

Category	Activity	Tasks	Responsibility		Role of Project	
			Primary	Support	Activity	Responsibility
Administration & Finance	Establishment and operation of WUA/WUG	Determine structure	Community	Camat	Awareness training	Expert
		Elect representatives	Community	Kepala Desa/Camat/ BPD	Awareness training	Expert
		Implement formal agreement	WUA/WUG	Camat	Prepare draft WUA/WUG agreements	Expert
		Legally register organizations	WUA/WUG	Camat/PMD	Research registration requirements	Expert
		Regular reporting	WUA	Camat/PMD	Develop reporting requirements. Provide training.	Expert
		Audit requirements	WUA	Camat	Research audit requirements. Provide training.	Expert
	Financial management	Financial planning & budgeting	PDAM	BAPPEDA Tk. II	Training & initial support	Expert
		Tariff setting	PDAM	BAPPEDA Tk. II	Training. Assistance with initial tariff setting.	Expert
		Billing and collection	PDAM	BAPPEDA Tk. II	Training & support with establishment of systems	Expert
		Financial reporting	PDAM	BAPPEDA Tk. II	Training & support with establishment of systems	Expert
	Community liaison	Community information material	PDAM	WUA	Training & support with establishment of systems	Expert
		Complaints/reporting mechanism	PDAM	WUA	Training & support with establishment of systems	Expert
System Operation & Maintenance	Headworks	Water source management	PDAM	Kimpraswil Tk. II	Training & provision of tools & equipment	Expert
		Pump station operation	PDAM	Kimpraswil Tk. II	Training & provision of tools & equipment	Expert
		Storage operation	PDAM	Kimpraswil Tk. II	Training & provision of tools & equipment	Expert
	Pipelines	Regular inspection	PDAM	Kimpraswil Tk. II	Training & provision of tools & equipment	Expert
		Periodic repairs	PDAM	Kimpraswil Tk. II	Training & provision of tools & equipment	Expert
	Connections	PH inspection & repair	WUG	PDAM	Training & provision of tools & equipment	Expert
		HC inspection & repair	PDAM		Training & provision of tools & equipment	Expert
		Meter maintenance	PDAM		Training & provision of tools & equipment	Expert
		New connections	PDAM		Provide guidelines and training on capacity constraints	Expert
	System management	As-built records maintenance	PDAM		Provide initial as-built drawings for update. Provide training.	Expert
		O&M Manuals	PDAM		Provide initial system O&M manuals. Provide training.	Expert
		O&M record keeping	PDAM		Provide forms for record keeping. Provide training.	Expert
	Spare parts & equipment	Stock control	PDAM		Provide forms for stock records. Provide training.	Expert
		Purchasing	PDAM		Provide details of suppliers. Provide training.	Expert

Table 6.2.12 Operation & Maintenance Plan – Type B

Category	Activity	Tasks	Responsibility		Role of Project	
			Primary	Support	Activity	Responsibility
Administration & Finance	Establishment and operation of WUA/WUG	Determine structure	Community	Camat	Awareness training	Expert
		Elect representatives	Community	Kepala Desa/Camat/ BPD	Awareness training	Expert
		Implement formal agreement	WUA/WUG	Camat	Prepare draft WUA/WUG agreements	Expert
		Legally register organisations	WUA/WUG	Camat/PMD	Research registration requirements	Expert
		Regular reporting	WUA	Camat/PMD	Develop reporting requirements. Provide training.	Expert
		Audit requirements	WUA	Camat	Research audit requirements. Provide training.	Expert
	Financial management	Financial planning & budgetting	WUA	BAPPEDAcTk. II	Training & initial support	Expert
		Tariff setting	WUA	PDAM	Training. Assistance with initial tariff setting.	Expert
		Billing and collection	WUA	Camat	Training & support with establishment of systems	Expert
		Banking	WUA	Kepala Desa	Training & support with establishment of systems	Expert
		Financial reporting	WUA	BPD	Training & support with establishment of systems	Expert
	Community liaison	Community information material	WUA	Camat/PMD/Puskesmas	Training & support with establishment of systems	Expert
		Complaints/reporting mechanism	WUA	BPD/IEC Task Force	Training & support with establishment of systems	Expert
System Operation & Maintenance	Headworks	Water source management	WUA	PDAM	Training & provision of tools & equipment	Expert
		Pump station operation	WUA	PDAM	Training & provision of tools & equipment	Expert
		Storage operation	WUA	PDAM	Training & provision of tools & equipment	Expert
	Pipelines	Regular inspection	WUA	PDAM	Training & provision of tools & equipment	Expert
		Periodic repairs	WUA	PDAM	Training & provision of tools & equipment	Expert
	Connections	PH inspection & repair	WUG	WUA	Training & provision of tools & equipment	Expert
		HC inspection & repair	WUA	PDAM	Training & provision of tools & equipment	Expert
		Meter maintenance	WUA	PDAM	Training & provision of tools & equipment	Expert
		New connections	WUA	PDAM	Provide guidelines and training on capacity constraints	Expert
	System management	As-built records maintenance	WUA	PDAM	Provide initial as-built drawings for update. Provide training.	Expert
		O&M Manuals	WUA	PDAM	Provide initial system O&M manuals.	Expert
		O&M record keeping	WUA	PDAM/Camat	Provide forms for record keeping. Provide training.	Expert
	Spare parts & equipment	Stock control	WUA	PDAM	Provide forms for stock records. Provide training.	Expert
		Purchasing	WUA	PDAM	Provide details of suppliers. Provide training.	Expert

Table 6.2.13 Operation & Maintenance Plan – Type C

Category	Activity	Tasks	Responsibility		Role of Project	
			Primary	Support	Activity	Responsibility
Administration & Finance	Establishment and operation of WUA/WUG	Determine structure	Community	Camat	Awareness training	Expert
		Elect representatives	Community	Kepala Desa/Camat/ BPD	Awareness training	Expert
		Implement formal agreement	WUA/WUG	Camat	Prepare draft WUA/WUG agreements	Expert
		Legally register organisations	WUA/WUG	Camat/PMD	Research registration requirements	Expert
		Regular reporting	WUA	Camat/PMD	Develop reporting requirements. Provide training.	Expert
		Audit requirements	WUA	Camat	Research audit requirements. Provide training.	Expert
	Financial management	Financial planning & budgetting	WUA	BAPPEDA Tk. II	Training & initial support	Expert
		Tariff setting	WUA	BAPPEDA Tk. II	Training. Assistance with initial tariff setting.	Expert
		Billing and collection	WUA	Camat	Training & support with establishment of systems	Expert
		Banking	WUA	Kepala Desa	Training & support with establishment of systems	Expert
		Financial reporting	WUA	BPD	Training & support with establishment of systems	Expert
	Community liaison	Community information material	WUA	Camat/PMD/Puskesmas	Training & support with establishment of systems	Expert
		Complaints/reporting mechanism	WUA	BPD/IEC Task Force	Training & support with establishment of systems	Expert
System Operation & Maintenance	Headworks	Water source management	WUA		Training & provision of tools & equipment	Expert
		Pump station operation	WUA		Training & provision of tools & equipment	Expert
		Storage operation	WUA		Training & provision of tools & equipment	Expert
	Pipelines	Regular inspection	WUA		Training & provision of tools & equipment	Expert
		Periodic repairs	WUA		Training & provision of tools & equipment	Expert
	Connections	PH inspection & repair	WUG	WUA	Training & provision of tools & equipment	Expert
		HC inspection & repair	WUA		Training & provision of tools & equipment	Expert
		Meter maintenance	WUA		Training & provision of tools & equipment	Expert
		New connections	WUA		Provide guidelines and training on capacity constraints	Expert
	System management	As-built records maintenance	WUA		Provide initial as-built drawings for update. Provide training.	Expert
		O&M Manuals	WUA		Provide initial system O&M manuals. Provide trainin	Expert
		O&M record keeping	WUA	Camat	Provide forms for record keeping. Provide training.	Expert
	Spare parts & equipment	Stock control	WUA		Provide forms for stock records. Provide training.	Expert
		Purchasing	WUA		Provide details of suppliers. Provide training.	Expert

Table 6.3.1 Key PDAM Capacity and Performance Data (FY 2000 except as noted)

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 (FY 2000)	,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 (FY 2000)	,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	,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	% 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	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)	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 popn.	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: [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 Role of PDAM in Project Villages

PDAM	Village	Proposed PDAM Role	Comment	O&M Implications for PDAM				
				New Connections	Additional O&M Cost [,000 Rp/year]	Additional Revenue [,000 Rp/year]	Staffing [1]	Summary
NUSA TENGGARA BARAT								
Menang Mataram	Kuranji	Management of proposed system	Source is PDAM pipeline	141	6,000	8,000	1	Net return to PDAM
	Bajur	Management of proposed system	Source is PDAM pipeline	540	20,000	29,000	1	
	Sembung	Management of proposed system	Source is PDAM pipeline	161	7,000	9,000	1	
	Duman (b)	Management of proposed system	Source is PDAM pipeline	144	8,000	11,000	1	
	Duman (a)	No specific role	Gravity system	NA	NA	NA	NA	NA
Lombok Timur	Bagik Papan	No specific role	Gravity system	NA	NA	NA	NA	NA
	Seleparang	Management of proposed system	Source is PDAM pipeline	574	17,000	26,000	2	Net return to PDAM
Sumbawa	Labuhan Mapin	Management of proposed system	Utilizes existing PDAM source	453	17,000	26,000	1	Net return to PDAM
	Labuhan Lalar	O&M support to community	Pumped system	NA	Minimal	Cost recovery	NA [2]	
Bima	Piong	O&M support to community	Pumped system	NA	Minimal	Cost recovery	NA [2]	
	Kawuwu (a)	O&M support to community	Pumped system	NA	Minimal	Cost recovery	NA [2]	
	Kawuwu (b)	No specific role	Gravity system	NA	NA	NA	NA	
NUSA TENGGARA TIMUR								
Flores Timur	Sinar Hading	Management of proposed system	Pumped system	222	14,000	12,000	1	Net loss to PDAM approximately 2.3% of FY 2000 operating costs
	Ile Padung	Management of proposed system	Pumped system	187	20,000	11,000	2	
Sumba Barat	Weerame	O&M support to community	Pumped system	NA	Minimal	Cost recovery	NA [2]	
Sumba Timur	Kondamara	O&M support to community	Pumped system	NA	Minimal	Cost recovery	NA [2]	
Kupang	Oebao	O&M support to community	Pumped system	NA	Minimal	Cost recovery	NA [2]	
	Nusakdale	No specific role	Gravity system	NA	NA	NA	NA	
	Tarus	Management of proposed system	Existing PDAM facilities at source.	659	41,000	33,000	2	Net cost to PDAM approximately 0.2% of FY 2000 operating costs

[1] Staffing generally to be allocated from existing resources.
[2] Village liaison person to be nominated in each PDAM

The Study on Rural Water Supply Project in Nusa Tenggara Barat and Nusa Tenggara Timur

JAPAN International Cooperation Agency

Figure 6.1.1

Flow Chart of Implementation Plan on Health and Hygiene Education

FLOW CHART OF IMPLEMENTATION PLAN ON HEALTH AND HYGIENE EDUCATION

COMMUNITY PREPARATION

- Project socialization and explanation to all stakeholders at all levels down to the village and neighborhood level.
- Identify key persons to work as group members.
- Establishment of Working groups by Health Field Officer(HFO) and NGO
- Workshop on development of hygiene, sanitation and water use indicators, to be organized by NGO and Community Health Education Specialist(CHES)
- Training for trainers (TOT) on how to identify and develop simple material for CIE
- Training of elementary school teacher on use of local module in elementary schools at all project sites
- Train the community voluntary (EH Cadres) to become community motivators on hygiene, sanitation and water use in each neighborhood.
- Develop and conduct KAP surveys at all project location.

PROMOTION AND MOBILIZATION

- Conduct intensive counseling trough mosque, church and culture performances
- Conduct drama and cultural performances at all neighborhoods on "The danger of poor health, sanitation and hygiene" To be implement by Cultural leaders 8 times each years.
- Organize community participation (local materials and labor) for water supply activities at each public tap.
- Mobilize community groups to implement hygiene, environmental and sanitation activities (physical activities).
- Group discussions on hygiene, sanitation and water use education in women and children group every week in all neighborhood.

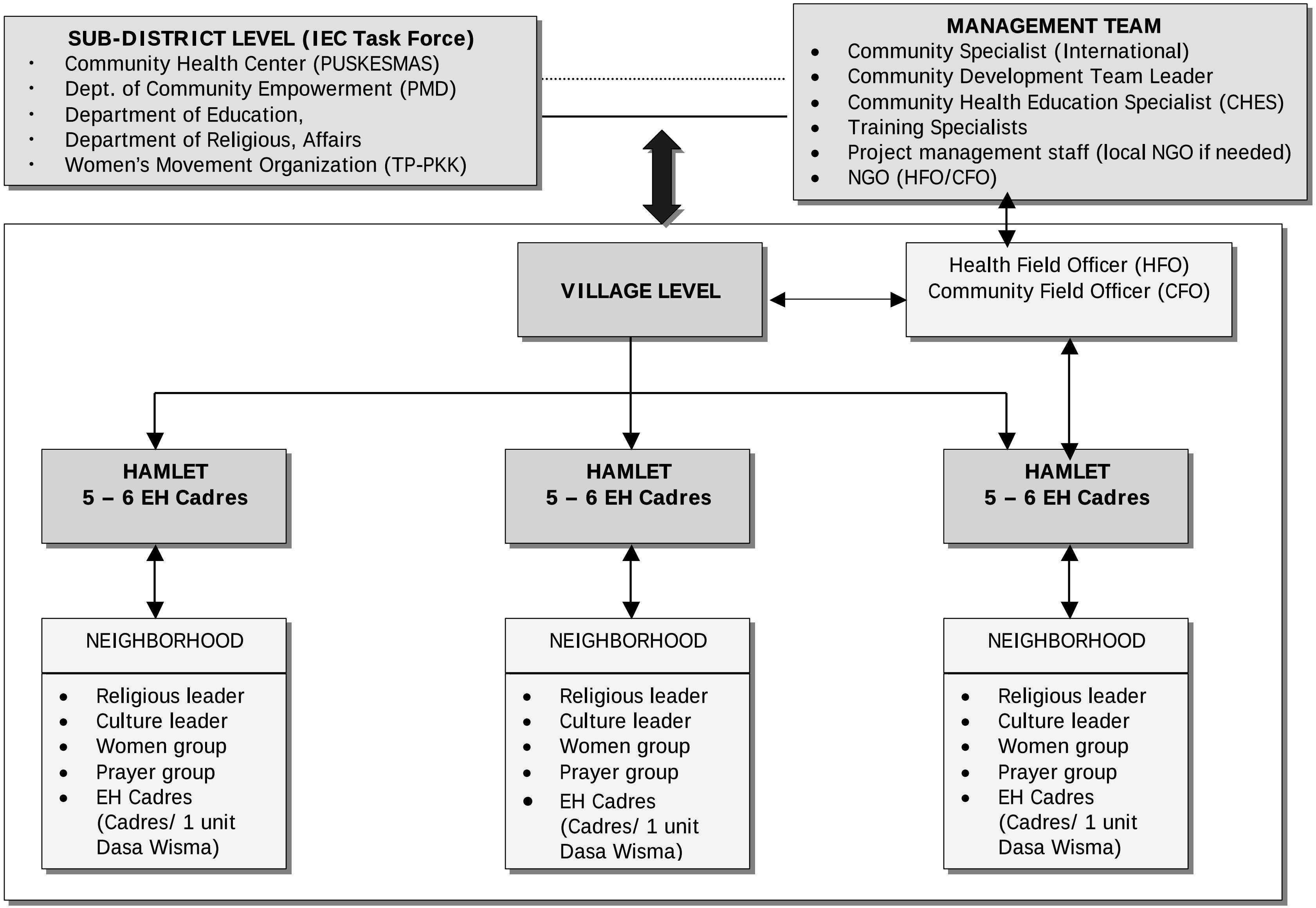
IMPLEMENTATION OF PHYSICAL ACTIVITIES (Latrine, Waste Water Disposal and Cleaning)

MONITORING AND EVALUATION

- The monitoring activities will be performed intensively after the projects arrive in the village. After six months of community preparation the HFO. EH Cadres and Community leaders can start intensive supervision and monitoring;.
- Focus on Knowledge Attitude and Practices.
- Record and Reporting: recording and reporting will be done by community and project team, using start and data sheet.
- Conducting evaluation workshop at village level for hand over and follow up

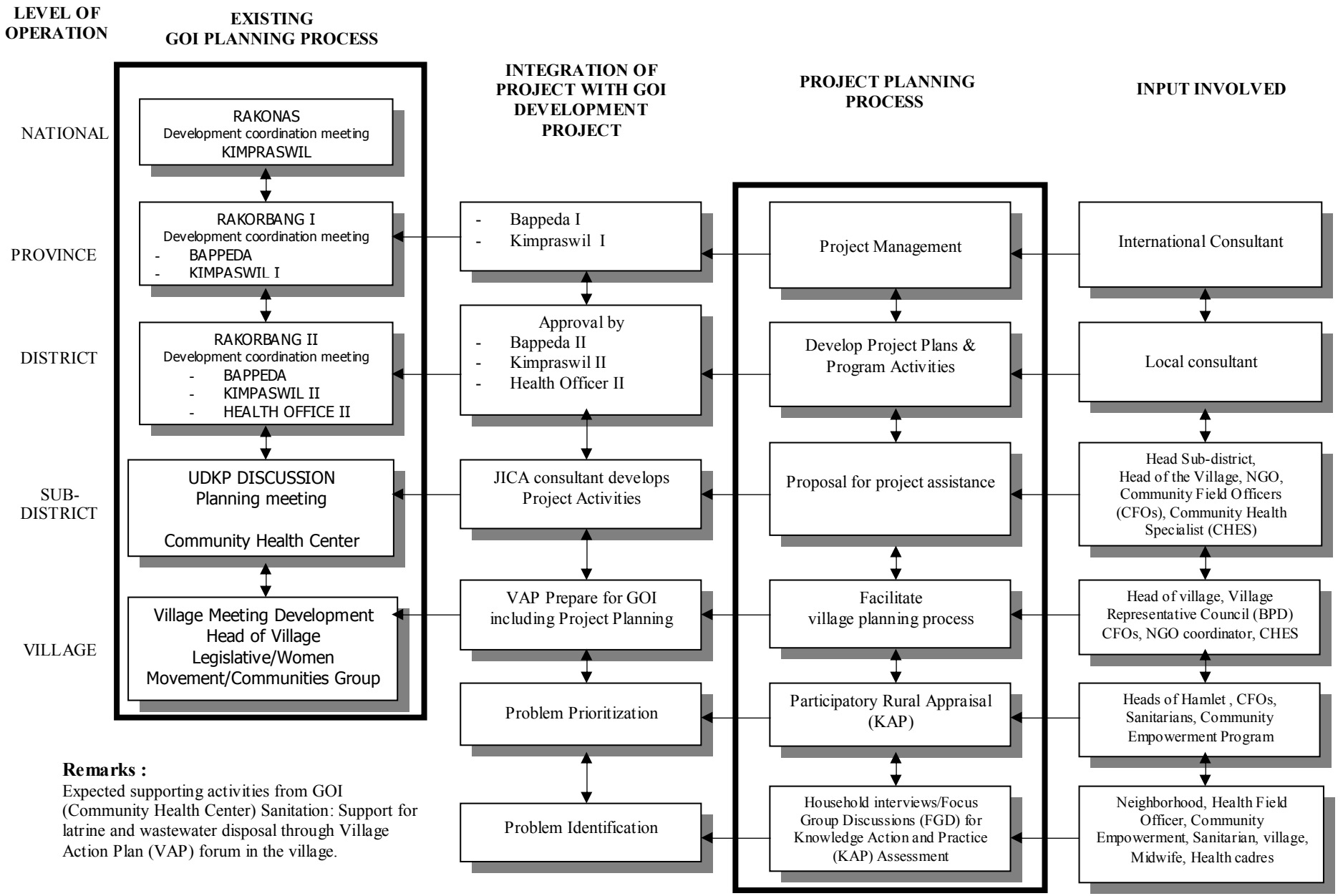
Figure 6.1.2
Organization Chart for Activities at Village Level

ORGANIZATION CHART FOR ACTIVITIES AT THE VILLAGE LEVEL



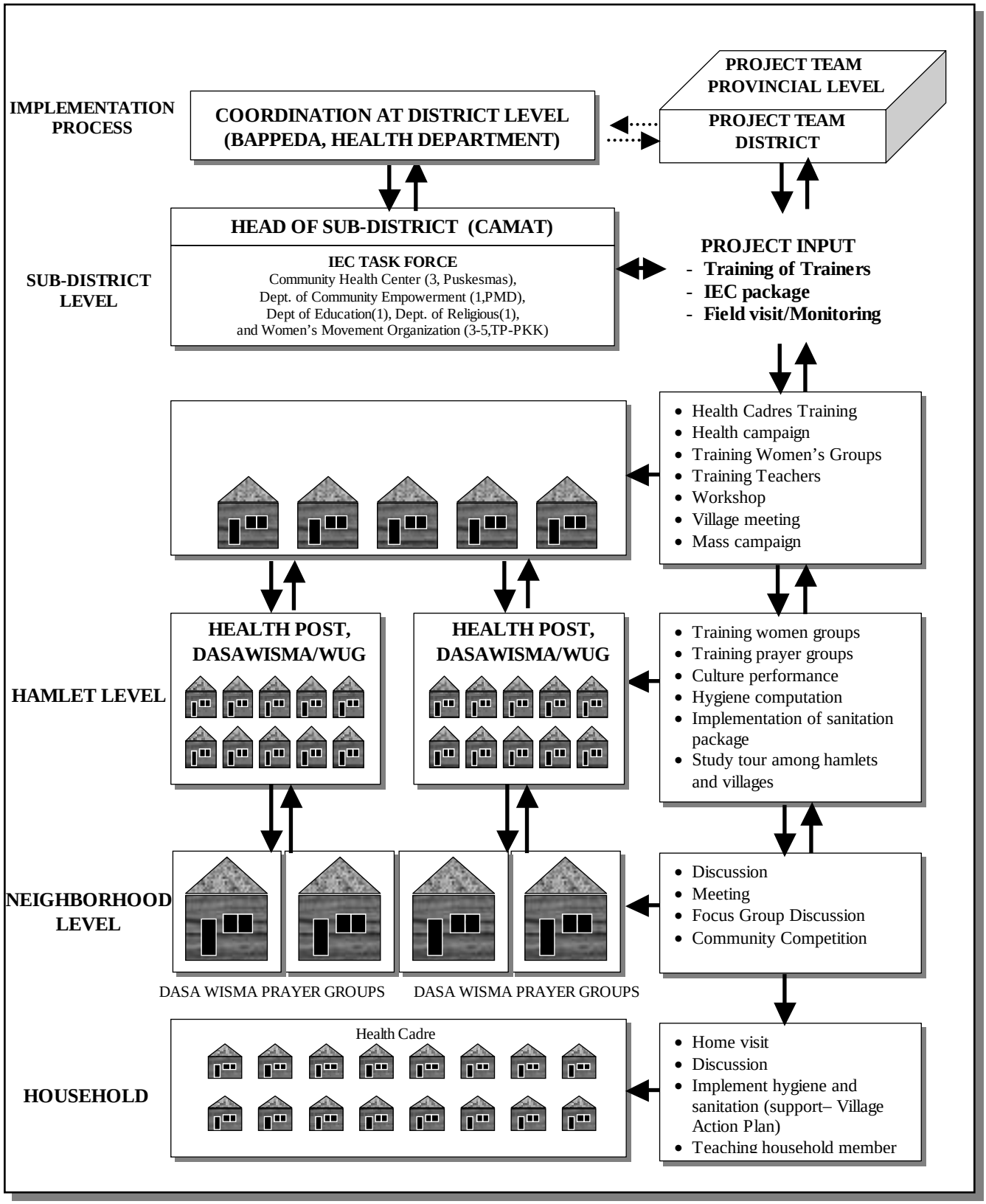
Dasa Wisma : Family unit group consist of 10 – 20 houses/unit

Figure 6.1.3 Relationship Between GOI and Project Processes



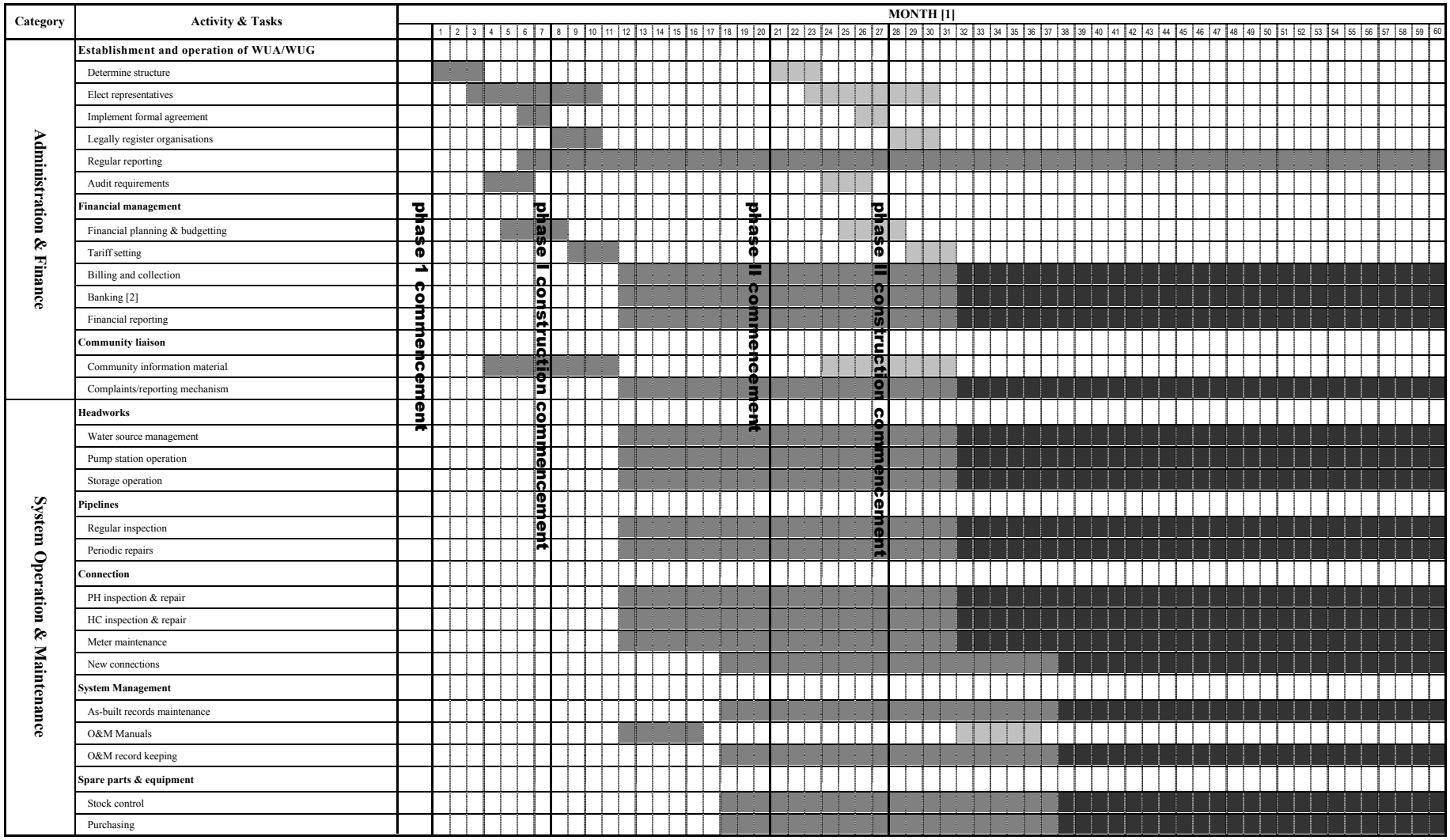
Remarks :
Expected supporting activities from GOI (Community Health Center) Sanitation: Support for latrine and wastewater disposal through Village Action Plan (VAP) forum in the village.

Figure 6.1.4 The Process of Health and Hygiene Education at Village Level



*Desa Wisma : family unit group consist of 10-20 houses/ unit

Figure 6.2.1 Operation & Maintenance Plans Implementation Program



LEGEND:

- Phase I
- Phase II
- Phase I & II

NOTE:

[1] Timing for many activities is approximate only as each village will have a different construction program.

[2] Only for Types B & C.

Chapter 7 IMPLEMENTATION PLAN

7.1 Phased Development

There are two implementation plans conceivable for 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 discussed 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 and management costs because the villages in NTB are smaller than those 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.
- Unfortunately this does not reflect the needs of the people which are, in general, far more urgent in NTT. However it will help to reduce the opportunities for other agencies to undertake the selected projects as this is much more likely to occur in NTB.

Plan 1 has such feature:

- that meets the decentralization objectives of the present national policy;
- that is advantageous to keep the work area smaller from the viewpoint of construction management (both construction supervision by the employer and site management/resource control by the contractor);

- that brings easier management, than that of developing two or more provinces, from the viewpoint of less number of local governments and agencies whom it is necessary to liaise with during construction;

  (The local government agencies that will support the implementation of the project are organized on a provincial and district basis. There are five districts involved in NTB and four in NTT. It is more effective and efficient to reduce the number of departments and agencies with whom it is necessary to liaise during construction.

  Suppose, for example, that two villages were developed in a province (Case 1) and two villages in two provinces (Case 2); Case 1 will have more advantages than Case 2. In Case 1, one provincial and two district officers, three local government officials in total, will liaise with the project, while in Case 2, two provincial officials and two district officials, four in total, are required. In Case 1, the setup enables the local governments to support the project in a more simple and reasonable way than Case 2, as the provincial government may act as a leader and a coordinator between the local governments, while in Case 2 this may not be the case.)

- that may make the work period shorter and would lead to earlier rising of effect on the development, than those of developing large area, because of more efficient management;
- that is less costly, than developing large area, because of developing smaller area at each of phases;
- that would bring higher quality of the works and services, than those of developing large area, because of efficient management;
- that may reduce the risk of projects in developing smaller area comparing to the development of a larger area; but
- that does not give both of the provinces an equal opportunity of development.

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 side. Plan 2 is discussed through in parallel with Plan 1 in the report. Plan 2 has a feature to put equal importance on NTB and NTT provinces.

Plan 2 has such feature:

- that does not meet the decentralization objectives of the present national policy very much;
- that is disadvantageous to keep the work area larger from the viewpoint of construction management (both construction supervision by the employer and site management/resource control by the contractor);

- that requires harder management, than that of developing one province, from the viewpoint of more number of local governments and agencies whom it is necessary to liaise with during construction;
- that may make the work period longer and would lead to later rising of effect on the development, than those of developing small area, because of less efficient management;
- that is more costly, than developing small area, because of developing larger area at each of phases;
- that would bring lower quality of the works and services, than those of developing small area, because of less efficient management;
- that may increase the risk of projects in developing larger area comparing to the development of a smaller area; but
- that gives both of the provinces an equal opportunity of development.

The commissioning, operation and maintenance of the water supply facilities in Phase 1, will start progressively from about four months after the commencement of construction and will be completed within one year. The application for the implementation of Phase 2 will be based on the early O&M experience in the villages of Phase 1.

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 of Urban and Rural Affairs in the Ministry of Settlement and Regional Infrastructure has overall responsibility for rural water supply development in Indonesia. 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 consultants and civil works, under the project. Also, he should issue the certificates to settle the payment to the consultant and contractors in accordance with the contracts.

The operative GOI agencies at provincial and district level are BAPPEDA Tk. I and Tk. II respectively, for matters of policy and liaison with other branches of PEMDA, but they are not engineers. Kimpraswil Tk. I and Tk. II, as the successors to the disbanded Ministry of Public Works, are responsible for the management of most engineering works carried out in their areas, but they are not normally involved in aid projects funded by foreign governments and donor agencies. Co-operation with Kimpraswil would involve liaison with eleven different offices at two separate levels of government (5 for NTB and 4 for NTT). P3P, which exists only at provincial level, is responsible for the construction of water supply projects by contractors and is probably the most logical choice as Counterparts for foreign Contractors. PDAMs have no responsibility or capability for construction.

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

7.3.1 Employment of Consultant

An independent consultant will be employed for each phase of the project, to conduct detailed design, construction supervision and rural extension services.

7.3.2 Procurement of Works

Construction will be carried out through separate contract packages for Phase 1 and Phase 2. If the project is funded by grant-aid, the contracts will be let to bidders selected through donor nation competitive bidding. If loan funds are provided, selection would probably be by ICB. In either case Pre-qualification (PQ) will be required prior to bidding. The selected contractors will be required to manage all construction activities, including the employment of locally hired staff, material purchase, equipment and transport hiring and performance on site.

7.3.3 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.

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 Consultantancy Services

7.4.1 Personnel Requirement

The following personnel are required, including foreign and local experts to execute design, supervision, and community development and PDAM capacity building at Phase 1 and Phase 2.

Required Consultant Personnel (Plan 1)

(Unit: M/M)

Work	Phase 1 (F)	Phase 1 (L)	Phase 1 Total	Phase 2 (F)	Phase 2 (L)	Phase 2 Total	Total
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**

Note: (F): Foreign expert
(L): Local expert and staff, including field officers
*1: Field officers (L) account for much of the above personnel quantities; i.e. 154 M/M in Phase 1 and 95 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

Required Consultant Personnel (Plan 2)

(Unit: M/M)

Work	Phase 1 (F)	Phase 1 (L)	Phase 1 Total	Phase 2 (F)	Phase 2 (L)	Phase 2 Total	Total
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 expert
(L): Local expert and staff, including field officers
*1: Field officers (L) account for much of the above personnel quantities; i.e. 154 M/M in Phase 1 and 95 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

A team leader will manage the overall services of the consultants in both Phase 1 and Phase 2. A design engineer, a design/supervision engineer and a community specialist, all 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. Health and hygiene education and community development will be conducted before and during construction. The PDAM capacity building will be conducted during construction. The education and extension works before construction are called social preparation.

The proposed consultants' setup 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 consultants' setup 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

Design works will be executed by 6 foreign experts and 5 or 6 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 at each of Phase 1 and Phase 2. The experts will go to do site investigations when required, based at the main office.

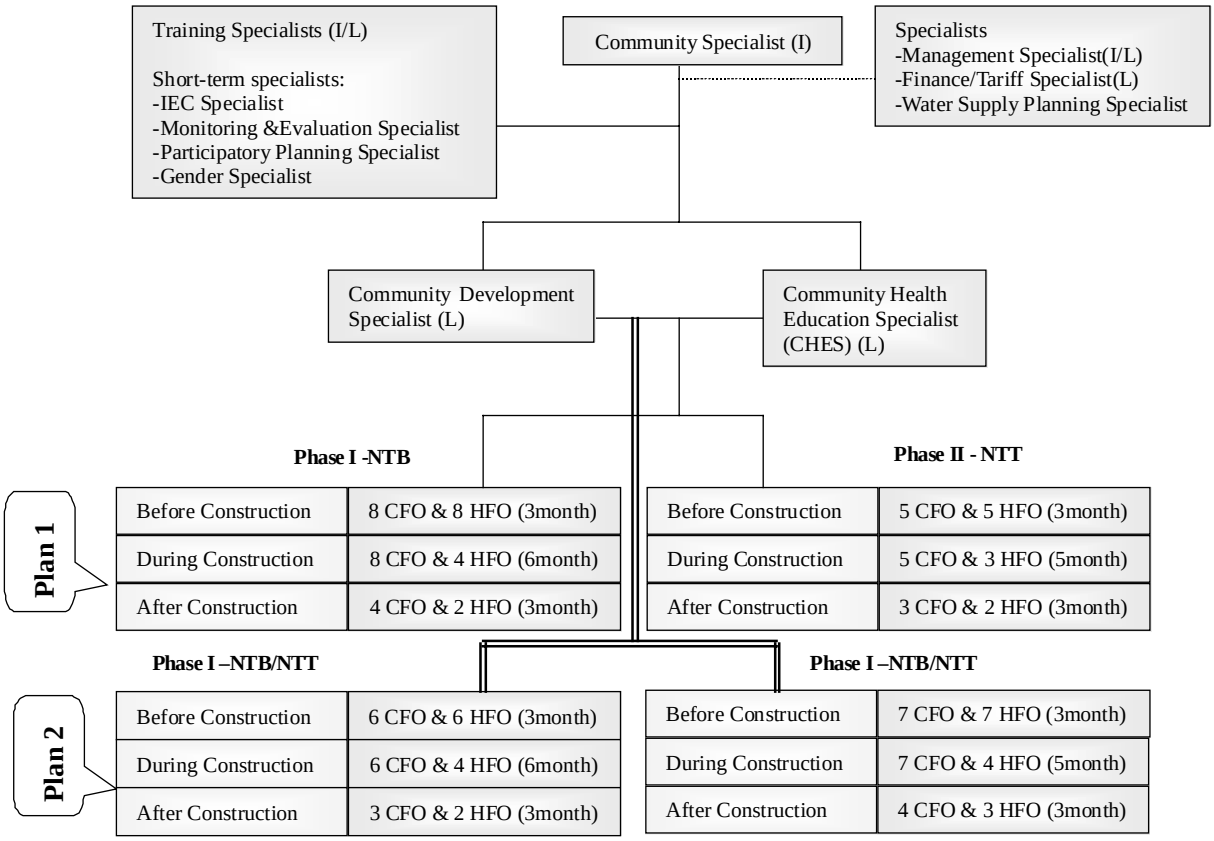
Supervision works will be executed by 3 foreign experts and 8 or 10 locals headed by a foreign design/supervision engineer under the control of the team leader. Foreign experts will work at the main office, and two local engineers will maintain branch offices to supervise the site physical works. Foreign experts can reach the site by airplane, ferry or fast ferry from the main office when required.

7.4.3 Community Development and PDAM Capacity Building

The project will be complemented by a substantial soft component program including health and hygiene education plans, operation & maintenance plans and PDAM capacity building, all of which are detailed in Chapter 6. This soft component program is considered below, according to two work-streams: (a) Community Development and (b) PDAM Capacity Building.

a) Community Development Workstream

Firstly, the Community Development component will assist communities to empower themselves, to improve community health and to obtain the capacity to plan, manage and sustain water supply facilities.



The Community Specialist will control and monitor the major activities of community development through local specialists, mainly the Community Development Specialist (CDS) and the Community Health Education Specialist (CHES), who are selected by the Community Specialist and Team Leader. The CDS and CHES will appoint, train, direct, control and supervise the local field officers under the supervision of the Community Specialist. Field Officers will work at the community level to introduce community development approaches by the Community Field Officer CFO, and to implement community health promotion by the Health Field Officer (HFO).

b) PDAM Capacity Building

The PDAM Capacity Building has four separate activities, which can be considered under two categories.

(a) Capacity building for PDAM's generally related business planning and tariff issues. This work is proposed to be undertaken in five PDAM (3 in NTB and 2 in NTT) in Phase I. The work will be undertaken in two packages, initially focused on business planning followed by specific tariff setting and implementation support. This work will involve an international Management

Specialist for a short-term assignment. He/she will be supported by the following local specialists: a Management Specialist, Financial/Tariff Specialists (2 in number), and a Water Supply Planning Specialist.

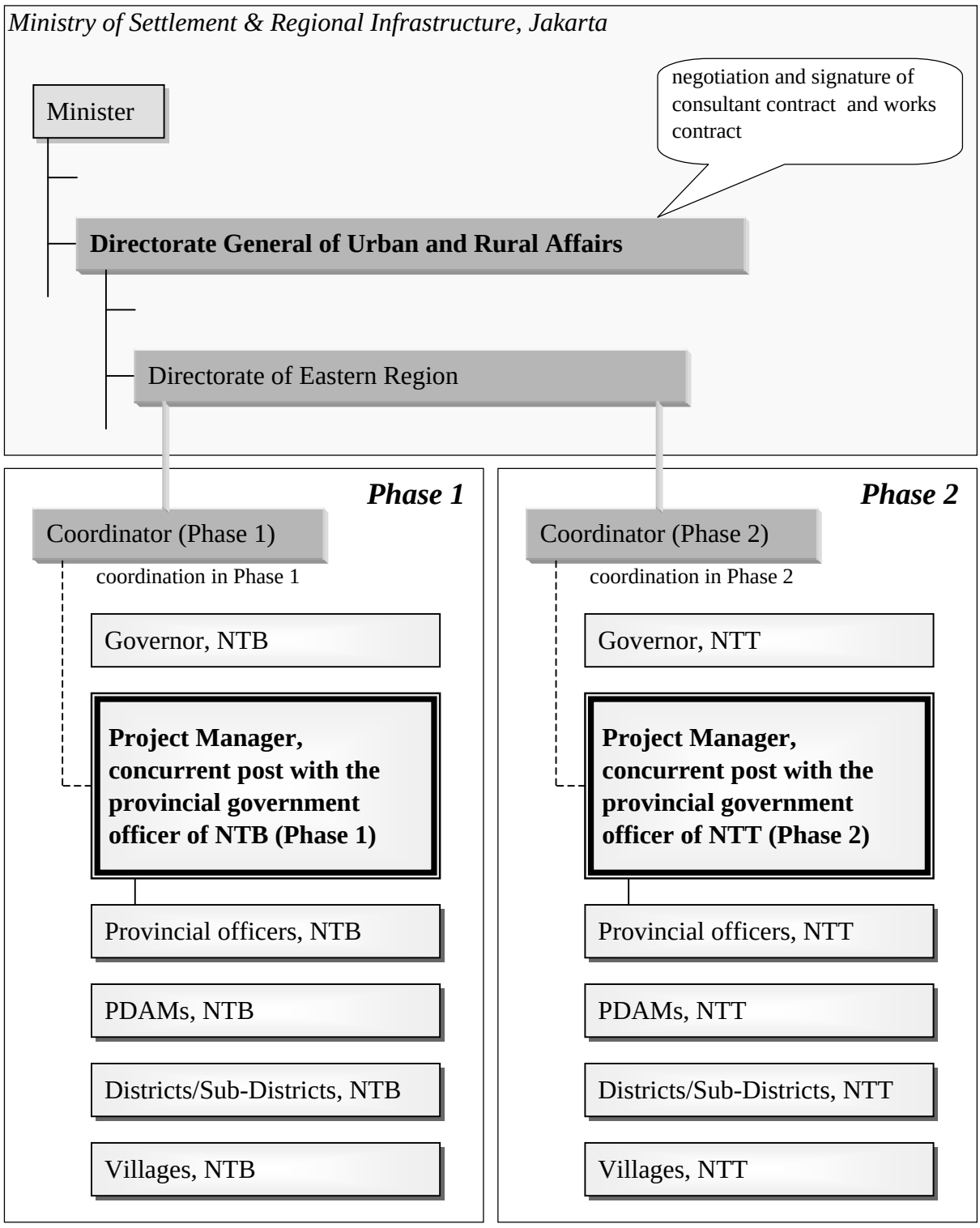
(b) Training of PDAM staff in specific rural water supply operation & maintenance activities. This work includes training of PDAM staff to strengthen understanding and relationships between the PDAM organization and the village WUAs/WUGs, as wells as operation & maintenance training for selected staff in the various villages. This latter training will parallel activities for community managed systems. The staffing for these activities will be drawn from the Community Development and Engineering Supervision teams. A local Management Specialist (from the PDAM Capacity Building Team) will provide support.

Detailed implementation and resource schedules are contained in Chapter 6.

Staff for Community Development and PDAM Capacity Building Work Streams

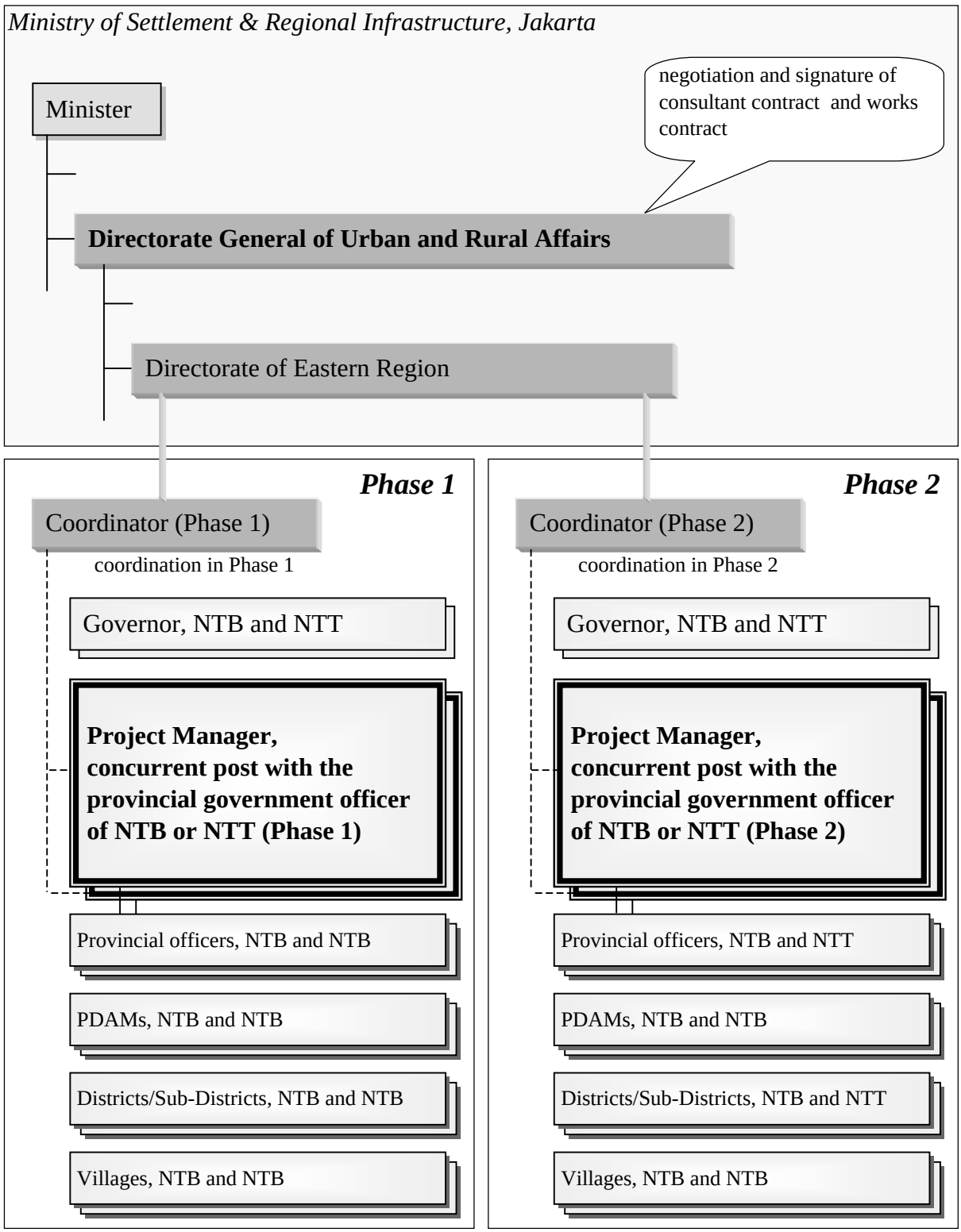
	Allo-cation	Plan 1 Phase 1&2	Plan 2 Phase 1&2	Timing	Main Activities
	I/L	M/M	M/M	B/D/A	
Community specialist	I	18	18	B/D/A	Control, direct and supervise overall community development activities, selecting and directing specialists.
Training specialist	I L	1 11	1 11	B	Provide support and guidance to all specialists in the planning, development and delivery of training activities for Community Development and PDAM Capacity Building workstreams.
Community development specialist	L	19	19	B/D/A	Select, direct, train, coordinate, control and supervise field officers, develop community management manuals.
Community health education specialist	L	19	19	B/D/A	Develop and supervise implementation of health and hygiene education programs.
Management Specialist 1	I	12	12	B/D	Plan and direct the capacity building activities related to PDAM business planning and tariff setting.
Management Specialist 2	L	24	24	B/D	Assist with implementation of capacity building activities for PDAM through workshops and on-the-job support & training-focusing on business planning. Assist with training of PDAM management for community water supply operations.
Finance/tariff specialist	L	24	24	B/D	Assist with implementation of capacity building activities for PDAM through workshops and on-the-job support & training-focusing on financial management and tariffs.
Water supply planning specialist	L	6	6	B	Provide technical input to business planning process.
IEC specialist	L	6	6	B	Develop the locally appropriate IEC materials methodology. Train field officer and task force.
Gender specialist	L	2	2	D	Implement genders analysis, develop and conduct gender training.
Monitoring and evaluation specialist	L	6	6	A	Establish and implement social-economic assessment, regular monitoring and evaluation.
Participatory planning specialist	L	4	4	D	Prepare and conduct participatory local appraisal and prepare development plans.
Community Field Officer	L (13)	144	146	B/D/A	Consult communities, organize group meetings and workshops with related officials, and facilitate management arrangement for social preparation. Organize and strengthen WUA/WUG formulation, conduct community empowerment, provide on the job training, monitor and evaluate the activities.
Health Field Officer	L (13)	111	103	B/D/A	Preparation of stakeholders, community mobilization, needs assessment (KAP survey), and training health environmental cadres. Ensure the delivery of health education in practice.

Allocation: I (international specialist), and L (local specialist).
Timing: B (before construction), D (during construction), and A (after construction).



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)** **Proposed Implementation Arrangements**
Japan International Cooperation Agency	

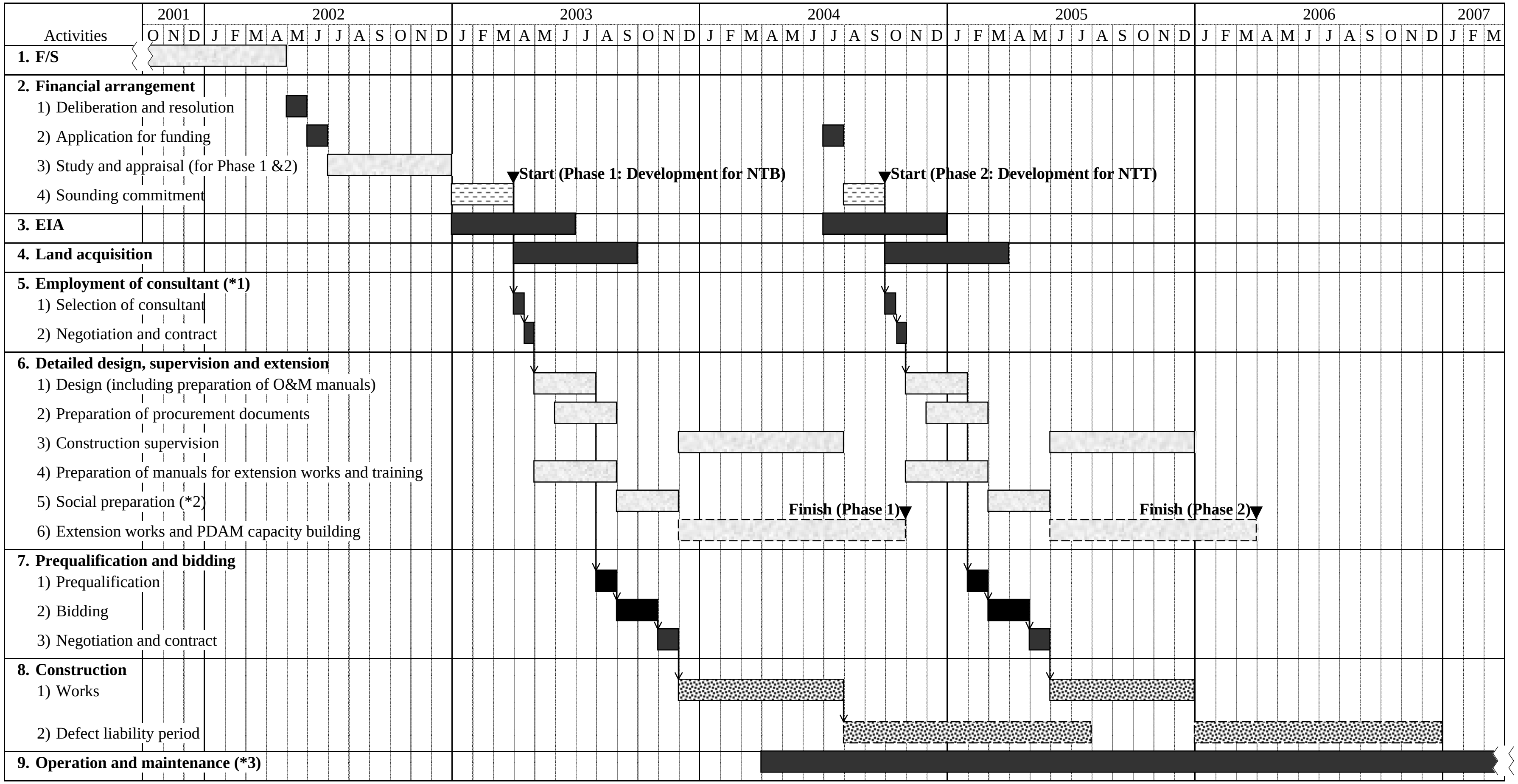


The Directorate of Eastern Region will give a delegation to two provincial government officers who holds post in NTB and NTT, to execute the project management, in each of Phase 1 and Phase 2.
The Directorate of Eastern Region will also dispatch a coordinator to monitor the project and to coordinate 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 Japan International Cooperation Agency	**Figure 7.2.2 (Plan 2)** **Proposed Implementation Arrangements**

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

Figure 7.3.1 (Plan 1)
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.

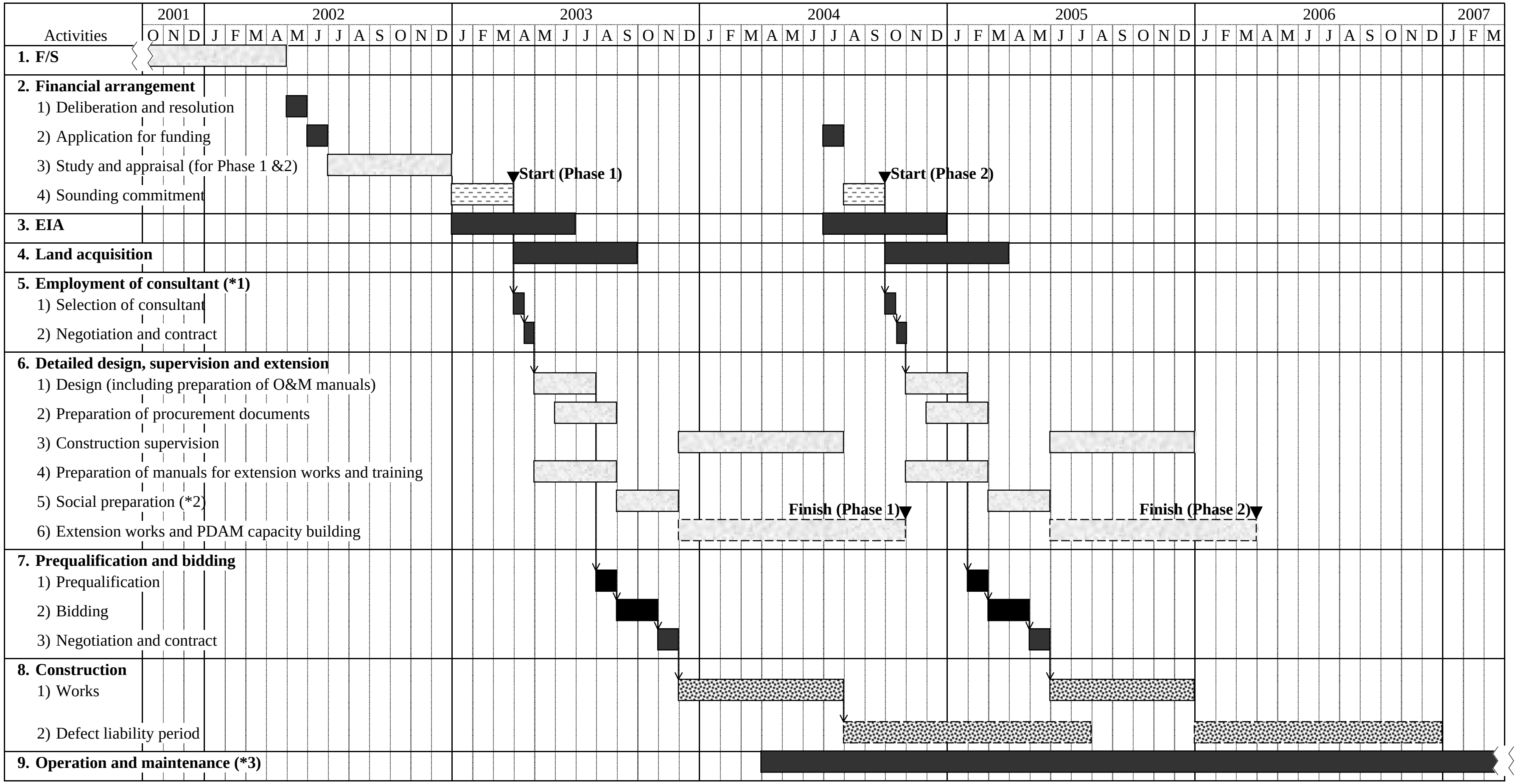
(*2): Social preparation is made simultaneously with the design works to form acceptant willingness for the works in the villages.

(*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

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.

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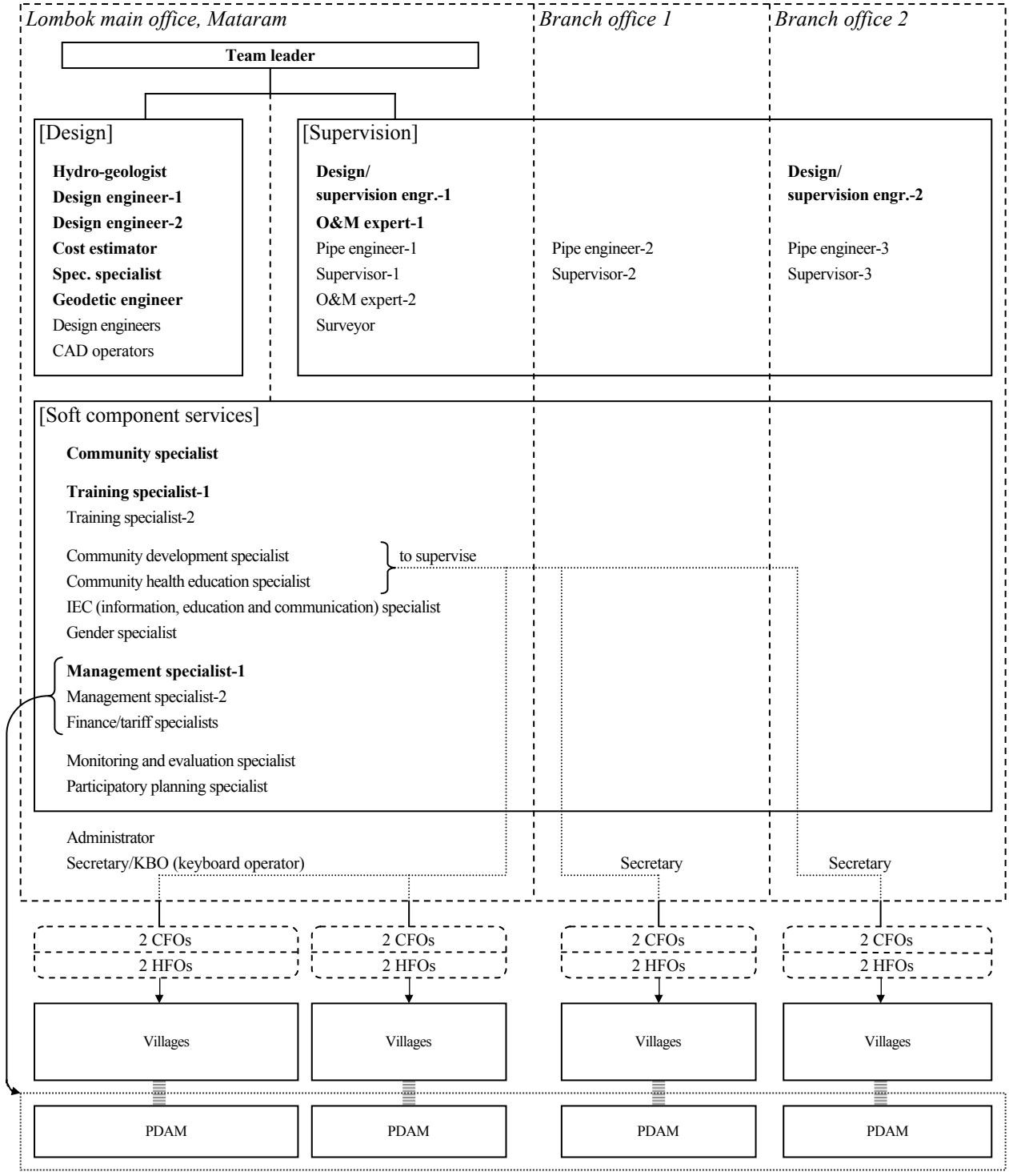
Application for funding for Phase 2 will be made after confirming the issue of operation and maintenance for Phase 1.

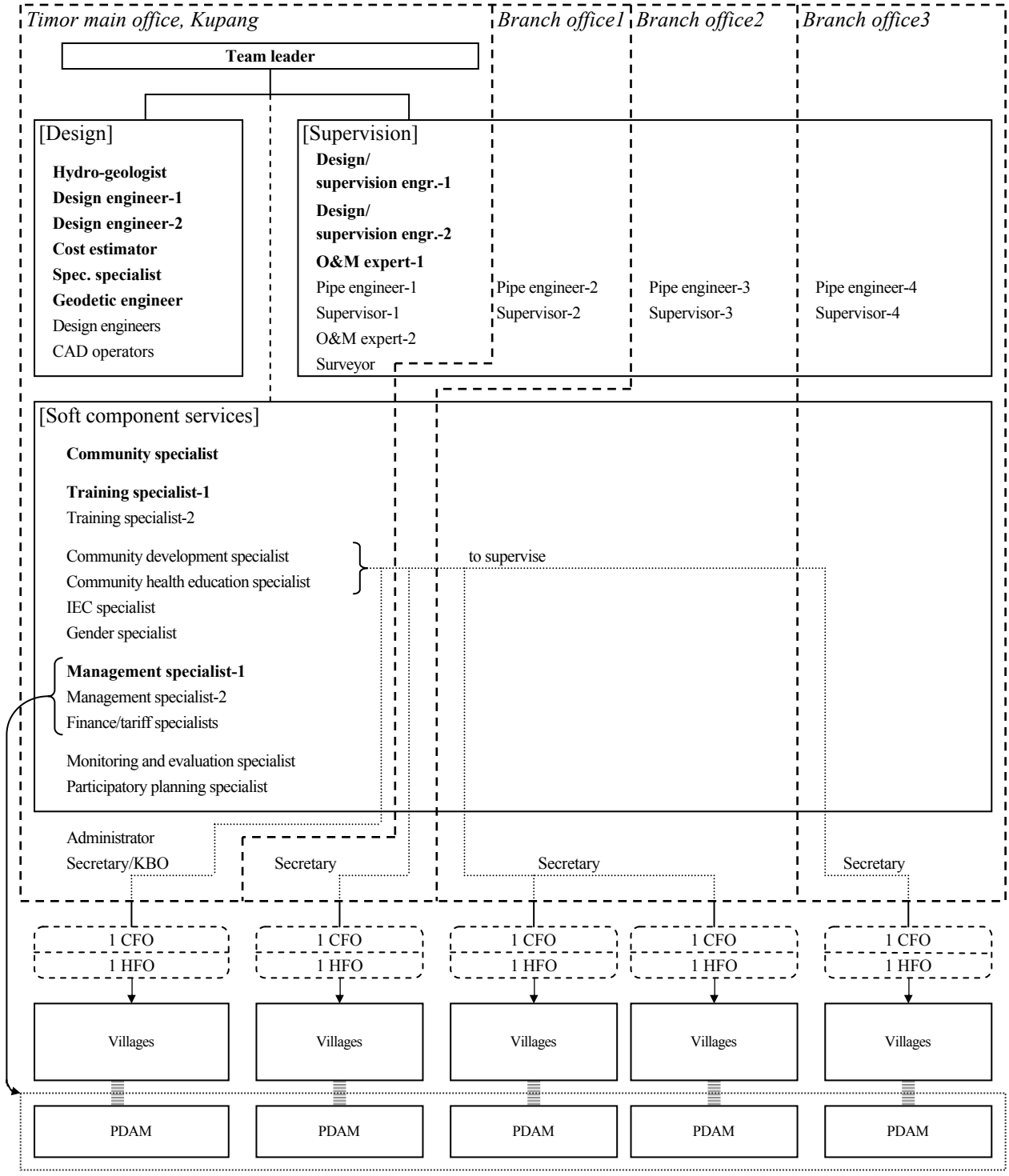
Legend:
- : Activity to be conducted by recipient country
- : Activity to be conducted by donor country
- : Activity to be performed by consultant
- : Activity to be performed by contractor



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.

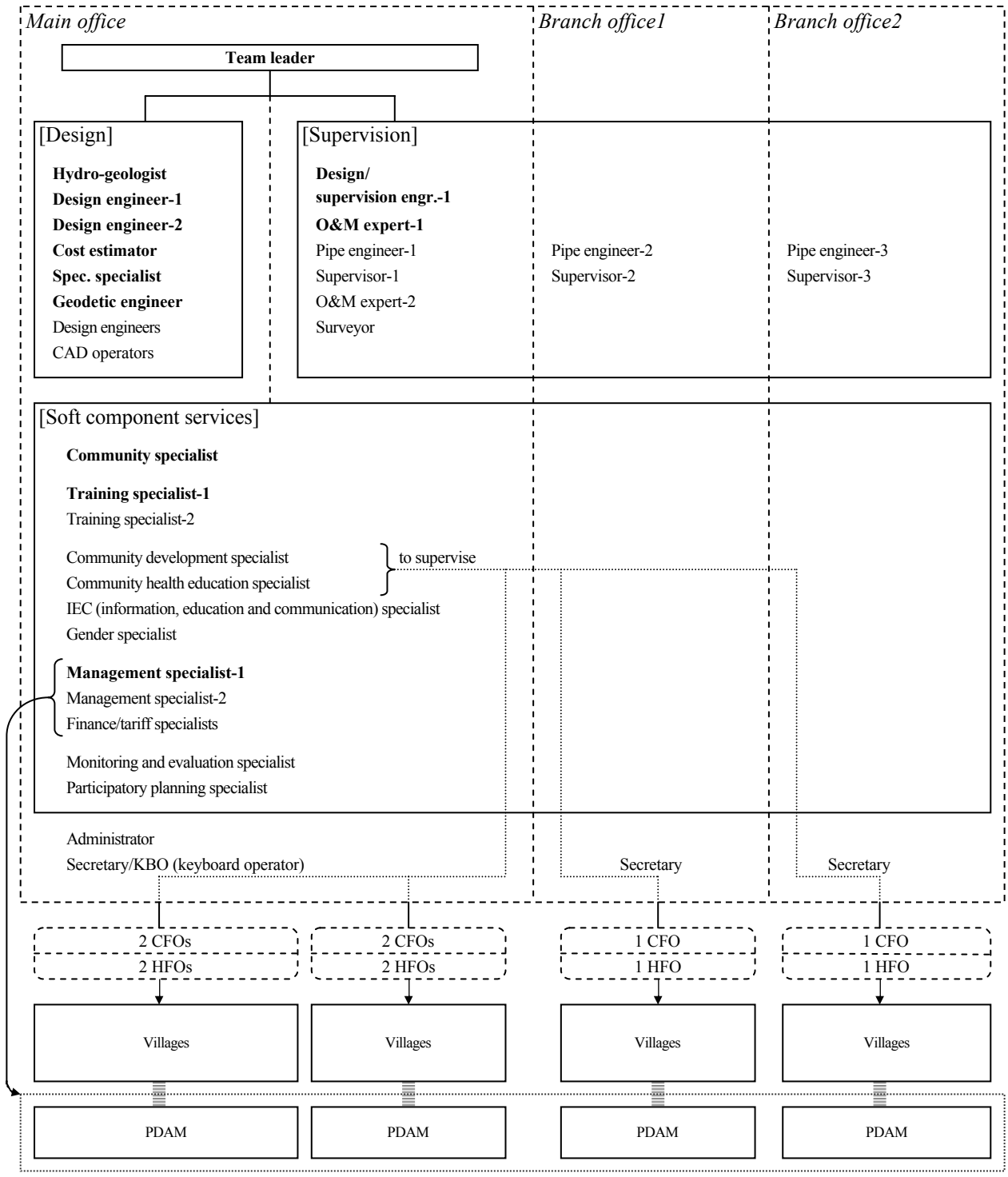
Study on Rural Water Supply Project in Nusa Tenggara Barat and Nusa Tenggara Timur Japan International Cooperation Agency	**Figure 7.4.1 (Plan 1)** **Proposed Consultant's Setup for Phase 1**



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.

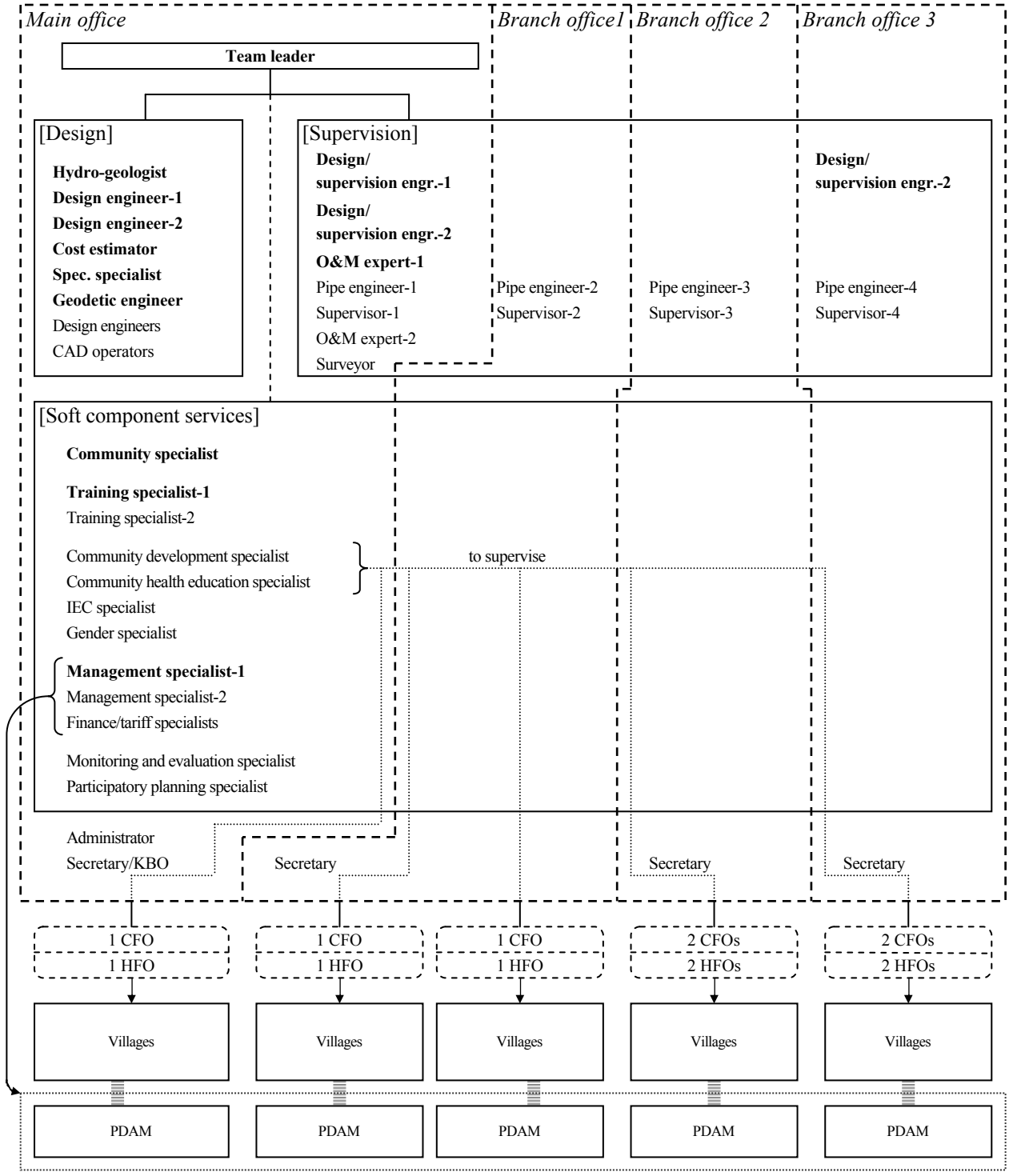
Study on Rural Water Supply Project in Nusa Tenggara Barat and Nusa Tenggara Timur Japan International Cooperation Agency	**Figure 7.4.2 (Plan 1)** **Proposed Consultant's Setup for Phase 2**



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

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

8.1.2 Currency

The cost of all items that are imported shall be estimated in Japanese yen (¥). The cost of items that are procured in the country shall be estimated in Indonesian rupiah (Rp.).

The foreign currency portion (¥) includes wages of foreign labor, costs of imported goods, international transportation cost and contractors' indirect cost and profit. The local currency portion (Rp.) includes wages of local labor, cost of goods to be purchased in the domestic market, inland transportation cost, contractor's indirect cost, compensation cost and purchasing cost of land and other real property.

For imported goods and for goods that are manufactured of, or assembled from, foreign materials and parts in the country, the cost will be estimated in Indonesian rupiah (Rp.) as long as they can be purchased in the domestic market.

8.1.3 Exchange Rate

The following are the exchange rates 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

8.1.4 Project Cost Component

The following are the components of the project cost;

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

Note:
- Items (1) and (2) shall be estimated excluding taxes and duties.
- Items (3) and (4) shall 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 for the 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 a grant aid. Other costs than the construction and consultancy services will be borne by the Government of Indonesia.

8.1.5 Construction Cost

Construction works and supply of equipment will be executed on a contract basis through international competitive bidding (ICB). All the labor, materials and equipment required for the works will be provided by the contractor.

The works will be executed under a contract. The contract will be a unit price contract. The contract price is estimated multiplying work quantities by unit prices estimated.

Each of the unit prices (rates) are estimated as the sum of laborers' wages, material cost, equipment cost, and overhead and profit. The following are referred to for fixing the unit rate.

- Unit Rate for Construction Works-2000, Ministry of Publics Works Cipta Karya,
- Journal of Building Construction and Interior-May 2001, the 16th edition,
- Law of Manpower, Law of The Republic of Indonesia No.1 Year 1951,
- Regulation of The Ministry of Labor No:Per.06/Men/1993,
- Law of Manpower, Law of The Republic of Indonesia No.25 Year 1997,

Overhead and profits for contractor is set at 25 % of net cost required to carry out construction works.

8.1.6 Consultancy Services Cost

A consultant will be employed for design, supervision, and extension services for the project by the Government of Indonesia under the loan or grant aid to be agreed.

The major scope of works of the consultant will be the following:

(i) Engineering services:

- Detailed design including preparation of procurement documents,
- Construction supervision and

(ii) Soft component services:

- Soft component services (health and hygiene education, community development and PDAM capacity building)

8.1.7 Administration Cost

Administration cost includes all the expenses required for the administrative activities directly associated with the project implementation, such as personnel, vehicle, training and office running costs. This cost will be provided by the executing agencies.

8.1.8 Land Acquisition Cost

The Government of Indonesia will be responsible for the cost of land acquisition for the facilities to be constructed.

In practice, the land costs depend on the village, topography and present land use. In this report, however, the cost is estimated, based on a common unit rate using the average land price, since the land needed for the facilities has not been finalised yet. The area of land is estimated assuming that half of the land would be required for facilities such as pump houses, BPTs (break pressure tanks), public hydrants and public taps.

8.1.9 Taxes and Duties

Taxes and duties are estimated based on the following:

- Government Regulation Number 42 of the Year 1995
- Ministry of Finance decree Number 486/KMK.04/2000,
- Director General of Taxation decree Number Kep-526/PJ/2000,

(i) Customs duty

The goods to be imported for public works will be exempted from Customs duty, as will equipment supplied under grant and loan projects in Indonesia. Neither customs duty nor extra duty is estimated on the works.

(ii) Value-added Tax (VAT)

Value-added tax (VAT) is levied at a rate of 10% against the portion of the contract amount that is funded by the National Budget (A.P.B.N). The portion of the contract that is funded by foreign loan is not subject to VAT or luxury tax. This applies to the main contractors, subcontractors, suppliers and consultants that work for the project.

For the work portion that is to be borne by the Government of Indonesia, VAT will be levied at a rate of 10 %. For the remainder, value-added tax is estimated at 0 (zero) percent, assuming that the non-GOI contract cost is funded entirely by foreign loan or grant aid.

8.1.10 Physical Contingency

Physical contingency is estimated at 5% to 15% depending on the accuracy of design. The physical contingency is included in each of cost component.

8.1.11 Price Contingency

Price escalation rates are set at 0.4% per annum for the foreign currency portion and 7.5% per annum for the local currency portion.

8.2 Estimated Project Cost

8.2.1 Construction Cost

Estimated construction cost is summarized below.

Estimated construction cost (Plan 1)

No.	Item	Foreign portion (Y, million)	Local portion (Rp., million)	Total (Y, million)	Equivalent (Rp., billion)
Phase 1	**NTB**				
1.	Preparatory works	51.4	0	51.4	4.4
2.	Water works	154.3	1,106.9	167.2	14.3
3.	Physical contingency	30.8	166.0	32.8	2.8
4.	Price contingency	46.8	305.5	50.4	4.3
	Total for Phase 1 (NTB)	283.3	1,578.4	301.7	25.8
Phase 2	**NTT**				
1.	Preparatory works	58.1	0	58.1	5.0
2.	Water works	98.2	605.9	105.3	9.0
3.	Physical contingency	23.5	90.9	24.5	2.1
4.	Price contingency	46.5	236.9	49.3	4.2
	Total for Phase 2 (NTT)	226.3	933.7	237.2	20.3
	Total of Phase 1 and Phase 2	**509.5**	**2,512.1**	**538.9**	**46.1**

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

Estimated construction cost (Plan 2)

No.	Item	Foreign portion (Y, million)	Local portion (Rp., million)	Total (Y, million)	Equivalent (Rp., billion)
Phase 1					
1.	Preparatory works	51.5	0	51.5	4.4
2.	Water works	137.2	1,035.7	149.3	12.8
3.	Physical contingency	28.3	155.4	30.1	2.6
4.	Price contingency	42.1	285.9	45.5	3.9
	Total for Phase 1	259.2	1,477.0	276.4	23.7
Phase 2					
1.	Preparatory works	59.8	0	59.8	5.1
2.	Water works	115.2	677.1	123.1	10.5
3.	Physical contingency	26.3	101.6	27.4	2.3
4.	Price contingency	53.8	264.7	56.9	4.9
	Total for Phase 2	255.1	1,043.3	267.2	22.9
	Total of Phase 1 and Phase 2	**514.2**	**2,520.3**	**543.7**	**46.5**

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

8.2.2 Consulting Service Cost

The following are the estimated amounts for consulting services.

Estimated consulting service cost (Plan 1)

No.	Item	Amount (Y, million)		Equivalent (Rp., billion)
Phase 1	**NTB**			
1.	Consulting service cost			
	1) Detailed design	64.9	(34 %)	5.6
	2) Construction supervision	67.6	(36 %)	5.8
	3) Soft component services	56.1	(30 %)	4.8
	Sub-total for 1.	188.6	(100 %)	16.1
2.	Physical contingency	9.4		0.8
3.	Price contingency	7.8		0.7
	Total for Phase 1 (NTB)	205.9		17.6
Phase 2	**NTT**			
1.	Consulting service cost			
	1) Detailed design	61.6	(36 %)	5.3
	2) Construction supervision	64.9	(38 %)	5.6
	3) Soft component services	43.9	(26 %)	3.8
	Sub-total for 1.	170.4	(100 %)	14.6
2.	Physical contingency	8.5		0.7
3.	Price contingency	9.9		0.8
	Total for Phase 2 (NTT)	188.8		16.2
	Total of Phase 1 and Phase 2	**394.7**		**33.8**

Note: Price level: October 2001

Estimated consulting service cost (Plan 2)

No.	Item	Amount (Y, million)		Equivalent (Rp., billion)
Phase 1				
1.	Consulting service cost			
	1) Detailed design	65.4	(34 %)	5.6
	2) Construction supervision	69.7	(37 %)	6.0
	3) Soft component services	55.3	(29 %)	4.7
	Sub-total for 1.	190.3	(100 %)	16.3
2.	Physical contingency	9.5		0.8
3.	Price contingency	8.1		0.7
	Total for Phase 1	207.9		17.8
Phase 2				
1.	Consulting service cost			
	1) Detailed design	62.0	(32 %)	5.3
	2) Construction supervision	63.2	(32 %)	5.4
	3) Soft component services	49.6	(26 %)	4.2
	Sub-total for 1.	174.9	(100 %)	15.0
2.	Physical contingency	8.7		0.7
3.	Price contingency	12.0		1.0
	Total for Phase 2	195.6		16.7
	Total of Phase 1 and Phase 2	**403.5**		**34.5**

Note: Price level: October 2001

8.2.3 Administration Cost

The following table shows the estimated cost of administration.

Estimated administration cost (Plan 1)

No.	Item	Amount (Y, million)	Equivalent (Rp., billion)
Phase 1	Administration cost	12.1	1.0
Phase 2	Administration cost	14.0	1.2
	Total of Phase 1 and Phase 2	**26.1**	**2.2**

Note: Price level: October 2001

Estimated administration cost (Plan 2)

No.	Item	Amount (Y, million)	Equivalent (Rp., billion)
Phase 1	Administration cost	13.8	1.2
Phase 2	Administration cost	15.7	1.3
	Total of Phase 1 and Phase 2	**29.5**	**2.5**

Note: Price level: October 2001

8.2.4 Land Acquisition Cost

The following table shows the estimated cost of land acquisition.

Estimated land acquisition cost (Plan 1)

No.	Item	Amount (Y, million)	Equivalent (Rp., billion)
Phase 1	Land acquisition cost	0.08	0.006
Phase 2	Land acquisition cost	0.03	0.003
	Total of Phase 1 and Phase 2	**0.11**	**0.009**

Note: Price level: October 2001

Estimated land acquisition cost (Plan 2)

No.	Item	Amount (Y, million)	Equivalent (Rp., billion)
Phase 1	Land acquisition cost	0.07	0.006
Phase 2	Land acquisition cost	0.04	0.003
	Total of Phase 1 and Phase 2	**0.11**	**0.009**

Note: Price level: October 2001

8.2.5 Taxes and Duties

The following table shows the estimated Taxes and duties to be levied on the construction and consulting services.

Estimated taxes and duties (Plan 1)

No.	Item	Amount (Y, million)	Equivalent (Rp., billion)
1.	Value-added tax (VAT)	2.9	0.25
2.	Customs duty	0	0
	Total of 1.-2.	**2.9**	**0.25**

Note: VAT at 10% is levied on the works that would be borne by GOI. No customs duty is estimated because no equipment and materials would be imported under the project.

Estimated taxes and duties (Plan 2)

No.	Item	Amount (Y, million)	Equivalent (Rp., billion)
1.	Value-added tax (VAT)	2.9	0.25
2.	Customs duty	0	0
	Total of 1.-2.	**2.9**	**0.25**

Note: VAT at 10% is levied on the works that would be borne by GOI. No customs duty is estimated because no equipment and materials would be imported under the project.

8.2.6 Project Cost

The following is the estimated project cost for the options outlined in this chapter.

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

A breakdown of the above estimate is given in **Table 8.2.1 (Plan 1)** for Plan 1 development.

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
	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))
3.	Administration cost	13.8	1.2	0	0	13.8	1.2
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	195.1	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

A breakdown of the above estimate is given in **Table 8.2.2 (Plan 2)** for Plan 2 development.

8.3 Operation and Maintenance Cost

8.3.1 Annual Operation and Maintenance Cost

Annual operation and maintenance (O&M) costs consist of:

1) Salaries and wages,
2) Operation cost, and
3) Maintenance cost of the facility.

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

A breakdown of the above estimate is given in **Table 8.3.1**.

8.3.2 Replacement Cost

Some of the project facilities, especially equipment and mechanical works such as pumps and generators, have a shorter useful life 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 GSP (galvanized iron pipe) exposed could be usable for about twenty years and more, respectively. Since the project life is set at 20 years for the pipe works, replacement cost is only estimated for the pumps and generators whose life expectancy is less than that of the pipe works.

The following is 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

A breakdown of the above estimate is given in **Table 8.3.2**.

Since it is hard for villagers to pay for the replacement cost in the year of replacement, the villagers are to save money regularly every month for replacement at 15 years.

Table 8.2.1 (Plan 1) Estimated Project Cost

(unit: Y, thousand or Rp., thousand)

Cost Item	Foreign portion				Local portion	*Equivalent*	Total	*Equivalent*
	F.C. (Y)	L.C. (Rp.)	Total (Y)	*Equiv. (Rp.)*	(Rp.)	*(Y)*	(Y)	*(Rp.)*
Phase1								
1) Construction cost	43,684	20,504,718	283,253	*24,243,633*	1,578,380	*18,441*	301,694	*25,822,013*
2) Consultancy services cost	168,904	3,166,217	205,897	*17,622,704*	0	*0*	205,897	*17,622,704*
3) Administration cost	0	0	0	*0*	1,036,920	*12,115*	12,115	*1,036,920*
4) Land acquisition cost	0	0	0	*0*	6,526	*76*	76	*6,526*
5) Taxes and duties	0	0	0	*0*	157,838	*1,844*	1,844	*157,838*
Total for Phase1	**212,588**	**23,670,935**	**489,150**	***41,866,338***	**2,779,664**	***32,476***	**521,626**	***44,646,001***
Phase2								
1) Construction cost	46,669	15,372,725	226,278	*19,367,123*	933,740	*10,909*	237,187	*20,300,863*
2) Consultancy services cost	152,575	3,102,641	188,825	*16,161,497*	0	*0*	188,825	*16,161,497*
3) Administration cost	0	0	0	*0*	1,195,519	*13,968*	13,968	*1,195,519*
4) Land acquisition cost	0	0	0	*0*	2,930	*34*	34	*2,930*
5) Taxes and duties	0	0	0	*0*	93,374	*1,091*	1,091	*93,374*
Total for Phase2	**199,244**	**18,475,366**	**415,103**	***35,528,620***	**2,225,563**	***26,003***	**441,105**	***37,754,182***
Phase1 + Phase2								
1 Construction cost	90,353	35,877,443	509,531	*43,610,756*	2,512,120	*29,351*	538,882	*46,122,876*
2 Consultancy services cost	321,478	6,268,858	394,721	*33,784,202*	0	*0*	394,721	*33,784,202*
3 Administration cost	0	0	0	*0*	2,232,438	*26,083*	26,083	*2,232,438*
4 Land acquisition cost	0	0	0	*0*	9,456	*110*	110	*9,456*
5 Taxes and duties	0	0	0	*0*	251,212	*2,935*	2,935	*251,212*
Project cost	**411,831**	**42,146,302**	**904,252**	***77,394,958***	**5,005,226**	***58,479***	**962,731**	***82,400,183***

Note: - Price level ; Oct. 2001
US$ 1.0 = Rp.10,435
US$ 1.0 = J. Yen 121.92
J. Yen 1.0 = Rp.85.59
- Foreign portion: Amount that may be financed by foreign assistant agency
- Local portion: Amount that would be borne by the Government of Indonesia

Table 8.2.2 (Plan 2) Estimated Project Cost

(unit: Y, thousand or Rp., thousand)

Cost Item	Foreign portion				Local portion	*Equivalent*	Total	*Equivalent*
	F.C. (Y)	L.C. (Rp.)	Total (Y)	*Equiv. (Rp.)*	(Rp.)	*(Y)*	(Y)	*(Rp.)*
Phase1								
1) Construction cost	43,684	18,441,786	259,151	*22,180,701*	1,476,953	*17,256*	276,407	*23,657,654*
2) Consultancy services cost	169,667	3,273,132	207,909	*17,794,972*	0	*0*	207,909	*17,794,972*
3) Administration cost	0	0	0	*0*	1,178,040	*13,764*	13,764	*1,178,040*
4) Land acquisition cost	0	0	0	*0*	6,172	*72*	72	*6,172*
5) Taxes and duties	0	0	0	*0*	147,695	*1,726*	1,726	*147,695*
Total for Phase1	**213,352**	**21,714,918**	**467,060**	***39,975,673***	**2,808,860**	***32,818***	**499,878**	***42,784,533***
Phase2								
1) Construction cost	46,669	17,836,167	255,060	*21,830,565*	1,043,346	*12,190*	267,250	*22,873,911*
2) Consultancy services cost	149,938	3,911,202	195,635	*16,744,372*	0	*0*	195,635	*16,744,372*
3) Administration cost	0	0	0	*0*	1,344,073	*15,704*	15,704	*1,344,073*
4) Land acquisition cost	0	0	0	*0*	3,324	*39*	39	*3,324*
5) Taxes and duties	0	0	0	*0*	104,335	*1,219*	1,219	*104,335*
Total for Phase2	**196,607**	**21,747,369**	**450,694**	***38,574,937***	**2,495,077**	***29,151***	**479,846**	***41,070,014***
Phase1 + Phase2								
1 Construction cost	90,353	36,277,953	514,210	*44,011,266*	2,520,299	*29,446*	543,657	*46,531,565*
2 Consultancy services cost	319,605	7,184,334	403,544	*34,539,345*	0	*0*	403,544	*34,539,345*
3 Administration cost	0	0	0	*0*	2,522,112	*29,467*	29,467	*2,522,112*
4 Land acquisition cost	0	0	0	*0*	9,496	*111*	111	*9,496*
5 Taxes and duties	0	0	0	*0*	252,030	*2,945*	2,945	*252,030*
Project cost	**409,958**	**43,462,287**	**917,755**	***78,550,610***	**5,303,937**	***61,969***	**979,724**	***83,854,547***

Note: - Price level ; Oct. 2001
US$ 1.0 = Rp.10,435
US$ 1.0 = J. Yen 121.92
J. Yen 1.0 = Rp.85.59
- Foreign portion: Amount that may be financed by foreign assistant agency
- Local portion: Amount that would be borne by the Government of Indonesia

Table 8.3.1 Estimated annual O&M Cost (1/3)

Serial No.	JICA #	Name of village	Design pop.	Nr. of house-holds	Source*1	O&M type*2	Type of pump*3	Output capacity		Diesel engine Capa.	Diesel engine Q'ty	Fuel type*4	Salary and allowance: Villagers Q'ty	Villagers Rate	Villagers Amount(1)	PDAM staff Q'ty	PDAM staff Rate	PDAM staff Amount(2)	Chemical Q'ty	Chemical Rate	Chemical Amount(3)
			(Nr.)	(Nr.)			(Nr.)	(kW)	(HP)	(HP)	(Nr.)		(M)	(Rp.)	(Rp., thous.)	(m.m)	(Rp.)	(Rp., thous.)	(kg)	(Rp.)	(Rp., thous.)
NTB				①																	
Lombok																					
1/	NTB 1.	Kuranji	1,894	379	E	(A)	-	-	-	-	-	-	12	26,000	312	12	440,000	5,280	108	12,000	1,296
2/	NTB 2.	Bajur	6,130	1,226	E	(A)	-	-	-	-	-	-	12	26,000	312	12	440,000	5,280	375	12,000	4,500
3/	NTB 3.	Sembung	2,225	445	E	(A)	-	-	-	-	-	-	12	26,000	312	12	440,000	5,280	127	12,000	1,524
4/	NTB 4a.	Duman, upper	3,078	616	Sp	(C)	-	-	-	-	-	-	12	68,000	816	-	440,000	-	162	12,000	1,944
5/	NTB 4b.	Duman, lower	1,926	386	E	(A)	-	-	-	-	-	-	12	26,000	312	12	440,000	5,280	110	12,000	1,320
6/	NTB 10.	Bagik Papan	3,182	637	E (Sp)	(C)	-	-	-	-	-	-	12	68,000	816	-	440,000	-	168	12,000	2,016
7/	NTB 11.	Selaparang	3,433	687	E (Sp)	(A)	-	-	-	-	-	-	12	26,000	312	24	440,000	10,560	271	12,000	3,252
Sumbawa																					
8/	NTB 13.	Lb. Mapin	3,570	714	Sp	(A)	-	-	-	-	-	-	12	26,000	312	12	440,000	5,280	274	12,000	3,288
9/	NTB 14.	Lb. Lalar	3,136	628	TW	(B)	ES	4.0	5.5	-	-	e	12	68,000	816	1	440,000	440	179	12,000	2,148
10/	NTB 16.	Piong	1,662	333	TW	(B)	ES	1.5	2.0	-	-	e	12	68,000	816	1	440,000	440	102	12,000	1,224
11/	NTB 18a.	Kawuwu, lower	414	83	SW	(B)	ES	1.5	2.0	-	-	e	12	68,000	816	1	440,000	440	22	12,000	264
12/	NTB 18b.	Kawuwu, upper	404	81	E (Sp)	(C)	-	-	-	-	-	-	12	68,000	816	-	440,000	-	18	12,000	216
Sub-total for NTB			31,054	6,215							-		(144)		6,768	(87)		38,280	(1,916)		22,992
NTT																					
Flores																					
13/	NTT 6.	Sinar Hading	1,294	259	NTT 7.	(A)	-	-	-	-	-	-	12	26,000	312	12	440,000	5,280	103	12,000	1,236
14/	NTT 7.	Ile Padung	1,122	225	Sp	(A)	CV	2.2	3.0	10	2	d	12	26,000	312	18	440,000	7,920	89	12,000	1,068
						(A)	CV	0.4	0.5	2	2	d	12	26,000	312	-	440,000	-	-	12,000	-
Sumba																					
15/	NTT 18.	Weerame	1,616	324	CW	(B)	CV	2.2	3.0	10	2	d	12	68,000	816	1	440,000	440	128	12,000	1,536
16/	NTT 19.	Kondamara	1,828	366	E (Sp)	(B)	CV	2.2	3.0	10	2	d	12	68,000	816	1	440,000	440	91	12,000	1,092
Rote																					
17/	NTT 21.	Oebau	632	127	CW	(B)	CV	0.8	1.0	2	1	d	12	68,000	816	1	440,000	440	31	12,000	372
18/	NTT 23.	Nusakdale	450	90	Sp	(C)	-	-	-	-	-	-	12	68,000	816	-	440,000	-	22	12,000	264
Timor																					
19/	NTT 24.	Tarus	3,977	796	E (Sp)	(A)	ES	7.5	10.2	-	-	e	12	26,000	312	24	440,000	10,560	314	12,000	3,768
						(A)	CV	7.5	10.2	10	2	d									
Sub-total for NTT			10,919	2,187							11		(252)		4,512	(57)		25,080	(778)		9,336
Total of NTB and NTT			**41,973**	**8,402**							**11**		**(396)**		**11,280**	**(144)**		**63,360**	**(2,694)**		**32,328**
Note:															6%			35%			18%

- Price level: October 2001
- Exchange rate:
  - US$ 1.0= Y 121.92
  - US$ 1.0= Rp. 10,435
  - Y 1.0= Rp. 85.59

*1: E: existing water supply sytem. Sp: spring.
E (Sp) means that the works will require tapping or diverting from an existing system that has the water source of spring.
TW: tube well. SW: shallow well. CW: cavern water.

*2: (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.

Monthly rate by O&M type:

(A)	26,000
(B)	68,000
(C)	68,000

*3: ES: Electrical submergible pump
CV: Centrifugal volute pump

*4: e: electric power; Rate: 260 /kWh
d: light oil; Rate: 900 /lit

Table 8.3.1 Estimated annual O&M Cost (2/3)

Serial No.	JICA #	Name of village	Design pop. (Nr.)	Nr. of house-holds (Nr.)	Source*1	O&M type*2	Electricity Q'ty*5 (kWh)	Electricity Rate (Rp.)	Electricity Amount(4) (Rp., thous.)	Light oil Q'ty*6 (lit)	Light oil Rate (Rp.)	Light oil Amount(5) (Rp., thous.)	Maintenance and repair cost: Base price (Rp., thous.)	Pump Q'ty (Nr.)	Standard life (Year)	Repair rate*7 (%)	Maintenance and repair cost: Amount(6) (Rp., thous.)	Σ{Amount (1) to (6)} Sub-total (Rp., thous.)	Other expenses 5% (Rp., thous.)	Annual total by village (Rp., thous.)
NTB				①																
Lombok																				
1/	NTB 1.	Kuranji	1,894	379	E	(A)	-	-	-	-	-	-	-	-	15.0	100%	-	6,888	344	7,232
2/	NTB 2.	Bajur	6,130	1,226	E	(A)	-	-	-	-	-	-	-	-	15.0	100%	-	10,092	505	10,597
3/	NTB 3.	Sembung	2,225	445	E	(A)	-	-	-	-	-	-	-	-	15.0	100%	-	7,116	356	7,472
4/	NTB 4a.	Duman, upper	3,078	616	Sp	(C)	-	-	-	-	-	-	-	-	15.0	100%	-	2,760	138	2,898
5/	NTB 4b.	Duman, lower	1,926	386	E	(A)	-	-	-	-	-	-	-	-	15.0	100%	-	6,912	346	7,258
6/	NTB 10.	Bagik Papan	3,182	637	E (Sp)	(C)	-	-	-	-	-	-	-	-	15.0	100%	-	2,832	142	2,974
7/	NTB 11.	Selaparang	3,433	687	E (Sp)	(A)	-	-	-	-	-	-	-	-	15.0	100%	-	14,124	706	14,830
Sumbawa																				
8/	NTB 13.	Lb. Mapin	3,570	714	Sp	(A)	-	-	-	-	-	-	-	-	15.0	100%	-	8,880	444	9,324
9/	NTB 14.	Lb. Lalar	3,136	628	TW	(B)	21,024	260	5,466	-	-	-	35,500	1	15.0	100%	2,367	11,237	562	11,799
10/	NTB 16.	Piong	1,662	333	TW	(B)	7,884	260	2,050	-	-	-	19,386	1	15.0	100%	1,292	5,822	291	6,113
11/	NTB 18a.	Kawuwu, lower	414	83	SW	(B)	5,256	260	1,367	-	-	-	19,386	1	15.0	100%	1,292	4,179	209	4,388
12/	NTB 18b.	Kawuwu, upper	404	81	E (Sp)	(C)	-	-	-	-	-	-	-	-	15.0	100%	-	1,032	52	1,084
Sub-total for NTB			31,054	6,215			(34,164)		8,883	(0)		-		(3)			4,951	81,874	4,095	85,969
NTT																				
Flores																				
13/	NTT 6.	Sinar Hading	1,294	259	NTT 7.	(A)	-	-	-	-	-	-	-	-	15.0	100%	-	6,828	341	7,169
14/	NTT 7.	Ile Padung	1,122	225	Sp	(A)	-	-	-	7,140	900	6,426	11,508	2	15.0	100%	1,534	17,260	863	21,289
						(A)	-	-	-	1,730	900	1,557	8,593	2	15.0	100%	1,146	3,015	151	
Sumba																				
15/	NTT 18.	Weerame	1,616	324	CW	(B)	-	-	-	7,140	900	6,426	11,508	2	15.0	100%	1,534	10,752	538	11,290
16/	NTT 19.	Kondamara	1,828	366	E (Sp)	(B)	-	-	-	7,140	900	6,426	11,508	2	15.0	100%	1,534	10,308	515	10,823
Rote																				
17/	NTT 21.	Oebau	632	127	CW	(B)	-	-	-	1,300	900	1,170	8,593	1	15.0	100%	573	3,371	169	3,540
18/	NTT 23.	Nusakdale	450	90	Sp	(C)	-	-	-	-	-	-	-	-	15.0	100%	-	1,080	54	1,134
Timor																				
19/	NTT 24.	Tarus	3,977	796	E (Sp)	(A)	5,256	260	1,367	-	-	-	18,915	2	15.0	100%	2,522	18,529	926	37,629
						(A)	-	-	-	16,430	900	14,787	18,915	2	15.0	100%	2,522	17,309	865	
Sub-total for NTT			10,919	2,187			(5,256)		1,367	(40,880)		36,792		(13)			11,365	88,452	4,422	92,874
Total of NTB and NTT			**41,973**	**8,402**			**(39,420)**		**10,250**	**(40,880)**		**36,792**		**(16)**			**16,316**	**170,326**	**8,517**	**178,843**
Note:									6%			21%					9%		5%	100%

- Price level: October 2001
- Exchange rate:

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

*5: Electricity's quantity includes about 30% of extra.
*6: Light oil's quantity includes about 30% of extra.
*7: The value indicates the rate of total maintenance and repair cost against the base price of equipment for the whole of the standard life.

Table 8.3.1 Estimated annual O&M Cost (3/3)

Serial No.	JICA #	Name of village	Design pop.	Nr. of house-holds	Source*1	O&M type*2	Annual total by system*8	per house-hold	Annual O&M cost by type			Annual O&M cost per household by type			Monthly O&M cost per household by type		
									(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)
			(Nr.)	(Nr.)			(Rp., thous.)	(Rp.)	(Rp., thous.)	(Rp., thous.)	(Rp., thous.)	(Rp.)	(Rp.)	(Rp.)	(Rp.)	(Rp.)	(Rp.)
NTB				①			②	②/①									
Lombok																	
1/	NTB 1.	Kuranji	1,894	379	E	(A)	7,232	19,082	7,232	-	-	19,082	-	-	1,590	-	-
2/	NTB 2.	Bajur	6,130	1,226	E	(A)	10,597	8,644	10,597	-	-	8,644	-	-	720	-	-
3/	NTB 3.	Sembung	2,225	445	E	(A)	7,472	16,791	7,472	-	-	16,791	-	-	1,399	-	-
4/	NTB 4a.	Duman, upper	3,078	616	Sp	(C)	2,898	4,705	-	-	2,898	-	-	4,705	-	-	392
5/	NTB 4b.	Duman, lower	1,926	386	E	(A)	7,258	18,803	7,258	-	-	18,803	-	-	1,567	-	-
6/	NTB 10.	Bagik Papan	3,182	637	E (Sp)	(C)	2,974	4,669	-	-	2,974	-	-	4,669	-	-	389
7/	NTB 11.	Selaparang	3,433	687	E (Sp)	(A)	14,830	21,587	14,830	-	-	21,587	-	-	1,799	-	-
Sumbawa																	
8/	NTB 13.	Lb. Mapin	3,570	714	Sp	(A)	9,324	13,059	9,324	-	-	13,059	-	-	1,088	-	-
9/	NTB 14.	Lb. Lalar	3,136	628	TW	(B)	11,799	18,788	-	11,799	-	-	18,788	-	-	1,566	-
10/	NTB 16.	Piong	1,662	333	TW	(B)	6,113	18,357	-	6,113	-	-	18,357	-	-	1,530	-
11/	NTB 18a.	Kawuwu, lower	414	83	SW	(B)	4,388	52,867	-	4,388	-	-	52,867	-	-	4,406	-
12/	NTB 18b.	Kawuwu, upper	404	81	E (Sp)	(C)	1,084	13,383	-	-	1,084	-	-	13,383	-	-	1,115
Sub-total for NTB			31,054	6,215			85,969	13,833	56,713	22,300	6,956	14,781	21,360	5,214	1,232	1,780	435
NTT																	
Flores																	
13/	NTT 6.	Sinar Hading	1,294	259	NTT 7.	(A)	28,458	58,798	28,458	-	-	58,798	-	-	4,900	-	-
14/	NTT 7.	Ile Padung	1,122	225	Sp	(A)											
						(A)											
Sumba																	
15/	NTT 18.	Weerame	1,616	324	CW	(B)	11,290	34,846	-	11,290	-	-	34,846	-	-	2,904	-
16/	NTT 19.	Kondamara	1,828	366	E (Sp)	(B)	10,823	29,571	-	10,823	-	-	29,571	-	-	2,464	-
Rote																	
17/	NTT 21.	Oebau	632	127	CW	(B)	3,540	27,874	-	3,540	-	-	27,874	-	-	2,323	-
18/	NTT 23.	Nusakdale	450	90	Sp	(C)	1,134	12,600	-	-	1,134	-	-	12,600	-	-	1,050
Timor																	
19/	NTT 24.	Tarus	3,977	796	E (Sp)	(A)	37,629	47,273	37,629	-	-	47,273	-	-	3,939	-	-
						(A)											
Sub-total for NTT			10,919	2,187			92,874	42,466	66,087	25,653	1,134	51,630	31,399	12,600	4,303	2,617	1,050
Total of NTB and NTT			**41,973**	**8,402**			**178,843**	**21,286**	**122,800**	**47,953**	**8,090**	**23,998**	**25,767**	**5,681**	**2,000**	**2,147**	**473**
Note:							(Y, thous.)	(Y)	(Y, thous.)	(Y, thous.)	(Y, thous.)	(Y)	(Y)	(Y)	(Y)	(Y)	(Y)
- Price level: October 2001							2,090	249	1,435	560	95	280	301	66	23	25	6

- Exchange rate:

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

*8: The villages of Sinar Hading and Ile Padung are combined to compute the cost since they are to operate a common water system.

Table 8.3.2 Estimated Replacement Cost

Serial No.	JICA #	Name of village	Design pop.	Nr. of house-holds	Source*1	O&M type*2	Pumps: Submer-sible	Pumps: centri-fugal	Replacement rate: Submer-sible	Replacement rate: centri-fugal	Amount: Submer-sible	Amount: centri-fugal	Amount: Total*3	per household: per annum	per household: per month
			(Nr.)	(Nr.)			(Nr.)	(Nr.)	(Rp., thous.)	(Rp., thous.)	(Rp., thous.)	(Rp., thous.)	(Rp., thous.)	(Rp.)	(Rp.)
NTB															
Lombok															
1/	NTB 1.	Kuranji	1,894	379	E	(A)	-	-	-	-	-	-	-	-	-
2/	NTB 2.	Bajur	6,130	1,226	E	(A)	-	-	-	-	-	-	-	-	-
3/	NTB 3.	Sembung	2,225	445	E	(A)	-	-	-	-	-	-	-	-	-
4/	NTB 4a.	Duman, upper	3,078	616	Sp	(C)	-	-	-	-	-	-	-	-	-
5/	NTB 4b.	Duman, lower	1,926	386	E	(A)	-	-	-	-	-	-	-	-	-
6/	NTB 10.	Bagik Papan	3,182	637	E (Sp)	(C)	-	-	-	-	-	-	-	-	-
7/	NTB 11.	Selaparang	3,433	687	E (Sp)	(A)	-	-	-	-	-	-	-	-	-
Sumbawa															
8/	NTB 13.	Lb. Mapin	3,570	714	Sp	(A)	-	-	-	-	-	-	-	-	-
9/	NTB 14.	Lb. Lalar	3,136	628	TW	(B)	1	-	35,500	-	35,500	-	35,500	3,769	314
10/	NTB 16.	Piong	1,662	333	TW	(B)	1	-	19,386	-	19,386	-	19,386	3,881	323
11/	NTB 18a.	Kawuwu, lower	414	83	SW	(B)	1	-	19,386	-	19,386	-	19,386	15,571	1,298
12/	NTB 18b.	Kawuwu, upper	404	81	E (Sp)	(C)	-	-	-	-	-	-	-	-	-
Sub-total for NTB			31,054	6,215			3	-			74,272	-	74,272	4,743	395
NTT															
Flores															
13/	NTT 6.	Sinar Hading	1,294	259	NTT 7.	(A)	-	-	-	-	-	-	180,908	24,918	2,077
14/	NTT 7.	Ile Padung	1,122	225	Sp	(A)	-	4	-	45,227	-	180,908			
Sumba															
15/	NTT 18.	Weerame	1,616	324	CW	(B)	-	2	-	25,893	-	51,786	51,786	10,656	888
16/	NTT 19.	Kondamara	1,828	366	E (Sp)	(B)	-	2	-	25,893	-	51,786	51,786	9,433	786
Rote															
17/	NTT 21.	Oebau	632	127	CW	(B)	-	1	-	19,334	-	19,334	19,334	10,149	846
18/	NTT 23.	Nusakdale	450	90	Sp	(C)	-	-	-	-	-	-	-	-	-
Timor															
19/	NTT 24.	Tarus	3,977	796	E (Sp)	(A)	2	2	18,915	42,559	37,830	85,118	122,948	10,297	858
Sub-total for NTT			10,919	2,187			2	11			37,830	388,932	426,762	13,567	1,131
Total of NTB and NTT			**41,973**	**8,402**			**5**	**11**			**112,102**	**388,932**	**501,034**	**10,634**	**886**

Note:

- Price level: October 2001
- Exchange rate:
  US$ 1.0= Y 121.92
  US$ 1.0= Rp. 10,435
  Y 1.0= Rp. 85.59

*1: E: existing water supply sytem. Sp: spring.
E (Sp) means that the works will require tapping or diverting from an existing system that has the water source of spring.
TW: tube well. SW: shallow well. CW: cavern water.

*2: (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.

*3: The replacement cost will be required at a cycle of every 15 years. The villages of Sinar Hading and Ile Padung are combined to compute the cost since they are to operate a common water system.

	(Y, thous.)	(Y)	(Y)
	5,854	124	10

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 benefit 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 improvement of accessibility to water, upgrading of social status of women, increment of health environment, betterment of physical health conditions, and etc. Even though it is difficult to quantify the economical viability, it should be recognized that the rural water supply projects 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 construction and O&M cost of the Type-A villages

The following are the conditions and assumptions used for the financial analysis.

- Price level : 2001
- Interest : 10 %
- Project life : 20 year

The results are show in the table below.

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%

Note: > The value is calculated for each of the type A villages. The initial investment cost is estimated including extra overheads due to scale demerit based on the project cost estimated.
> Level of present worth: 2001
> Interest: 10 %
> Project life: 20 years

The computation is given to every type A village in Table 9.2.1.

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. PDAM will handle only operation and maintenance activity after the construction.

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

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

Financial analysis of O&M for type A villages

(Unit: Rp./ household /month)

Village	PDAM tariff		O&M Cost	WTP	3% of Income
	HC	PH			
Kuranji	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
Dumang, lower	6,605	1,742	1,567	1,015	25,205
Selaparang	4,200	1,580	1,799	1,000	25,205
Lab. Mapin	6,350	1,940	1,088	5,900	25,205
Sinar Hading	7,140	2,570	6,977	2,500	17,472
Ile Padung	7,140	2,570	6,977	3,500	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

The observations are as follows.

・ Financial Impacts on PDAM

PDAM tariff is greater than O&M costs for 3 PDAMs (Menan Mataram, Lonbok Timur, Sumbawa), but otherwise for 2 PDAMs (Flores Timur, Kupang). The project will have a possessive impact on the 3 PDAMs, and a negative impact on the 2 PDAMs. However, the Chapter 6 assessed the financial impacts and concluded that incremental O&M cost is only about 2 % less than 1 % for Flores Timur and Kupang, which is considered negligible. Therefore the project is generally considered to be viable.

It is preferable that GOI/district could support PDAM with subsidiaries for increased O&M cost.

・ 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 where cannot afford to pay, may be preferred to use public hydrant or public tabs 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. The hygiene and health education proposed in the report 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

(3) Financial analysis of O&M for types B&C villages

Financial analysis was also undertaken to compare the O&M cost, WTP (willingness to pay) and household income 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	1,015	25,205
Bagik Papan	C	389	1,000	25,205
Labuhan Lalar	B	1,880	9,300	25,205
Piong	B	1,853	875	25,205
Kawuwu, lower	B	5,704	675	25,205
Kawawu, upper	C	1,115	675	25,205
Weerame	B	3,792	1,810	17,472
Kondamara	B	3,250	1,000	17,472
Oebau	B	3,169	1,025	17,472
Nusakdale	C	1,050	1,107	17,472
Sub-total (type B&C)		22,594	18,482	221,118
Average (type B&C)		2,259	1,848	22,111

Note: >Each of the above indicates the value per household.

・ Tariff Settings

For the community-managed schemes, the tariffs should cover O&M costs only. The O&M costs vary amoung communities due to the various types of water supply system.

・ 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, RRA survey has been clarified that the willingness to pay was increased generally through group discussion. 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 photovaltaic 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

Affordability is the key indicator in assessing the viability of the rural water supply systems. It is essential that communities can meet the cost of ongoing

O&M of water supply facilities. For rural water supply systems it is not usual for communities to meet the full capital cost (through depreciation or loan redemption) but they would usually contribute in-kind through provision of land and locally available materials. A comparison between the O&M costs and 3% of estimated household income based on per capita GRDP indicates that the communities on average can easily afford to meet the O&M costs. Accordingly, all communities the proposed systems are financially feasible based on this criterion. 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

The proposed project provides for 19 village water supply systems to serve 17 villages in NTB and NTT. The 19 systems include 9 which will be managed by PDAM, 6 which will be managed by communities, with support being provided by PDAM, and 4 which will be managed entirely by the community themselves.

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, and providing on ongoing role in subsequent operation and maintenance. These institutions/agencies and their role in the Project are detailed in the table in Section 6.2.7. They include central, provincial and district level organizations. The following table 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. They key points are summarized below.

The project is relatively small and the implementation phase roles and responsibilities of provincial and district level agencies are well within their capacity. Only the PDAM has a long-term involvement at this level after project completion. While there are shortcomings in the PDAMs, the overall impact of the addition of the Type A and Type B systems will not be significant in terms of PDAM performance. The Project provides capacity building to address identified PDAM constraints related to sustainable management of village water supply operation & maintenance.

The requirements for district level agencies relate primary to their normal functions of coordination, liaison and support to village level administration. Further, the project design utilizes existing GOI structures and processes. There will be some additional workload but the impact is not expected to be significant and may be more dependent on other activities.

It is at the village/community level that there is a substantial addition burden created by the project. Many agencies are involved at this level and are required to make a significant contribution to project implementation. The project design provides for project appointed staff to assist agencies and communities at this level, particularly through the appointment of experienced Field Officers. Further, capacity building is provided as part of the implementation process. WUAs and WUGs will be established by the project. They will have a long term role in the operation & maintenance of the implemented water supply systems. The project provides capacity building for WUAs/WUGs and the proposed models provide for appropriate PDAM involvement in order to enhance sustainability.

Impact on Agencies

Category/Agency	Significant Impact	Key Impacts and Project Responses	
		During Implementation	After Completion
Central Level			
• Kimpraswil	No		
• Health	No		
Provincial Level			
• BAPPEDA	No		
• Kimpraswil	Yes	Key agency for coordinating the implementation of the Project. Small project size is within the capacity of existing resources supplemented by Consultant's implementation team resources.	No long term impact.
• P3P	Yes	P3P is the specialist project implementation arm of Kimpraswil and as such will be the key GOI agency responsible for construction activities. Small project size is within the capacity of existing resources supplemented by Consultant's implementation team resources.	No long term impact.
• Health	No		
• Community Empowerment	No		
District Level			
• BAPPEDA	No		
• Kimpraswil	Yes	Key coordinating agency at district level. This is a normal function of Kimpraswil and the requirements for this Project are relatively small.	No long term impact.
• P3P	Yes	Similar comments apply as for provincial level.	No long term impact.
• Health	No		
• Community Empowerment	No		
• PDAM	Yes	Will be involved in capacity building activities during implementation	Long term role in operation & maintenance in Type A villages and in providing ongoing support for Type B villages. Impact of the Project on overall PDAM role is very minor. Capacity building is provided by Project to address key constraints related to village water supply.
Sub-District Level			
• Various sections of Camat's organisation	Yes	Various sub-district level agencies will have a role in coordination of activities at sub-district level and providing support at the village level. Key sections include Community Empowerment, Religious Affairs, Education, Health centers, and TP PKK. Project design utilizes existing GOI structures and roles but may increase workload in project sub-district.	No long term impact.

Category/Agency	Significant Impact	Key Impacts and Project Responses	
		During Implementation	After Completion
Village Level			
• Village Representative Council (BPD)	Yes	All agencies involved at village level will be required to make a significant contribution to project implementation. The Project design provides for Project appointed staff in key areas to assist communities and agencies at this level primarily through recruitment of experienced Field Officers. Capacity building is provided as part of the implementation process. WUAs/WUG will be established with Project support.	WUAs/WUGs will have a long term role in operation and maintenance of water supply systems (Types A, B and C). Capacity building provide by the Project and management and support provided by the PDAM (Types A & B) under the proposed implementation models have been designed to enhance sustainability of institutions as well as the water supply systems.

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.

Technical appropriateness

The technologies to be adopted for the rural aspects of the project will be based on the evaluation of experience gained through previous studies and programs. In particular, the provision of water supply system will apply design criteria consistent with national standards. Alternative and cheaper options such as gravity systems and the less use of pumped systems will enable poorer families to access the benefits of the proposed project at lower cost. Further, the provision of public hydrants, or public tap connections, as an alternative to a house connection provides a means of ensuring that the poor within the communities can also have access to a water supply. Technologies for rural water supplies will be considered to suit both women and men and to maximize the use of local materials.

Operation & Maintenance aspects

The ability of PDAM and communities to operate and maintain the rural water supplies are basically limited and adequate approaches are urgently required to enhance their capacities. 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 that include the consideration with whether the PDAM management or the WUA/WUG management approaches.

These will be supported by capacity building activities to strengthen O&M and sustainability.

Land acquisition

It is not anticipated that land acquisition and/or compensation will be a significant factor in the implementation of the project. These matters are usually dealt with summarily by the local Kepala Desa or Kepala Suka. The village WUA will be responsible for the detailed siting of most of the system facilities and are best qualified to deal with any potential problems by choosing a different location. Land for the pipeline can be used without payment, providing the land is reinstated after the work is completed. The only area where compensation is likely to be required is if crops are damaged or destroyed during construction. Even this eventuality can be avoided by sympathetic planning.

Land acquisition may only be required for facilities and large constructions such as wells and reservoirs.

Environmental issues

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.

Project management

The constraints of project management over widely scattered villages can be resolved by taking the following measures:

(a) develop the project area by province in two phases; and
(b) employ a consultant to sustain both engineering and soft component works in each phase.

Construction works will be performed progressively from area to area , e.g. from the Lombok Barat area, Lombok Timur, Subawa and to the Bima areas. This

area-to-area construction would help to maintain the quality and punctuality of the work since it simplifies the construction management.

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) between the community members, upgrading of community living standards, and both direct and indirect health benefits. These social impacts of the Project are assessed in both qualitative and quantitative terms in the following sections.

9.5.1 Community Development Impacts

The rural water supply project in NTB and NTT will generate community development impacts as shown below:

- A contribution to improved awareness about the requirements and need for sustainable O&M;
- Associated increased capacity for members of WUAs/WUG;
- Increased knowledge and skills for O&M of water supply facilities;
- Improved communications through the establishment of WUAs/WUGs;
- Establishment of fund raising capacity and improved sustainability for O&M of water facilities;
- Generation of revenue for Water Users' Association through water sales.

9.5.2 Beneficiaries and Poverty Impacts

(1) Beneficiaries and needs:

The project will directly benefit 38,000 people through the construction of potable water supplies and the implementation of complementary health and hygiene programs. There is substantial evidence of the community's awareness of the need for improved water supply in the study area. Household surveys carried out

in the Project communities have revealed that most people do not presently enjoy access to water facilities and are interested in obtaining improved water supply systems. Furthermore, more than 93% of the households are willing to participate in the Project and 83% are willing to pay the required water fees. Access to secure water supply is a basic need within the target communities.

(2) Equity

The proposed Project will provide broadly equal distribution of the social benefits to be derived from the project. The coverage of water supply facilities is high at about 100% at the targeted hamlet. Provision is also included for some more remote families adjacent to pipelines to access water through public taps. Moreover, households with lower living standards, and ethnic minorities, will be fully integrated in the WUA & WUGs. Therefore there are no negative impacts on ethnic and religious groups or on different social levels within the Project communities.

(3) Poverty alleviation:

The Project specifically targets low-income areas. In the process of implementation, the focus on poverty alleviation will continue through the planning of appropriate water supply facilities (house connections and public hydrants/taps) and appropriate tariff structures as well as related programs for village development (through VAPs). Provision of improved access to clean water will enable household members to undertake other income generating activities as a consequence of time savings arising from the new system. Furthermore, employment opportunities will increase in some villages during construction of the systems and through ongoing O&M.

9.5.3 Gender Issues

While communities as a whole benefit from improved water supply, women are the primary beneficiaries as they are usually responsible for daily water collection (82%). These impacts are analyzed in detail in Section 9.5.6 & 9.5.7.

The promotion of women's participation in WUAs/WUGs and health & hygiene education, and consequently, in the planning, implementation and operation of the water supply facilities, will promote the status and influence of women in village

affairs. The Project will actively promote the involvement of women as decision-makers: (a) by training women as primary managers of water supply; (b) by encouraging communities to include women on the WUAs/WUGs to be established; (c) by developing community facilitation methods which stress the importance of active involvement by women; (d) by including women in post-project O&M activities; and (e) by adopting a proactive hiring policy during implementation which employs and supports a significant number of women

9.5.4 Acceptability to Society

Acceptability of the water supply plan to society in terms of religious and/or local practices are analyzed below:

(1) Cultural issues:

The communities have been selected with the criteria that the people themselves must request and welcome the proposed Project. Therefore, these communities will have an accepted water supply plan and an understanding in general terms of the improved facilities to be provided. However, from the past experience of rural water supply, the failure of water supply systems and the lack of maintenance were often caused by social conflict between different parties. Accordingly it is appropriate that Project planning and implementation take account of previous experience and the lessons learned to avoid these culture constraints: a) by hiring competent field officers who have a capacity for problem solving, communication and counseling; b) by facilitation, motivation and stimulation, thereby assisting communities to make informed choices about facilities and services, and to be responsible for their sustainable management; c) by respecting local cultural traditions and practices through the involvement of Adat leaders and local landowners; and d) by reviewing regulations to ensure that they reflect traditional approaches where possible. In order to maximize interest and involvement in community-based activities, culturally inappropriate strategies and activities should be avoided.

(2) Religious issues:

The population in the target communities in NTB is predominantly Moslem (97%) and Hindu (3%). Only Duman has a higher population of Hindus at 20%. On the other hand, in NTT the target communities are predominantly Catholic and Protestant. For example in Flores Catholics predominate, and in Sumba there is a

mix of animism and Protestant, in Rote Protestants predominate, and in Tarus Protestants (68%) and Muslims (31%) are included. Religious conflict has not been reported in the Project communities. Generally, religious leaders, praying groups and youth groups are active and influential. Their support will be important in mobilizing long-term community participation in O&M of the developed facilities. These traditional and cultural leaders will be involved in the process of identifying, planning, designing and implementing new projects. Through this process, acceptability of the proposed Project activities to all relevant religions will be high.

9.5.5 Adverse impacts

Impacts on adversely affected groups are usually a minor issue in rural water supply. Such groups include water sellers and providers of medical supplies. There will be a considerable decrease in water vendor businesses after the establishment of Project systems in some communities such as Labuhan Lalar and Ille Padung. However, compared with the other communities, the socio-economic conditions in these communities are relatively high. There is therefore, a possibility of alternative employment for those adversely affected by the Project.

9.5.6 Time saving and productivity increases

The main direct economic gain to households from improved access to water supply is the imputed price of time and energy savings due to no longer having to fetch and carry water from distant water sources. These gains apply most specifically for women and children who are usually those traditionally responsible for daily water collection. Time and energy savings for women are translated into time and energy for other activities, such as productive economic activity to supplement household income, improved reproductive activity (improved child and family care) or leisure time.

9.5.7 Health benefits – direct and indirect

The provision of good quality water supply, either in or reasonably close to houses, is essential for improved health, particularly through prevention and reductions in diarrhea and other water related diseases. Moreover, promoting improved sanitation and health and hygiene behavior change through the proposed health & hygiene education program, will contribute to improved health conditions.

The project will improve productivity through (a) reduced time of household members in caring for sick children, (b) reduction in time lost from education and work due to morbidity, and (c) the cost savings through reduced medical and health care expenditure.

Indirect longer-term gains from improved water supply may be in the form of reduced levels of childhood morbidity and reduced infant and childhood mortality, especially due to reduction of diarrheal diseases. Improved family health status and improved likelihood of childhood survival, to the degree that these may be attributed to improved water supply, eventually lead to lower birth rates with improved welfare for smaller rural families.

9.5.8 Overall Evaluation

Financial evaluation suggests that the project is hardly justifiable if the capital investment cost should be considered for the ovulation. 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.

Table 9.2.1 Financial Analysis on Type A Villages (1/9)

NTB 1. Kuranji

(Unit: Rp., million)

Chris-tian Era	Year	Financial value			Discount factor	Present money value		
		Cost	Benefit	Net benefit		Cost	Benefit	Net benefit
	a	*b*	*c*	*d= c-b*	*e*	*f= b*e*	*g= c*e*	*h= d*e*
2001	0	0	0	0	1.000	0	0	0
2002	1	0	0	0	0.877	0	0	0
2003	2	1,758	0	-1,758	0.769	1,353	0	-1,353
2004	3	3,516	7	-3,509	0.675	2,373	5	-2,368
2005	4	7	14	7	0.592	4	8	4
2006	5	7	14	7	0.519	4	7	4
2007	6	7	14	7	0.456	3	6	3
2008	7	7	14	7	0.400	3	6	3
2009	8	7	14	7	0.351	3	5	3
2010	9	7	14	7	0.308	2	4	2
2011	10	7	15	7	0.270	2	4	2
2012	11	7	15	7	0.237	2	3	2
2013	12	7	15	7	0.208	2	3	2
2014	13	7	15	7	0.182	1	3	1
2015	14	7	15	7	0.160	1	2	1
2016	15	7	15	7	0.140	1	2	1
2017	16	7	15	7	0.123	1	2	1
2018	17	7	15	7	0.108	1	2	1
2019	18	7	15	7	0.095	1	1	1
2020	19	7	15	7	0.083	1	1	1
2021	20	7	15	7	0.073	1	1	1
2022	21	7	15	7	0.064	0	1	0
2023	22	7	15	7	0.056	0	1	0
2024	23	7	15	7	0.049	0	1	0
Total		5,418	296	-5,122		3,758	69	-3,689
				FIRR ***-22.1%***		*B/C ratio=* $\Sigma g/\Sigma f$ ***0.02***		*NPV* ***-3,689***

Note: † Present money level : 2001
† Interest : 14% (money market rate per annum)
† Project life : 20 years (after the completion of works)
† Discount factor (*e*) : *e* = (1+Interest)^*a*
† *B/C ratio* : Benefit-cost ratio
† *NPV* : Net present value (B minus C)
† *FIRR* : Financial internal rate of return
† Cost : expenditure of PDAM for initial investment and O&M costs including tax on said village
† Benefit : revenue of PDAM on said village
† 'Cost', 'Benefit' and 'Net benefit' (economic vale) are all incremental value to those without project.

Table 9.2.1 Financial Analysis on Type A Villages (2/9)

NTB 2. Bajur

(Unit: Rp., million)

Chris-tian Era	Year	Financial value			Discount factor	Present money value		
		Cost	Benefit	Net benefit		Cost	Benefit	Net benefit
	a	*b*	*c*	*d= c-b*	*e*	*f= b*e*	*g= c*e*	*h= d*e*
2001	0	0	0	0	1.000	0	0	0
2002	1	0	0	0	0.877	0	0	0
2003	2	2,255	0	-2,255	0.769	1,735	0	-1,735
2004	3	4,510	26	-4,484	0.675	3,044	18	-3,027
2005	4	11	52	42	0.592	6	31	25
2006	5	11	53	42	0.519	6	27	22
2007	6	11	53	42	0.456	5	24	19
2008	7	11	53	43	0.400	4	21	17
2009	8	11	54	43	0.351	4	19	15
2010	9	11	54	43	0.308	3	17	13
2011	10	11	54	44	0.270	3	15	12
2012	11	11	54	44	0.237	3	13	10
2013	12	11	54	44	0.208	2	11	9
2014	13	11	54	44	0.182	2	10	8
2015	14	11	54	44	0.160	2	9	7
2016	15	11	54	44	0.140	1	8	6
2017	16	11	54	44	0.123	1	7	5
2018	17	11	54	44	0.108	1	6	5
2019	18	11	54	44	0.095	1	5	4
2020	19	11	54	44	0.083	1	4	4
2021	20	11	54	44	0.073	1	4	3
2022	21	11	54	44	0.064	1	3	3
2023	22	11	54	44	0.056	1	3	2
2024	23	11	54	44	0.049	1	3	2
Total		6,978	1,104	-5,873		4,827	257	-4,570
				FIRR		*B/C ratio= Σg/Σf*		*NPV*
				-14.3%			***0.05***	***-4,570***

Note: † Present money level : 2001
† Interest : 14% (money market rete per annum)
† Project life : 20 years (after the completion of works)
† Discount factor (*e*) : *e* = (1+Interest)^*a*
† *B/C ratio* : Benefit-cost ratio
† *NPV* : Net present value
† *FIRR* : Financial internal rate of return
† Cost : expenditure of PDAM for initial investment and O&M costs including tax on said village
† Benefit : revenue of PDAM on said village
† 'Cost', 'Benefit' and 'Net benefit' (economic vale) are all incremental value to those without project.

Table 9.2.1 Financial Analysis on Type A Villages (3/9)

NTB 3. Sembung

(Unit: Rp., million)

Chris-tian Era	Year	Financial value			Discount factor	Present money value		
		Cost	Benefit	Net benefit		Cost	Benefit	Net benefit
	a	*b*	*c*	*d= c-b*	*e*	*f= b*e*	*g= c*e*	*h= d*e*
2001	0	0	0	0	1.000	0	0	0
2002	1	0	0	0	0.877	0	0	0
2003	2	1,771	0	-1,771	0.769	1,363	0	-1,363
2004	3	3,543	8	-3,535	0.675	2,391	6	-2,386
2005	4	7	17	9	0.592	4	10	5
2006	5	7	17	9	0.519	4	9	5
2007	6	7	17	9	0.456	3	8	4
2008	7	7	17	9	0.400	3	7	4
2009	8	7	17	9	0.351	3	6	3
2010	9	7	17	10	0.308	2	5	3
2011	10	7	17	10	0.270	2	5	3
2012	11	7	17	10	0.237	2	4	2
2013	12	7	17	10	0.208	2	4	2
2014	13	7	17	10	0.182	1	3	2
2015	14	7	17	10	0.160	1	3	2
2016	15	7	17	10	0.140	1	2	1
2017	16	7	17	10	0.123	1	2	1
2018	17	7	17	10	0.108	1	2	1
2019	18	7	17	10	0.095	1	2	1
2020	19	7	17	10	0.083	1	1	1
2021	20	7	17	10	0.073	1	1	1
2022	21	7	17	10	0.064	0	1	1
2023	22	7	17	10	0.056	0	1	1
2024	23	7	17	10	0.049	0	1	0
Total		5,464	348	-5,116		3,788	81	-3,707
				FIRR		*B/C ratio= Σg/ Σf*		*NPV*
				-20.9%			***0.02***	***-3,707***

Note: † Present money level : 2001
† Interest : 14% (money market rete per annum)
† Project life : 20 years (after the completion of works)
† Discount factor (*e*) : *e* = (1+Interest)^*a*
† *B/C ratio* : Benefit-cost ratio
† *NPV* : Net present value
† *FIRR* : Financial internal rate of return
† Cost : expenditure of PDAM for initial investment and O&M costs including tax on said village
† Benefit : revenue of PDAM on said village
† 'Cost', 'Benefit' and 'Net benefit' (economic vale) are all incremental value to those without project.

Table 9.2.1 Financial Analysis on Type A Villages (4/9)

NTB 4(b). Duman, lower

(Unit: Rp., million)

Chris-tian Era	Year	Financial value			Discount factor	Present money value		
		Cost	Benefit	Net benefit		Cost	Benefit	Net benefit
	a	*b*	*c*	*d= c-b*	*e*	*f= b*e*	*g= c*e*	*h= d*e*
2001	0	0	0	0	1.000	0	0	0
2002	1	0	0	0	0.877	0	0	0
2003	2	1,894	0	-1,894	0.769	1,458	0	-1,458
2004	3	3,789	7	-3,782	0.675	2,557	5	-2,552
2005	4	7	14	7	0.592	4	8	4
2006	5	7	14	7	0.519	4	7	4
2007	6	7	14	7	0.456	3	7	3
2008	7	7	15	7	0.400	3	6	3
2009	8	7	15	7	0.351	3	5	3
2010	9	7	15	7	0.308	2	5	2
2011	10	7	15	8	0.270	2	4	2
2012	11	7	15	8	0.237	2	4	2
2013	12	7	15	8	0.208	2	3	2
2014	13	7	15	8	0.182	1	3	1
2015	14	7	15	8	0.160	1	2	1
2016	15	7	15	8	0.140	1	2	1
2017	16	7	15	8	0.123	1	2	1
2018	17	7	15	8	0.108	1	2	1
2019	18	7	15	8	0.095	1	1	1
2020	19	7	15	8	0.083	1	1	1
2021	20	7	15	8	0.073	1	1	1
2022	21	7	15	8	0.064	0	1	0
2023	22	7	15	8	0.056	0	1	0
2024	23	7	15	8	0.049	0	1	0
Total		5,828	301	-5,527		4,047	70	-3,977
				FIRR		*B/C ratio= Σg/ Σf*		*NPV*
				-22.3%			***0.02***	***-3,977***

Note: † Present money level : 2001
† Interest : 14% (money market rete per annum)
† Project life : 20 years (after the completion of works)
† Discount factor (*e*) : *e* = (1+Interest)^*a*
† *B/C ratio* : Benefit-cost ratio
† *NPV* : Net present value
† *FIRR* : Financial internal rate of return
† Cost : expenditure of PDAM for initial investment and O&M costs including tax on said village
† Benefit : revenue of PDAM on said village
† 'Cost', 'Benefit' and 'Net benefit' (economic vale) are all incremental value to those without project.

Table 9.2.1 Financial Analysis on Type A Villages (5/9)

NTB 11. Selaparang

(Unit: Rp., million)

Chris-tian Era	Year	Financial value			Discount factor	Present money value		
		Cost	Benefit	Net benefit		Cost	Benefit	Net benefit
	a	*b*	*c*	*d= c-b*	*e*	*f= b*e*	*g= c*e*	*h= d*e*
2001	0	0	0	0	1.000	0	0	0
2002	1	0	0	0	0.877	0	0	0
2003	2	2,438	0	-2,438	0.769	1,876	0	-1,876
2004	3	4,876	14	-4,861	0.675	3,291	10	-3,281
2005	4	15	29	14	0.592	9	17	8
2006	5	15	29	14	0.519	8	15	8
2007	6	15	29	15	0.456	7	13	7
2008	7	15	30	15	0.400	6	12	6
2009	8	15	30	15	0.351	5	10	5
2010	9	15	30	15	0.308	5	9	5
2011	10	15	30	15	0.270	4	8	4
2012	11	15	30	15	0.237	4	7	4
2013	12	15	30	15	0.208	3	6	3
2014	13	15	30	15	0.182	3	6	3
2015	14	15	30	15	0.160	2	5	2
2016	15	15	30	15	0.140	2	4	2
2017	16	15	30	15	0.123	2	4	2
2018	17	15	30	15	0.108	2	3	2
2019	18	15	30	15	0.095	1	3	1
2020	19	15	30	15	0.083	1	3	1
2021	20	15	30	15	0.073	1	2	1
2022	21	15	30	15	0.064	1	2	1
2023	22	15	30	15	0.056	1	2	1
2024	23	15	30	15	0.049	1	1	1
Total		7,610	616	-6,994		5,233	143	-5,090
				FIRR		*B/C ratio= Σg/Σf*		*NPV*
				-20.1%			***0.03***	***-5,090***

Note: † Present money level : 2001
† Interest : 14% (money market rete per annum)
† Project life : 20 years (after the completion of works)
† Discount factor (*e*) : *e* = (1+Interest)^*a*
† *B/C ratio* : Benefit-cost ratio
† *NPV* : Net present value
† *FIRR* : Financial internal rate of return
† Cost : expenditure of PDAM for initial investment and O&M costs including tax on said village
† Benefit : revenue of PDAM on said village
† 'Cost', 'Benefit' and 'Net benefit' (economic vale) are all incremental value to those without project.

Table 9.2.1 Financial Analysis on Type A Villages (6/9)

NTB 13. Labuhan Mapin

(Unit: Rp., million)

Chris-tian Era	Year	Financial value			Discount factor	Present money value		
		Cost	Benefit	Net benefit		Cost	Benefit	Net benefit
	a	*b*	*c*	*d= c-b*	*e*	*f= b*e*	*g= c*e*	*h= d*e*
2001	0	0	0	0	1.000	0	0	0
2002	1	0	0	0	0.877	0	0	0
2003	2	2,046	0	-2,046	0.769	1,574	0	-1,574
2004	3	4,091	20	-4,071	0.675	2,761	14	-2,748
2005	4	9	41	32	0.592	6	25	19
2006	5	9	42	33	0.519	5	22	17
2007	6	9	43	33	0.456	4	19	15
2008	7	9	43	34	0.400	4	17	14
2009	8	9	44	34	0.351	3	15	12
2010	9	9	44	35	0.308	3	14	11
2011	10	9	45	36	0.270	3	12	10
2012	11	9	45	36	0.237	2	11	8
2013	12	9	45	36	0.208	2	9	7
2014	13	9	45	36	0.182	2	8	6
2015	14	9	45	36	0.160	1	7	6
2016	15	9	45	36	0.140	1	6	5
2017	16	9	45	36	0.123	1	6	4
2018	17	9	45	36	0.108	1	5	4
2019	18	9	45	36	0.095	1	4	3
2020	19	9	45	36	0.083	1	4	3
2021	20	9	45	36	0.073	1	3	3
2022	21	9	45	36	0.064	1	3	2
2023	22	9	45	36	0.056	1	3	2
2024	23	9	45	36	0.049	0	2	2
Total		6,323	907	-5,416		4,377	209	-4,168
				FIRR		*B/C ratio= Σg/ Σf*		*NPV*
				-14.9%			***0.05***	***-4,168***

Note: † Present money level : 2001
† Interest : 14% (money market rete per annum)
† Project life : 20 years (after the completion of works)
† Discount factor (*e*) : *e* = (1+Interest)^*a*
† *B/C ratio* : Benefit-cost ratio
† *NPV* : Net present value
† *FIRR* : Financial internal rate of return
† Cost : expenditure of PDAM for initial investment and O&M costs including tax on said village
† Benefit : revenue of PDAM on said village
† 'Cost', 'Benefit' and 'Net benefit' (economic vale) are all incremental value to those without project.

Table 9.2.1 Financial Analysis on Type A Villages (7/9)

NTT 6. Sinar Hading

(combined with NTT 7. Ile Padung)

(Unit: Rp., million)

Chris-tian Era	Year	Financial value			Discount factor	Present money value		
		Cost	Benefit	Net benefit		Cost	Benefit	Net benefit
	a	*b*	*c*	*d= c-b*	*e*	*f= b*e*	*g= c*e*	*h= d*e*
2001	0	0	0	0	1.000	0	0	0
2002	1	0	0	0	0.877	0	0	0
2003	2	3,897	0	-3,897	0.769	2,998	0	-2,998
2004	3	7,794	17	-7,776	0.675	5,260	12	-5,249
2005	4	28	35	6	0.592	17	21	4
2006	5	28	35	7	0.519	15	18	3
2007	6	28	35	7	0.456	13	16	3
2008	7	28	36	7	0.400	11	14	3
2009	8	28	36	7	0.351	10	13	3
2010	9	28	36	7	0.308	9	11	2
2011	10	28	36	8	0.270	8	10	2
2012	11	28	36	8	0.237	7	9	2
2013	12	28	36	8	0.208	6	7	2
2014	13	28	36	8	0.182	5	7	1
2015	14	28	36	8	0.160	5	6	1
2016	15	28	36	8	0.140	4	5	1
2017	16	28	36	8	0.123	3	4	1
2018	17	28	36	8	0.108	3	4	1
2019	18	209	36	-173	0.095	20	3	-16
2020	19	28	36	8	0.083	2	3	1
2021	20	28	36	8	0.073	2	3	1
2022	21	28	36	8	0.064	2	2	0
2023	22	28	36	8	0.056	2	2	0
2024	23	28	36	8	0.049	1	2	0
Total		12,440	735	-11,705		8,403	171	-8,232
				FIRR		*B/C ratio= Σg/ Σf*		*NPV*
				-35.7%			***0.02***	***-8,232***

Note: † Present money level : 2001
† Interest : 14% (money market rete per annum)
† Project life : 20 years (after the completion of works)
† Discount factor (*e*) : *e* = (1+Interest)^*a*
† *B/C ratio* : Benefit-cost ratio
† *NPV* : Net present value
† *FIRR* : Financial internal rate of return
† Cost : expenditure of PDAM for initial investment and O&M costs including tax on said village
† Benefit : revenue of PDAM on said village
† 'Cost', 'Benefit' and 'Net benefit' (economic vale) are all incremental value to those without project.
† Each of cost and benefit for the villages of Sinar Hading and Ile Padung is combined since they use a common water system.

Table 9.2.1 Financial Analysis on Type A Villages (8/9)

NTT 7. Ile Padung

(combined with NTT 6. Sinar Hading)

(Unit: Rp., million)

Chris-tian Era	Year	Financial value			Discount factor	Present money value		
		Cost	Benefit	Net benefit		Cost	Benefit	Net benefit
	a	*b*	*c*	*d= c-b*	*e*	*f= b*e*	*g= c*e*	*h= d*e*
2001	0	0	0	0	1.000	0	0	0
2002	1	0	0	0	0.877	0	0	0
2003	2	3,897	0	-3,897	0.769	2,998	0	-2,998
2004	3	7,794	17	-7,776	0.675	5,260	12	-5,249
2005	4	28	35	6	0.592	17	21	4
2006	5	28	35	7	0.519	15	18	3
2007	6	28	35	7	0.456	13	16	3
2008	7	28	36	7	0.400	11	14	3
2009	8	28	36	7	0.351	10	13	3
2010	9	28	36	7	0.308	9	11	2
2011	10	28	36	8	0.270	8	10	2
2012	11	28	36	8	0.237	7	9	2
2013	12	28	36	8	0.208	6	7	2
2014	13	28	36	8	0.182	5	7	1
2015	14	28	36	8	0.160	5	6	1
2016	15	28	36	8	0.140	4	5	1
2017	16	28	36	8	0.123	3	4	1
2018	17	28	36	8	0.108	3	4	1
2019	18	209	36	-173	0.095	20	3	-16
2020	19	28	36	8	0.083	2	3	1
2021	20	28	36	8	0.073	2	3	1
2022	21	28	36	8	0.064	2	2	0
2023	22	28	36	8	0.056	2	2	0
2024	23	28	36	8	0.049	1	2	0
Total		12,440	735	-11,705		8,403	171	-8,232
				FIRR		*B/C ratio= Σg/ Σf*		*NPV*
				-35.7%			***0.02***	***-8,232***

Note: † Present money level : 2001
† Interest : 14% (money market rete per annum)
† Project life : 20 years (after the completion of works)
† Discount factor (*e*) : *e* = (1+Interest)^*a*
† *B/C ratio* : Benefit-cost ratio
† *NPV* : Net present value
† *FIRR* : Financial internal rate of return
† Cost : expenditure of PDAM for initial investment and O&M costs including tax on said village
† Benefit : revenue of PDAM on said village
† 'Cost', 'Benefit' and 'Net benefit' (economic vale) are all incremental value to those without project.
† Each of cost and benefit for the villages of Sinar Hading and Ile Padung is combined since they use a common water system.

Table 9.2.1 Financial Analysis on Type A Villages (9/9)

NTT 24. Tarus

(Unit: Rp., million)

Chris-tian Era	Year	Financial value			Discount factor	Present money value		
		Cost	Benefit	Net benefit		Cost	Benefit	Net benefit
	a	*b*	*c*	*d= c-b*	*e*	*f= b*e*	*g= c*e*	*h= d*e*
2001	0	0	0	0	1.000	0	0	0
2002	1	0	0	0	0.877	0	0	0
2003	2	2,816	0	-2,816	0.769	2,167	0	-2,167
2004	3	5,632	23	-5,609	0.675	3,801	16	-3,786
2005	4	38	36	-2	0.592	22	21	-1
2006	5	38	36	-1	0.519	20	19	-1
2007	6	38	37	-1	0.456	17	17	0
2008	7	38	38	0	0.400	15	15	0
2009	8	38	38	0	0.351	13	13	0
2010	9	38	39	1	0.308	12	12	0
2011	10	38	39	2	0.270	10	11	0
2012	11	38	39	2	0.237	9	9	0
2013	12	38	39	2	0.208	8	8	0
2014	13	38	39	2	0.182	7	7	0
2015	14	38	39	2	0.160	6	6	0
2016	15	38	39	2	0.140	5	6	0
2017	16	38	39	2	0.123	5	5	0
2018	17	38	39	2	0.108	4	4	0
2019	18	161	39	-121	0.095	15	4	-11
2020	19	38	39	2	0.083	3	3	0
2021	20	38	39	2	0.073	3	3	0
2022	21	38	39	2	0.064	2	3	0
2023	22	38	39	2	0.056	2	2	0
2024	23	38	39	2	0.049	2	2	0
Total		9,323	797	-8,526		6,148	186	-5,962
				FIRR		*B/C ratio= Σg/ Σf*		*NPV*
				-51.8%			***0.03***	***-5,962***

Note: † Present money level : 2001
† Interest : 14% (money market rete per annum)
† Project life : 20 years (after the completion of works)
† Discount factor (*e*) : *e* = (1+Interest)^*a*
† *B/C ratio* : Benefit-cost ratio
† *NPV* : Net present value
† *FIRR* : Financial internal rate of return
† Cost : expenditure of PDAM for initial investment and O&M costs including tax on said village
† Benefit : revenue of PDAM on said village
† 'Cost', 'Benefit' and 'Net benefit' (economic vale) are all incremental value to those without project.
† 'Benefit' is estimated supposed that the revenue is a litte added from other portion within the whole revenue of said PDAM.

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 six islands, implementation in two 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.