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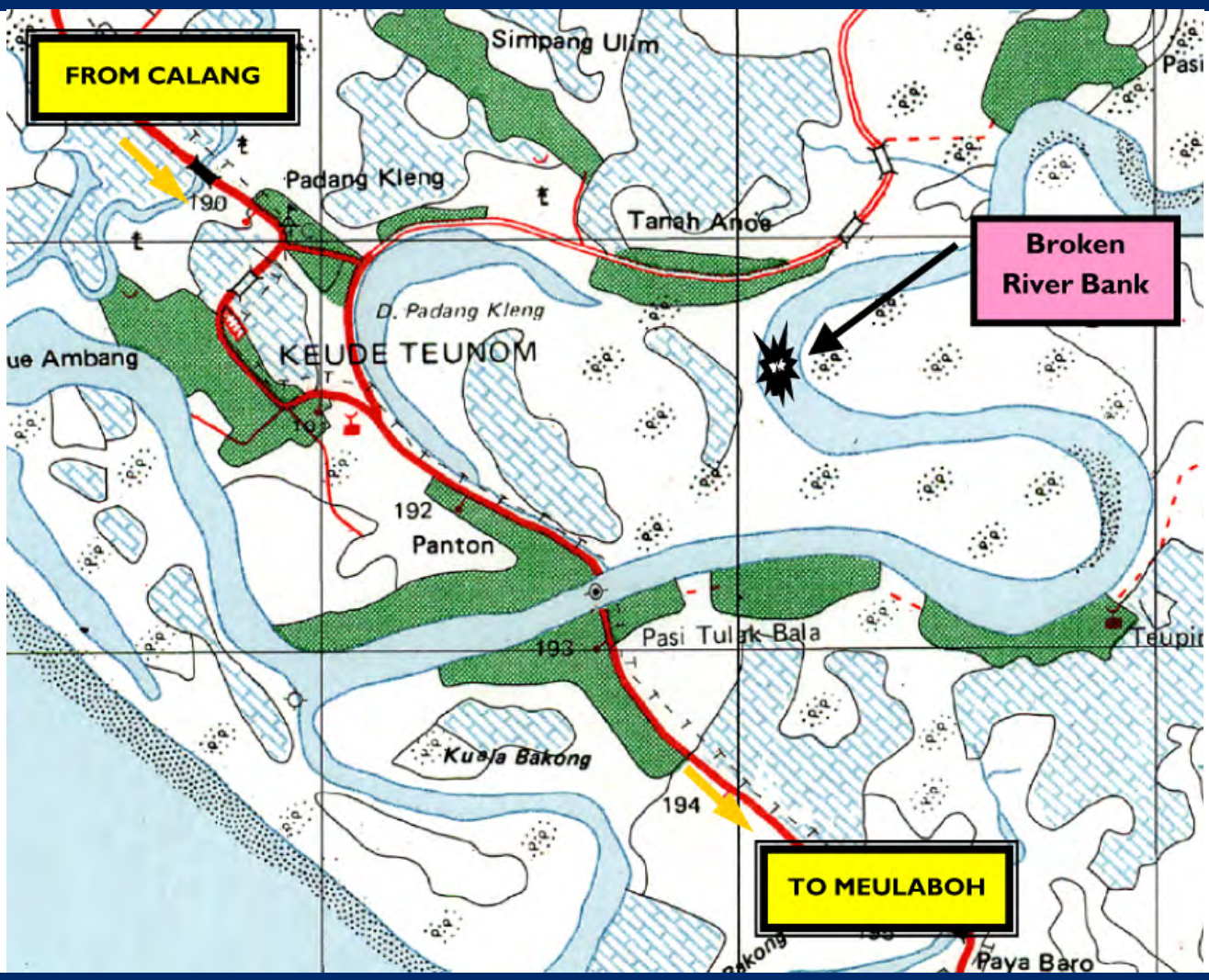
ENVIRONMENTAL ESP SERVICES PROGRAM

INFRASTRUCTURE OUTLINE CONCEPT PLAN: ACEH JAYA DISTRICT

WATER, SANITATION, SOLID WASTE, DRAINAGE



FEBRUARY 2006

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Map Credit: Sher Singh.

Krueng Teunom River Embankment Break.

INFRASTRUCTURE OUTLINE CONCEPT PLAN: KABUPATEN ACEH JAYA

WATER, SANITATION, SOLID WASTE, DRAINAGE

Title:	Infrastructure Outline Concept Plan: Kabupaten Aceh Jaya. Water, Sanitation, Solid Waste, Drainage.
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

Adat	customary law based on local and religious traditions and practices
AMDAL	Analisa Mengenai Dampak Lingkungan (Environmental Impact Review)
BAPPEDA	Badan Perencanaan Pembangunan Daerah (Regional Planning Board)
BAPPENAS	Badan Perencanaan Pembangunan Nasional (National Development Planning Agency)
BRR	Badan Rehabilitasi dan Rekonstruksi (Rehabilitation and Reconstruction Board)
Bupati	Head of Kabupaten (District)
Camat	Head of Kecamatan (Sub-District)
DED	Detailed Engineering Design
Desa	Village
Dinas Kebersihan	Sanitation Department
DPRD	Dewan Perwakilan Rakyat Daerah
FS	Feasibility Studies
GAM	Gerakan Aceh Merdeka (Free Aceh Movement)
GOI	Government of Indonesia
HDPE	High Density Poly Ethylene (Technical name is PE-100)
HIPAM	Himpunan Pengelola Air Minum (Community Managed Water System) also known as OPAM (Organisasi Pengguna Air Minum)
IKK	Ibu Kota Kecamatan; Principal town, often the capital
IMB	Izin Mendirikan Bangunan (Building Permit)
IPLT	Instalasi Pengolahan Lumpur Tinja (Septage Treatment Plant)
Kabupaten	District; administrative subdivision of a Province
Kecamatan	administrative subdivision of a Kabupaten (sub-district)
km	Kilometer = 1000 meters = 0.6 mile
Kr.	Krueng (river)
L/c/d	Liter per Capita per Day
L/s	Liters per second

m	meter = 1000 millimeters (mm)
m^3	cubic meters = 1000 Liters
MIIP	Market Infrastructure Improvement Program
msl	Mean Sea Level
Mukim	Aceh Province administrative unit between Kecamatan and Desa
NAD	Nanggroe Aceh Darussalam (official name of Aceh Province)
NGO	Non-Government Organization
O&M	Operations and Maintenance
PDAM	Perusahan Daerah Air Minum (authority responsible for drinking water supply)
PED	Preliminary Engineering Design
PU	Pekerjaan Umum (Department of Public Works)
Rp	Rupiah (currency of Indonesia)
TOR	Terms of Reference
TPA	Tempat Pembuangan Sampah Akhir (Solid Waste Final Disposal Site)
TPS	Tempat Pembuangan Sementara (Transfer Station)
Wilayah	Region

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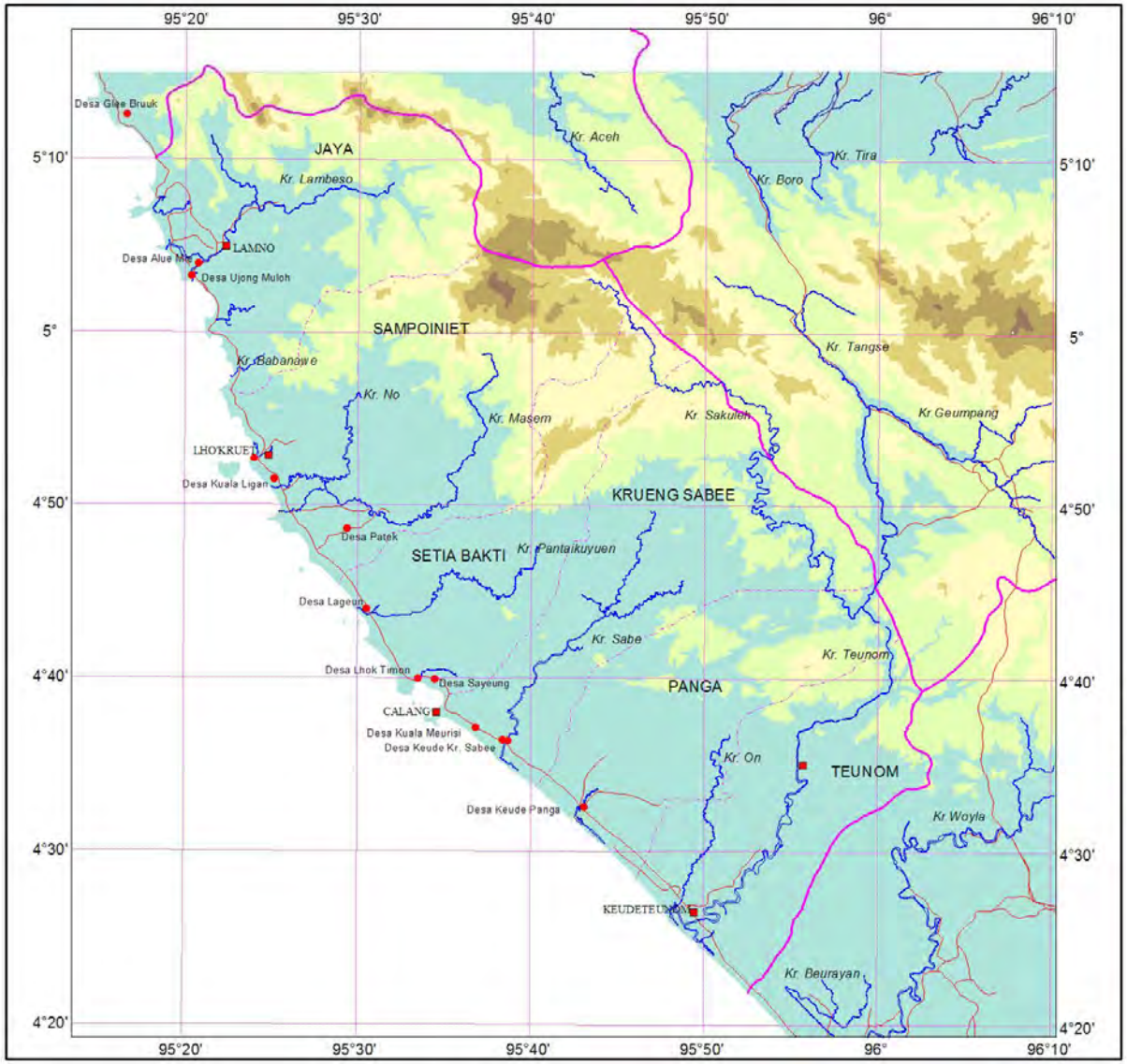

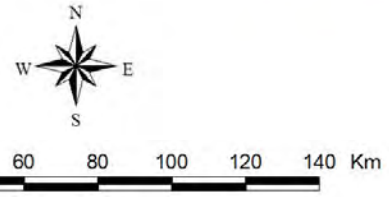

- Village
- Town
- River
- Road
- Sub District Boundary
- District Boundary

Elevasi

- 0 - 400
- 400 - 800
- 800 - 1200
- 1200 - 1600
- 1600 - 2000
- 2000 - 2400
- 2400 - 2800
- 2800 - 3025

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WGS 84 zone 46N

Map Resource :
Map Scale 1: 50.000
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Kabupaten Aceh Jaya

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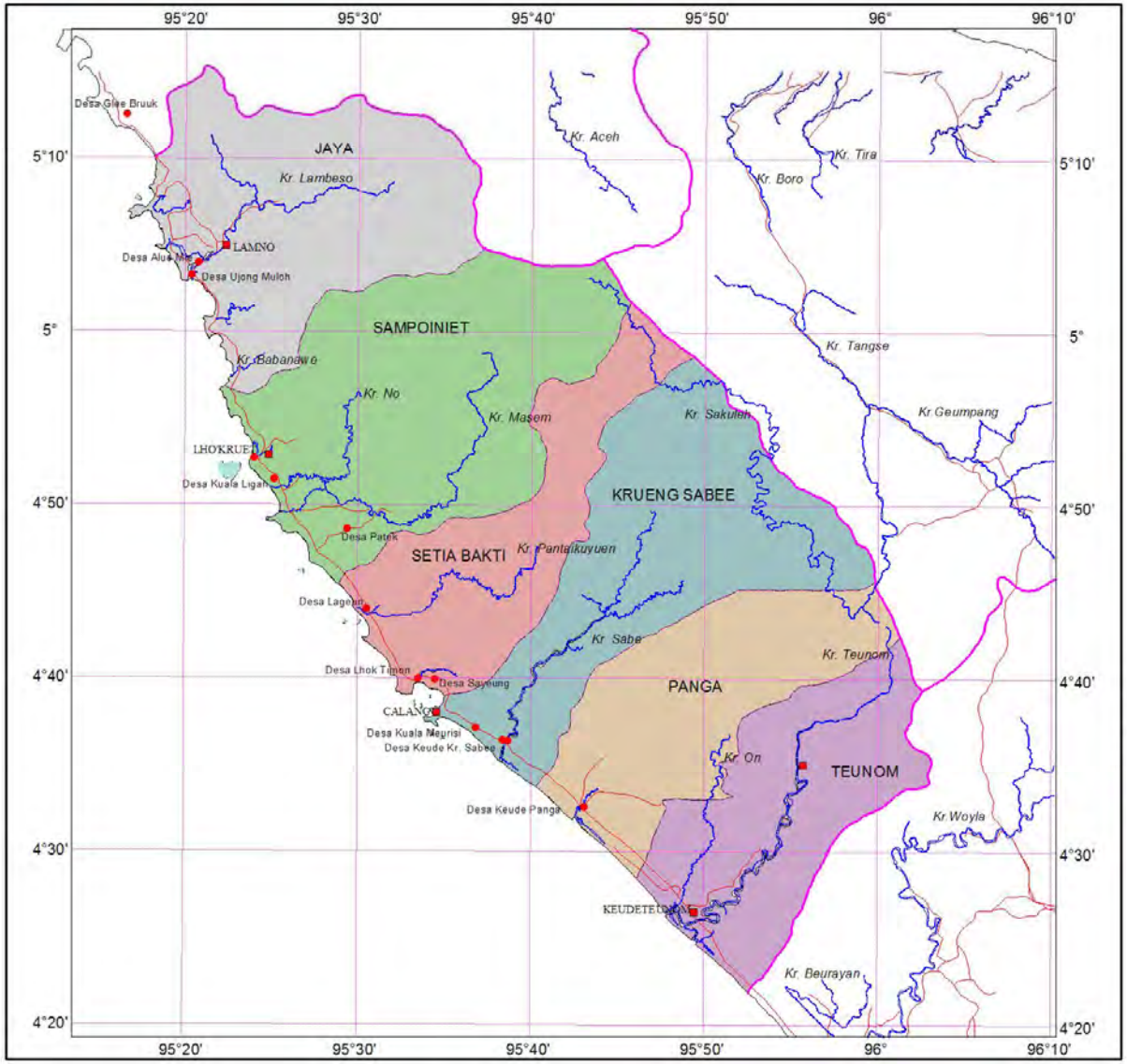

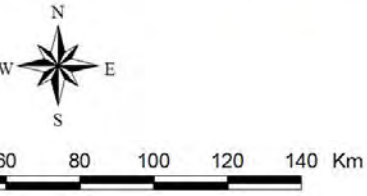

- Village
- Town
- River
- Road
- Sub District Boundary
- District Boundary
- JAYA
- KRUENG SABEE
- PANGA
- SAMPOINIET
- SETIA BAKTI
- TEUNOM

Map Projection :
WGS 84 zone 46N

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EXECUTIVE SUMMARY

The objective of this report is to describe the current status of water supply, sanitation, solid waste, and drainage infrastructure and services in Kabupaten Aceh Jaya, identify infrastructure needed to provide planned levels of service; and recommend infrastructure improvements during the period 2006 to 2010.

This report focuses on permanent infrastructure supporting permanent housing. It analyzes and forecasts at Kecamatan (sub-district) level because:
it is easier to get data and to analyze than Desa---there are 6 Kecamatan but 173 Gampong (Desa) in the Kabupaten
this level of government can coordinate among the Desa for use of limited resources such as waste collection vehicles
this level of government has responsibility for markets (major source of solid waste) and for maintenance of micro-drainage.

The chapters for each infrastructure sector start with a description of current activities; discuss methods, concepts, and strategies for providing service; and propose Outline Plans for the design and construction of facilities.

This report can be used to:
Plan and budget infrastructure for the period 2006 to 2010
Learn about the Kabupaten and institutions involved in infrastructure
Serve as a model for forecasting infrastructure services at other locations.

Data in the report comes from site visits, interviews, and reports collected by the ESP-Aceh Needs Assessment Team which arrived in Banda Aceh on 17 November 2005. To estimate quantities standard values and assumptions were used which should be verified through field measurements.

Activities continue at a fast pace and new programs begin, so this report is only a snapshot at a particular point in time. It must be updated. In particular, changes in population need to be monitored to determine if the proposed infrastructure should be implemented sooner or should be delayed.

Following is a summary of chapters in this report:
Chapter I "Introduction" states the purpose of the report; shows its relationship in the process of moving from Plan to Structure; and describes the methodology of research and analysis used to prepare this report.

Chapter II "Location, Geography, and Kecamatans (Sub-Districts)" provides details about the geography of the Kabupaten, land area of the six kecamatans (sub-districts), and the population density (number of residents per square kilometer).

Chapter III: "Earthquake and Tsunami Impacts" Part A describes conditions before the earthquake and tsunami that occurred on 26 December 2004 and the death and damage it caused. Part B presents data about Internally Displaced People (IDP). Part C discusses impact of GAM conflict on areas.

Chapter IV: "Government Institutions and Aceh Adat Organizations" starts with a description of local government. Part A explains Mukim and Gampong, legal community units unique to Aceh. Part B describes the Badan Rehabilitasi dan Rekonstruksi (BRR), the agency responsible for rehabilitation and repair in areas damaged by the earthquake and tsunami.

Chapter V "Level of Service Targets" Part A lists the standards from the Aceh Province Building Code for providing residential housing with water supply, sanitation, and solid waste and Part B lists BRR's goals for infrastructure services, for example 80% of urban population receiving water 24 hours a day, 7 days a week at pressure 7.5 meters.

Chapter VI "NGO and Donor Activities---WATSAN and Shelter" attempts to list shelter, water, and sanitation infrastructure activities by NGOs and donors in the 6 Kecamatans. In addition there are non-site specific donor financed projects such as USAID's Environmental Services Program and ADB's Community Water Services and Health Project. NGOs and Donors are supposed to provide BRR details and timelines through a "Project Concept Note" and to sign a Memorandum of Understanding (MOU) with the relevant Indonesian agency.

Chapter VII "Expected Development and Growth" describes Kabupaten plans for Kota Baru Calang and a new harbor and some details about the Banda Aceh-Muelaboh Road. Since there is no Spatial Plan for the Kabupaten this Report makes assumptions about future development and growth.

Chapter VIII "Population Projections" reports Year 2005 population data and projects population for the years 2006 to 2010. The reason for estimating population at Kecamatan level is that infrastructure services are geographic, so it is important to know the location of the demand.

Chapter IX "Water Infrastructure, Sources, and Demands", Part A presents details about the current situatoiin for water supply. Aceh Jaya has never had a PDAM; the pre-tsunami water supply systems for Lamno, Calang, and Teunom were IKK. Part B discusses water quality and suggests that NGOs could be a useful source of data since they analyze samples where they provide water. Part C lists water sources (rivers and springs) in each Kecamatan. Part D forecasts water demand for years 2006—2010 and recommends sizes for water supply for 2008 and 2010. Part D presents the water supply strategy which includes use of gravity systems; slow sand filters; and HDPE pipelines. Part E describes Future Water Supply Infrastructure for Kecamatans Jaya, Sampoiniet, Calang, and Teunom.

Chapter X "Sanitation (Human Waste) Infrastructure", Part A explains there is no organized wastewater collection, treatment, or disposal in the Kabupaten. NGOs are installing septic tanks in housing they construct so septage collection and treatment will be needed. Part B discusses aspects of septage collection and treatment at IPLT facilities. Part C estimates septage production in year 2010 and recommends IPLT, to be co-located with the solid waste disposal site, to serve Kecamatans, and to continue pilot studies to develop alternative methods wastewater treatment and disposal.

Chapter XI "Solid Waste Infrastructure", Part A explains that in the Kabupaten each community manages its own solid waste collection from residential housing. Disposal is by burying, burning, or dumping into a nearby river or the ocean. Part B estimates solid waste production for the period 2006 to 2010 and recommends developing a final disposal site (TPA) in each Kecamatan. Part C discusses Private Sector Participation (PSP) possibilites in

the Solid Waste Sector. Part D presents the strategy for solid waste facilities and services. Part E discusses future facilities for transfer sites (TPS) and for final disposal sites.

Chapter XII "Drainage Infrastructure", Part A discusses river flooding from Kr. Lambesso, Kr. Sabee, and Kr. Teunom. Part B discusses coastal flooding and protection, including re-development of destroyed mangrove systems. Part C presents issues about rebuilding houses on flood-prone land.

Chapter XIII "Other Infrastructure" discusses (1) roads, (2) fishing industry, and (3) market infrastructure improvement program (MIIP).

Chapter XIV "Institutions to Implement and Manage Infrastructure", Part A discuss possible arrangements for water infrastructure such as HIPAM or IKK Systems. Part B "Sanitation" and Part C "Solid Waste" propose to create new positons in Kecamatan government. Part D, "Drainage" proposes to continue Public Works as responsible for macro drainage; appoint the Kecamatan to enforce requirements of micro-drainage for housing and to develop and maintain Pasar drainage; and to engage the community in the planning, design, and management of local drains.

Chapter XV "Environmental Analysis of Infrastructure Projects" gives details about Government of Indonesia requirements for when an environmental impact assessment (AMDAL) or an Environmental Management and Monitoring Plan (UKL/UPL) are needed.

Chapter XVI " Establishing Priorities" describes the methodology used to prioritize kecamatans for infrastructure development and the results.

Chapter XVII "Proposed Commitments" lists donor funded projects for water supply and drainage and UNDP support for solid waste.

Chapter XVIII "Summary of Infrastructure Needs" lists recommended projects for each sector including indicative cost estimates.

Appendix A lists sources of data for this report that can be used to complete similar studies elsewhere in Propinsi NAD. Appendix B is a list of NGOs and Donors interviewed for this report. Appendix C lists examples of NGO WATSAN activities during the period October 2005 though January 2006.

1. INTRODUCTION

This document describes the current status of water supply, sanitation, solid waste, and drainage infrastructure and services in Kabupaten Aceh Jaya and recommends structures and institutions to provide services during the next five years. Ideally these services, along with electricity, schools, hospitals, and public transport, should be planned before houses are built to ensure communities become viable again. The focus of this document is permanent infrastructure supporting permanent housing; it does not deal with temporary shelter issues.

As shown in the table below, this document is only the first step toward providing the necessary infrastructure.

Table 1: From Plan to Structure

STEP	ACTIVITY	RESULT
1	Land Use Themes	Outline Concept Plan
2	Public Review and Comments	Preliminary Outline Development Plan
3	Engineering Review	Feasibility Study and Environmental Impact Report
4	Analysis of alternatives, impacts and mitigation measures, costs	Recommended Outline Development Plan
5	Scoping Design	Preliminary Engineering Design
6	Specifications and Drawings	Detailed Engineering Design
7	Tender	Contract Award
8	Construction	Structure/Facility
9	Commissioning	Hand-over to Agency (e.g. PDAM)

The reality in the Kabupaten is that developments on the ground----construction of permanent housing; upgrading of water supply facilities; disposal of solid waste---are proceeding. There is no time for multi-year studies. Thus recommendations in this plan range from those that can immediately go to tender (e.g. Detailed Engineering Design is already completed) to those requiring public review and comments (e.g. location of solid waste landfills).

Details in this Outline Plan are based on review of reports; site visits; interviews; analysis and discussion during the period from mid-November 2005 to mid-February 2006.

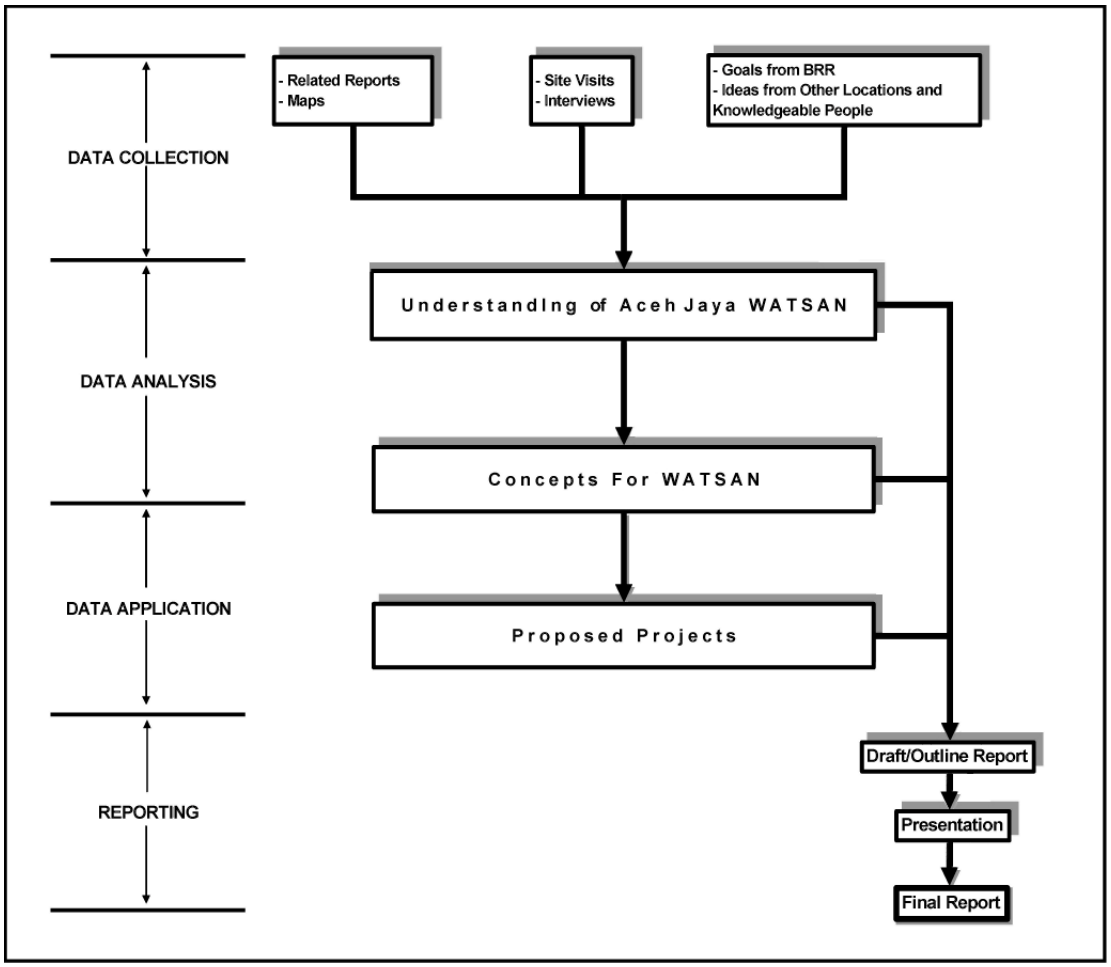


Figure 1: Methodology

Design and Construction are proceeding so quickly in Kabupaten Aceh Jaya that the "current status" described in this Plan is no more than a snapshot at a particular point in time. So it would be appropriate to review this document six (6) months from now to confirm progress and verify projections before proceeding with recommendations beyond the current period.

Data from this Infrastructure Concept Plan can serve as input to Government of Indonesia "Kabupaten Infrastructure Development Support" Program by identifying projects and locations for studies, spatial planning, and detailed engineering design, and local government institutions for capacity building.

Appendix A lists sources of data used for this report.

Finding Number 1: Action on the Ground is Faster Than Formal Planning.
Construction of permanent housing and the public services to support that housing (as well as the Temporary Location Centers) are going faster than formal planning procedures. Thus Development Plans need be in Outline format and updated annually.

2. LOCATION, GEOGRAPHY, AND KECAMATANS (SUB-DISTRICTS)

Kabupaten Aceh Jaya is located between 04°22'-05°16' Longitude (*Lintang Utara*) and 95°02'-96°03' Latitude (*Bujur Timur*). The Kabupaten has a coastline about 135 kilometers (km) long on a northwest-southeast axis and an average west-east width of 30 km. The interior (east) has hills; the west is at sea level. 80% of human settlements and cultivated land is at or below 25 meters elevation.

Figure 2: Map of Kabupaten Aceh Jaya

On the order of 60% to 80% of the population live within 10 kilometers of the coast and along the existing Banda Aceh-Meulaboh Highway which runs the length of the Kabupaten connecting the Ibu Kota of the six kecamatans.

Table 2 lists details about the six Kecamatans (Sub-Districts).

Table 2: Kab. Aceh Jaya Kecamatan Areas, Ibu-Kotas, and Desas

BPS No.	Kecamatan	Area (km^2)	% of Total Area	Ibu Kota	Desa
1116060	Jaya	624	17%	Lamno	48
1116050	Sampoiniet	1011	27%	Lhok Kruet	38
1116040	Setia Bakti	629	17%	Lageun	13
1116030	Krueng Sabee	588	16%	Calang	18
1116020	Panga	307	8%	Keude Panga	19
1116010	Teunom	568	15%	Teunom	37
	Kabupaten	3727	100%		173

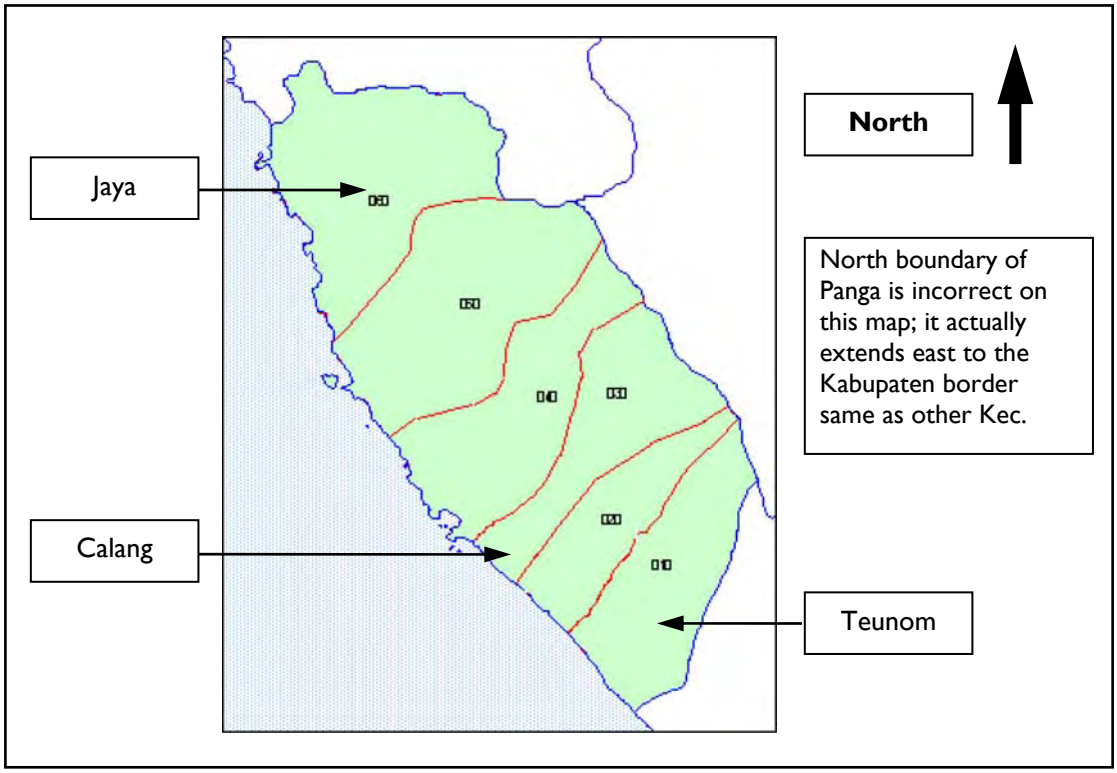


Figure 3: Kecamatans in Kabupaten Aceh Jaya

The Kabupaten can be classified as rural based on low population densities. However dividing population by total land area underestimates the density because 60% of the land is classified as conservation area and thus has no legal settlements. The table below shows the density calculated on entire land area and calculated assuming in each Kecamatan that only 40% of its land area is occupied with human settlements.

Table 3: Kab. Aceh Jaya Year 2005 Population and Density

[after earthquake and Tsunami]

BPS No.	Kecamatan	Land Area (km2)	Population Year 2005	Density (people/km2)	Occupied Land (km2)	Density (people/km2)
1116060	Jaya	624	17,904	29	250	72
1116050	Sampoiniet	1011	10,685	11	400	27
1116040	Setia Bakti	629	5,767	9	250	23
1116030	Krueng Sabee	588	10,244	17	240	43
1116020	Panga	307	4,888	16	120	41
1116010	Teunom	568	14,051	25	230	61
	Total	3,727	63,539	17	1,490	43

Source: Badan Pusat Statistic (BPS) Aceh Barat, 2004 and 2005 *60% of land is conservation area*

3. EARTHQUAKE AND TSUNAMI IMPACTS

Government of Indonesia, Donors, and NGOs have stated their commitment to "Build Back Better" housing, schools, health facilities, and infrastructure. The purpose of this section of the report is to provide qualitative and quantitative data that can be used to establish a baseline for pre-earthquake and tsunami conditions.

The earthquake and tsunami of 26 December 2004 affected the entire Kabupaten from coast line inland up to 6 kilometers. All six sub-districts of the Kabupaten were affected. 24% of the population is dead or missing; 90 of the 173 villages damaged; 60% of schools damaged; 90% of government offices destroyed; about 24% of government staff dead.

3.1. CONDITIONS BEFORE AND AFTER

Prior to the tsunami, almost 90% of Aceh Jaya residents were farmers and fishermen, with the remainder being traders, civil servants and members of security agencies (TNI, POLRI). For Year 2002 about 70% of the Gross Regional Domestic Product for Aceh Jaya (total Rupiah 302 billion) was from Agriculture (Rp 216 billion). With much of the infrastructure, arable land and all fishing infrastructure ruined by the tsunami, the main sources of income have been destroyed.

The following tables summarize data from BPS for 173 villages in the six kecamatan for water supply, sanitation, solid waste, and drainage.

Table 4: Year 2003 Infrastructure Services in Kab Aceh Jaya

WATSAN Condition	Kecamatan in Kabupaten Aceh Jaya						
	Jaya	Sampoiniet	Setia Bakti	Krueng Sabee	Panga	Teunom	Total
Water Supply							
PAM/or Mineral water	2	0	0	0	0	1	3
Pump	0	0	0	0	0	0	0
Well and Spring	43	29	13	9	17	35	146
Others	3	9	0	9	2	1	24
Solid Waste							
Transported to other place	2	2	0	0	0	1	5
Buried or Burned	28	31	9	11	18	23	120
Disposed to river	10	0	3	7	0	0	20
Other	8	5	1	0	1	13	28
Latrine							
Private Latrine	2	2	0	4	1	8	17
Latrine for a group	1	0	1	0	0	2	4
Public Latrine	17	0	0	0	0	2	19
Others	28	36	12	14	18	25	133
Drainage/Sewer							
Flowing normally	4	8	0	5	0	8	25
Bad condition	8	21	2	10	1	7	49
flooded	1	0	0	3	0	2	6
No sewer	35	9	11	0	18	20	93

Source: Badan Pusat Statistik (BPS) Provinsi Nanggroe Aceh Darussalam

Table 5: Details about Water Supply before 26 December 2004

Kecamatan	Village	Water Supply
Teunom	Teunom	5 L/s surface water treatment plant that was NOT operational due to deterioration and neglect
Panga		Individual wells
Krueng Sabee	Calang	20 L/s surface water treatment plant but not yet in service
	Paya Seumanto	1 L/s deep well
Setia Bakti		No information
Sampoiniet	Lhok Kruet	2.5 L/s spring water; gravity system
	Blang Dalam	1 L/s deep well
Jaya	Lamno	5 L/s spring water, gravity system
	Janget	1 L/s deep well

Prior to the earthquake and tsunami it was possible to drive north and south on asphalt roads and bridges. For example from Calang north to Lamno took on average 1.5 hours on asphalt paved road with two-lane steel girder bridges. Now the same trip takes about 6 hours with delays at single-lane bridges, waiting for cars in front to get unstuck from deep, muddy ruts in the dirt road and at Krueng Lambesso with the bridge destroyed crossing the river by a ferry powered by two 40-Hp outboard motors and holding a maximum of four passenger vehicles. From Calang south to Teunom used to take one hour; but now two hours with slow driving on rough, hard packed dirt road and delays at single-lane bridges. Before the earthquake and tsunami driving from Teunom to Meulaboh was a 1 to 2 hour trip but immediately after it took about 16 hours and today about 4 hours.

PLN provided electricity before 26 December. With poles and electric lines knocked down people now use generators, bottled gas, kerosene, and candles.

3.2. INTERNALLY DISPLACED PERSONS

About 19,000 people are classified as Internally Displaced Persons (IDP) and currently living in tents or barracks or with host families. In Calang individual NGOs have assumed responsibility for providing WATSAN services to Temporary Living Centers. Factors in assuring smooth operations[1] are establishing a committee of barracks residents to handle day-to-day matters and to designate a specific individual as "Barracks Liaison".

Table 6: Kab. Aceh Jaya IDP Status October 2005

BPS No.	Kecamatan	Spontaneous Settlement Camp	Host Communities	Temporary Living Center	Early Return	Total
1116060	Jaya	not available				
1116050	Sampoiniet		899		832	1,731
1116040	Setia Bakti		171		3,499	3,670
1116030	Krueng Sabee	427	2,054	778	4,331	7,590
1116020	Panga		27		1,919	1,946
1116010	Teunom	436	197		3,578	4,211
	6	863	3,348	778	14,159	19,148

Source: UNIMIS

[1] Interview and site visit with Gazaly Malek, Program Manager for Canadian Red Cross, Calang

3.3. GOI-GAM CONFLICT

The Kabupaten was impacted by the Free Aceh Movement (Gerakan Aceh Merdeka, GAM) who had been fighting for an independent homeland in Aceh since 1976. On 15 August 2005 the Government of Indonesia and GAM signed a peace Memorandum of Understanding (MOU).

NGOs providing houses to people affected by earthquake and tsunami are sometimes asked to do same for former GAM.
It has been reported that former GAM will be given Rupiah one million per month for the next several years. Thus presence of GAM in a small village can have large, positive economic benefits to that village.

Finding Number 2: Earthquake & Tsunami Damage Extensive.
Earthquake and Tsunami damaged areas in Kabupaten Aceh Jaya are in all six Kecamatans due their location on the west coast. Interior areas of the kecamatans have been impacted by influx of Internally Displaced People. Destruction of the north-south roadway has significantly limited movement of repair materials. Thus infrastructure improvements are going to be 100% replacement of damaged facilities and development of new facilities to support relocated and new communities.

4. GOVERNMENT INSTITUTIONS AND ACEH ADAT ORGANIZATIONS

Kabupaten Aceh Jaya was established in year 2002 from an area that was formerly part of Kabupaten Aceh Barat. Established Kabupaten offices stayed in Meulaboh so the Aceh Jaya District government has never been fully formed, for example there has never been a PDAM or Dinas Kebersihan.

4.1. ADAT ORGANIZATIONS

Government refers to Central, Province, Kabupaten/Kota, Kecamatan, Desa and Kelurahan. This organizational structure is found throughout Indonesia. Community refers to groups of people and in Aceh Province the community is organized into *Mukims* and *Gampongs* which date back to the time when Aceh was an independent Kingdom.

- *Gampong* is a legal community unit; is headed by the Keuchik; and constitutes the lowest administration organization under the direct supervision of the *Mukim*.

- *Mukim* is formed from several *Gampongs*; has boundaries and assets; is led by the *Imeum Mukim*; and is directly under the supervision of the Kecamatan.

The *Mukim* and *Gampong* have legal status and are considered to be key elements implementing a community-oriented and participatory rehabilitation and reconstruction program in Aceh Province. Kabupaten Aceh Jaya is organized into 6 Kecamatans which are further subdivided into 25 Mukim and 173 Gampong (Desa). In this report the term Desa is used because that is the term commonly used by agencies working in Aceh and in databases.

Finding Number 3 Working with the Mukim.
According to NGOs working in the region, the Mukim has been helpful getting agreement and implementing projects. Thus the Mukim could be helpful in developing and implementing Public Awareness and Education campaigns that accompany infrastructure programs.

4.2. BADAN REHABILITASI DAN REKONSTRUKSI (BRR)

BRR was established by Government of Indonesia on April 16 2005, by Regulation in Lieu of a Law (Regulation / Perpu) No. 2/2005 issued by the President of the Republic of Indonesia with the Mission statement: "To restore livelihoods and strengthen communities in Aceh and Nias by designing and implementing a coordinated, community-driven reconstruction and development program with the highest professional standards." BRR

- brings together project proposals;
- facilitates local government and civil society bodies in implementation of projects, capacity-building where needed
- Monitors progress of on-budget and off-budget projects
- does NOT execute or implement projects directly
- does NOT direct donor or NGO activities

The BRR's infrastructure program unit is tasked with the role of coordinating donor support, reviewing proposals, and prioritizing projects.

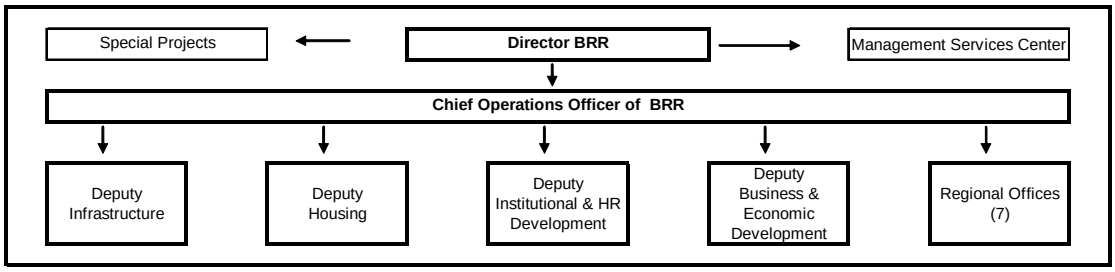


Figure 4: BRR Organization Chart

Water and Sanitation sector is included under the Deputy for Infrastructure. Details about the organization below Deputy are currently under revision.

5. LEVEL OF SERVICE TARGETS

5.1. RESIDENTIAL HOUSING

Reference: Humanitarian Information Center (HIC) for Sumatra: HIC Shelter Data Pack – 30 July 2005 available from web site http://www.humanitarianinfo.org/sumatra/
This document contains Procedures for NGOs to follow informing local government agencies about their shelter project and Building Code Standards for design and construction of housing and provision of services (water, sanitation, electricity, etc.) that are based on Indonesian National Standards (SNI). It includes details about interior water supply piping and storage, wastewater disposal, and garbage disposal.

These standards define the Level of Service government agencies should provide to residential housing for water supply, sanitation, and solid waste.

HIC Shelter Pack 2.2.3 System of Clean Water Supply

- Obtained individually or collectively from Drinking Water Company (PAM), or well, or other sources
- Quantity: 60-250 liter/person/day

  NOTE: This is too wide a range and will lead to over sizing infrastructure. For an individual house, GOI standards are on the order of 120 L/capita/day. For water production facilities it is appropriate to use a higher number to take into consideration the demand of commercial, social, and institutional users. That could be on the order of 50 L/cap/day.

- Duration: available continually.
- Quality: meet the quality requirements for clean water and a drinking water source shall comply with Regulation of Minister of Health of the Republic of Indonesia Number 416/ MENKES/PER/IX/ 1990 and Decision of Minister of Health of the RI Number 907/ MENKES/ VII/ 2002.
- Pipe: PVC, PE, GI, or copper; does not contain toxic substances
- Service Connection (connection between customer and PDAM pipes):
  a. diameter of pipe connection from city's distribution pipe network is established according to the type of building and activity therein;
  b. should be equipped with water meter
  c. made of PVC, PE, GI, or other material which can resist water pressure
  d. provide sufficient quantity and pressure
  e. requires service connections to have back flow prevention valve or vacuum breaker (many Indonesians are likely to consider this expensive and omit but it is particularly important where houses have alternate water sources such as a well due to risk of contaminating the public water supply).

HIC Shelter Pack 2.2.4. Wastewater Disposal System

- Any building which produces wastewater must be provided with wastewater plumbing

- Wastewater containing toxic and hazardous materials may not be combined with (domestic) waste.
- Disposal and Processing of Wastewater in accordance with SNI 03-6379-2000
- All wastewater must be processed before it is disposed of in a city's communal wastewater conduits or carried to communal wastewater processing places if there are any.
- Processing is conducted in a waterproof septic tank and equipped with an absorbing well unless there is a communal wastewater conduit.
- Distance of septic tank and absorption from the source of clean water is 10 meter minimal.
- Site of septic tank might be in the front or back of the house, depending upon the ease of flow from bathroom and taking into account the minimum (separation) distance from clean water sources in the settlement environment.
- For areas with shallow water table (less than 1 m), the septic tank is made higher and absorption is made to flow horizontally.
- Checking for the maintenance of waste water disposal system includes cleaning of sump pit once every six months

HIC Shelter Pack 2.2.6. Garbage Processing System

- Criteria for the amount of garbage from a dwelling house (i.e. residential) are 2.1 L/capita/day, while for non-dwelling house is 24 L/unit/day.
- Containers for organic and inorganic garbage are separated
- If a new building has sufficient area, then the garbage can be buried on the property at a distance of > 10 m from the clean water or drinking water source.
- Scheduling of the collection by institutions managing garbage in settlement areas refer to the SNI 03-3242-1994.
- Frequency of collection: organic garbage is collected once in every two days and inorganic garbage is collected once in every three days

HIC Shelter Pack 2.2.7. Community Sanitation Systems

- Public taps-- serve between 30 L/capita/day and 50 L/capita/day.
- Public MCK (bathing, washing, toilet)---built in the settlements which are not provided with the private bathing/toilet facilities and planning is according to SNI 03-2399-2002
- Waste processing from public MCK is done by using septic tank, with a capacity determined according to the number of MCK users unless communal drainage (i.e. collection system) is available for connection.
- Garbage--Communal containers must be provided in settlements that are difficult to access by transportation and in irregular settlements where walking distances between collection bin and dwellings exceed 100 meters.

5.2. LEVEL OF SERVICE COVERAGE

BRR is setting Level of Service coverage for infrastructure services for reconstruction of settlements:

- Water supply system, transmission and distribution of clean water with the target to cover 80% of urban population 24 hours/day, 7 days/week, at pressure 7.5 meters[2].

[2] BRR presentation at Banda Aceh-Aceh Besar WATSAN Meeting, 16 Jan 06.

- Water supply system to serve 50% rural population by piped water systems with remaining 50% rural population easy access to water (e.g. Public Hydrant)
- Construction of drainage system to cover 100% urban population and 10% rural population
- Development of Solid Waste services (including sanitary land fill) to cover 100% urban and 10% rural population

There is no international definition for "urban" or "rural" population; each country has their own criterion that generally is based on density (number of people per square kilometer). Data from Table 3 indicates that Kabupaten Aceh Jaya is predominantly rural. As discussed later in this report, there are "urban" concentrations around the Ibu Kota of each Kecamatan.

6. NGO AND DONOR ACTIVITIES: WATSAN AND SHELTER

6.1. GENERAL DISCUSSION

Immediately after the earthquake and tsunami of 26 December 2004 foreign governments and relief agencies came to the region to provide emergency assistance that included water, food, temporary shelter, medical care, and supplies of clothing and other items. Tent camps and wooden barracks were established to provide temporary shelter for the Internally Displaced People (IDP). Water was delivered to these camps by tanker truck; septic tanks pumped, trash collected.

During 2005 the Relief Stage transitioned to the Rehabilitation Stage. Non-Governmental Organizations (NGO)[3] and donors such as USAID and World Bank are now organizing and financing construction of housing and rehabilitation of infrastructure such as roads, bridges, water supply, solid waste disposal, schools, hospitals, etc.

The housing construction is at Desa level. Water supply is typically a bored well or a mountain spring piped to the settlement. Sanitation is the typical Indonesian septic tank (see Chapter 10 for details).

NGOs are supposed to agree with the relevant government agency a Memorandum of Understanding (MOU) specifying what the NGO will do. This benefits Government by clearly defining the scope of work and the agency doing it, but some MOUs do not have timelines or deadlines to perform.

Data about exact location and scope of NGO infrastructure activities is often incomplete and out-of-date. Reasons for this include:
difficulties in submitting the data via the internet
confusion about exact location---the NGO knows where it is working but the location may have more than one name or be on the border between two sub-districts.
multiple NGOs in the same location because one or more NGOs are providing shelters while another NGO is providing WATSAN or two or more NGOs are in partnership for the same project
NGOs that have not followed through on earlier promises
competition amongst NGOs.

BRR is responsible for coordinating efforts of NGOs and it is assisted by UNICEF, the donor community coordinator for water and sanitation. Coordination enables recognition of unmet needs or duplication of efforts. Previous efforts at coordination were not successful.

[3] NGO is also referred to as Private Voluntary Organization (PVO) and Government organized NGO's as GO-NoGO.

Now BRR's main coordination tool is a fast-track project approval process in which every agency submits a Project Concept Note[4] detailing the project's plans, location of activities, budgets, and targets, which is then fed into a projects database, the "Recovery Aceh Nias Database", called RAN, established end of October 2005 to track project approval and progress monitoring. Already there are complaints about difficulty of data input, so this database cannot be considered complete at this time.

Donors and NGOs recognize coordination to be a collaborative task, not solely BRR's responsibility, and that participation in meetings and forums is needed to inform others of their programs and activities. Thus UN coordinating agencies (e.g. UNICEF) organize and conduct meetings for NGOs to specifically discuss Shelter and WATSAN activities.

6.2. NGO AND DONOR ACTIVITIES IN KABUPATEN ACEH JAYA

There are 37 NGOs, 10 United Nations agencies and offices, and 5 International Donor organizations doing projects and providing services in Kabupaten Aceh Jaya. At least 24 have some involvement with infrastructure---shelter, water supply, and sanitation. Table 7 lists NGOs and Donors working in these sectors in the Kabupaten.

An exact count of NGOs is not easy to do. For example

- UNHCR is building housing and is negotiating with IRC to do rain water collection system for each house. IRC is negotiating with American Red Cross for funding. So each agency is going to report involvement in the same project.

Danish Red Cross, involved in livelihood projects in Teunom, intends to repair river embankments (drainage project) to protect farmland and houses. They are stating their intention not by BRR Concept Note but by Red Cross report forms. So this data may or may not be in the RAN data base system.

The United Nations established an Office of Recovery Coordinator in Calang last year. This office neither directs nor controls the NGOs; it serves as a central contact point; manages the NGO office-living area; and promotes coordination among the NGOs and between NGOs and the community. In January of this year BRR established the Aceh Jaya Regional Office in Calang.

NGOs are taking the lead to develop water supply for the villages where they are providing housing. For example OXFAM hired an Indonesian Engineering Consultant to design the water system for Lamno; CARDI-IRC developed the water supply for Calang; Action Contre la Faime (ACF) and German Red Cross organized water for Teunom.

As an example of coordination, NGOs in Calang propose to construct, equip, and staff a Water Quality Laboratory. Each NGO would contribute money or materials or staff. USAID through the Environmental Services Project (ESP) will contribute laboratory equipment, reagents, and initial training. To assure sustainability Aceh Jaya NGOs will

[4] Letter Nomor 0021/BRR.3/I/2006 "Prosedur Partisipasi Pembangunan Sektor Air Bersih dan Sanitasi" from BRR dated 05 Jan 2006.

arrange for an Indonesian agency, probably the local Health Department (Dinas Kesihatan) to operate the laboratory and will provide training and support for one year.

The following table lists NGOs reported to be doing Shelter and WATSAN activities in each Kecamatan of the Kabupaten.

Table 7: NGOs Doing Shelter, Water, & Sanitation in Kab. Aceh Jaya

NGO and DONOR in Kab. Aceh Jaya	JAYA	SAMPOINIET	SETIA BAKTI	KRUENG SABEE	PANGA	TEUNOM	Total
Action Contre la Faime (ACF)			Water & San	Water & San	Water & San	Water & San	4
ADRA (temporary housing)						Shelter	1
Agency for Technical Cooperation and Development (ACTED)						Water	1
American Red Cross	Water & San	Water & San	Water & San	Water & San		Water & San	5
British Red Cross						Shelter	1
CAM		Water					1
Canadian Red Cross	Shelter	Shelter	Shelter	Shelter			4
CARITAS Czechia			Shelter				1
German Red Cross				Shelter		Shelter & Water	2
Int. Disaster Emergency Service (IDES)						Shelter	1
International Blue Crescent	Shelter						1
International Medical Corps (IMC)	Water & San	Water & San					2
International Rescue Committee (IRC) [sometimes referred to as CARDI-IRC]		Water & San	Water & San	Water & San	Water & San	Water & San	5
MERLIN		Water & San			Water & San		2
Obor Berkat Indonesia (OBI) with Habitat for Humanity Int. (HfHI)	Shelter	Shelter	Shelter				3
OIKOS Portugal		Shelter					1
Oman Charity Org (OCO)			Shelter				1
OXFAM	Shelter, Water, & San	Shelter, Water, & San	Water & San	Shelter, Water, & San	Water & San	Water & San	6
Palang Merah Indonesia (PMI)	Shelter, Water, & San						1
Samaritan's Purse					Shelter		1
UNDP				Shelter			1
UNHCR				Shelter			1
West-South Humanitarian Relief Center		Shelter, Water, & San	Shelter, Water, & San				2
World Vision	Shelter						1
24	**8**	**10**	**9**	**8**	**5**	**9**	

Donor activities in Kabupaten Aceh Jaya include:

- USAID is organizing rehabilitation of the Banda Aceh—Meulaboh Highway.
- UNDP (Banda Aceh office) has offered assistance for siting, constructing, and operating solid waste disposal sites (TPA).
- Asian Development Bank is funding the "Community Water Services and Health Project" which includes Aceh Jaya. Focus is on rural communities.
- UNICEF will provide WATSAN facility at 45 temporary schools through agreements with NGOs working in the area.

6.3. HOUSING (SHELTER) ACTIVITIES IN KABUPATEN ACEH JAYA

International Disaster Emergency Services (IDES) is constructing 430 "temporary homes" in Teunom [200 complete, 50 in progress] but have requests from Village leaders for 800. Red Cross organizations (British, Canadian, German, and Indonesian) are committed to building

about 6,000 houses; the UN High Commissioner for Refugees (UNHCR) about 3,000; and Samaritan's Purse about 900. This is about 70 % of the 14,000 estimated permanent homes needed in Aceh Jaya.

Table 8: Kab. Aceh Jaya Housing Status—Nov.05

	HOUSING (as of Nov-05)		
Kecamatan	**Needed**	**MOU**	**Not Committed**
Jaya	3,250	1,661	49%
Sampoiniet	2,649	1,300	51%
Setia Bakti	1,950	400	79%
Krueng Sabee	1,460	1,025	30%
Panga	1,416	950	33%
Teunom	3,145	702	78%
6	13,870	6,038	7,832
			56%

Finding Number 4: Future Demands from Current NGO Activities.
NGO provided housing and water supply serves a useful humanitarian purpose but it creates a demand for public works services. Therefore Kabupaten and Kecamatan agencies need to plan now to assure sufficient qualified staff, equipment, and infrastructure to support this housing.

Other activities include:

- Asian Development Bank (ADB) is funding the "Community Water Services and Health Project" which includes Aceh Jaya. Focus is on rural communities.
- Catholic Relief Services is repairing the existing Banda Aceh-Meulaboh Road from Lamno to Calang and Japanese International Cooperation Services (JICS) from Calang to Meulaboh
- International Organization for Migration (IOM) is building schools.
- UNDP (Banda Aceh office) has offered assistance for siting, constructing, and operating solid waste disposal sites (TPA).
- USAID is organizing rehabilitation of the Banda Aceh—Meulaboh Highway
- World Health Organization (WHO) is reported to be donating a pumper truck to de-sludge septic tanks

7. EXPECTED DEVELOPMENT AND GROWTH

With so much death and destruction, the major effort to date has been on recovery and temporary construction. The emphasis is to construct permanent housing with associated infrastructure (water supply, electricity, etc.); provide public services (education; health; religion); re-establish government facilities and services; develop economic and livelihood activities (e.g. fishing, agricultural, trade).

There is currently no development plan for the entire Kabupaten[5]. A Spatial Plan for New Calang has been prepared[6] that lists types and number of buildings, area (square meters), utility (electricity, water, sanitation) demands, roads, number of houses for the period 2009 to 2015. The new Calang (*kota baru*) is planned for a location about 4 kilometers inland from existing and at a higher elevation. The Report discusses locations elsewhere in the Kabupaten and recommends new IbuKotas for 5 of the 6 Kecamatans.

The harbor in Calang is being rebuilt and enlarged to accommodate delivery of construction materials. It would be designated as a Regional Port in accordance with Government of Indonesia Ministry of Transportation Guidelines. There has been discussion about establishing an ice plant in Calang to be used to preserve fish for shipment. This would reduce reliance on Meulaboh and enable direct shipments of fish.

USAID has signed a Memorandum of Understanding (MOU) with GOI Ministry of Public Works (MPW) to reconstruct the road between Banda Aceh and Meulaboh (240 kilometers) to ASEAN Highway Standards (7 meter carriage-way with 2 meter shoulders).

Table 9: Banda Aceh-Meulaboh Road Specifications

Length	240 km
Lanes	2
Pavement Width	7 m
Shoulders	2 to 2.5 m
Width of Right-of-Way	30 m

Construction is estimated at 4 years in two phases. Phase 1 will rehabilitate existing road between Banda Aceh to Lamno (80 km). Phase 2 will extend the road from Lamno to Meulaboh (about 160 km) along a new alignment. In the meantime, Japanese International Cooperation Services (JICS) is rehabilitating the existing road from Calang to Meulaboh (115 km) and Catholic Relief Services (CRS) from Lamno to Calang.

[5] Interview with Bpk Chairul Anwar, Kabid Perencanan, Kab. Aceh Jaya, 081-516352505

[6] Rencana Rihei Tata Ruang Kawasan Kota Calang, prepared by PT. Ciriatama Nusawidya Consult, December 2005.

The exact alignment of the Banda Aceh-Meulaboh Road is not yet settled. According to the Environmental Assessment Report[7] the preferred alternative utilizes most of the original roadway up to Lhok Kruet (Kec. Sampoiniet) at which point a new roadway alignment will be created that is further east from the coast, i.e. inland toward the mountains. Thus there will have to be several west-east roads connecting the coast to the BA-M Road.

Design for the road is being done in the USA and there seems to be reluctance to state the exact alignment because early announcement can make land acquisition more expensive and time consuming. Unfortunately uncertainty about status of the road and lack of visual progress adds to the uncertainty as to how the Kabupaten will develop.

Based on development elsewhere in Indonesia and on government announced plans for the Kabupaten, it seems reasonable to assume that:

Most IDPs are living in their native Kecamatan and will want to return to their original villages as soon as shelter is available.

The majority of population—70% to 80%---is likely to be living and working within 5 to 10 kilometers of the coast and along both the old and the new Banda Aceh—Meulaboh Highway.

The primary employment of people will continue to be fishing and agriculture. Thus trade through the ports and local markets will be important. So there is a need for east-west roads between the Highway and the coast to connect to the ports and to move commodities and supplies such as fish and crops.

Calang will have a large day-time population with people coming to it because of the Kabupaten Offices and the Port.

Each Kecamatan will develop independently from the others in terms of economy and infrastructure.

In the medium term (5-years), infrastructure such as water supply and sanitation will develop on a village or town basis.

Figure 5: Distances between Kecamatan Capitals (IKK)

	NORTH										SOUTH
IKK	Lamno		Lhok Kruet		Lageun		Calang		Keude Panga		Teunom
		23		34		18		22		12	

[7] Environmental Assessment for Proposed Phase II-Banda Aceh to Meulaboh Road Reconstruction and Rehabilitation, US Army Corps of Engineers, Honolulu Eng. Dist. Nov05.

8. POPULATION PROJECTIONS

Year 2005 population data was obtained from the Kabupaten.

Table 10: Kab. Aceh Jaya Population for Year 2005

BPS No.	Kecamatan	pre-tsunami	Yr. 2005 post-tsunami	died
1116060	Jaya	24,279	17,904	26%
1116050	Sampoiniet	13,835	10,685	23%
1116040	Setia Bakti	6,903	5,767	16%
1116030	Krueng Sabee	14,662	10,244	30%
1116020	Panga	6,772	4,888	28%
1116010	Teunom	17,163	14,051	18%
		83,614	63,539	20,075

To estimate the population growth rate population statistics were obtained from historic records for Kabupaten Aceh Barat, from which Kabupaten Aceh Jaya was formed. The table shows that the average population growth over the last 14 years has been approximately two percent per year. The average growth rate for the three years immediately preceding the Tsunami was 2.8%.

Table 11: Kecamatan Historical Population Data

Year	Kecamatan						Total	% Change
	Jaya	Sampoi-niet	Setia Bakti	Krueng Sabee	Panga	Teunom		
1991							74,272	
1992							76,382	+2.8%
1993							79,223	+3.7%
1994							80,141	+1.2%
1995							81,797	+2.1%
1996							82,656	+1.1%
1997	22,220	17,236	10,428	13,748	6,459	21,054	91,145	+10.3%
1998	22,239	17,236	10,355	14,270	6,501	21,189	91,790	+0.7%
1999	22,002	17,178	9,833	14,294	6,564	21,060	90,931	-0.9%
2000	23,015	13,401	7,883	13,895	7,391	21,016	86,601	-5.0%
2001	23,048	13,258	7,978	13,802	7,389	21,007	86,482	-0.1%
2002	23,472	13,532	8,059	14,106	7,514	21,553	88,236	+2.0%
2003	24,903	14,478	8,691	15,007	7,981	22,804	93,864	+6.4%
2004	24,900	14,500	8,700	15,000	8,000	22,800	93,900	+0.0%
							Average	+1.9%

Source: Historic records for Kab. Aceh Barat and Badan Pusat Statistic (BPS), 2004

Fluctuations in annual growth rate were mainly caused by moving transmigrants both in- and out of the area. Applying the average growth rate of 2% at rate to Kabupaten Aceh Jaya gives the following results, indicated by formula below and shown in Table 12

Population Year $_{2010}$ = (Pop. Year$_{2005}$) x (1 + 2%)^5

Table 12: Projected Population for Kab. Aceh Jaya

BPS No.	Kecematan	Yr. 2005	Yr. 2006	Yr. 2007	Yr. 2008	Yr. 2009	Yr. 2010
1116060	Jaya	17,904	18,262	18,627	19,000	19,380	19,767
1116050	Sampoiniet	0,685	10,899	11,117	11,339	11,566	11,797
1116040	Setia Bakti	5,767	5,882	6,000	6,120	6,242	6,367
1116030	Krueng Sabee	10,244	10,449	10,658	10,871	11,088	11,310
1116020	Panga	4,888	4,986	5,085	5,187	5,291	5,397
1116010	Teunom	14,051	14,332	14,619	14,911	15,209	15,513
		63,539	64,810	66,106	67,428	68,777	70,152

source: Year 2005 Badan Statistic, Kab. Aceh Barat

Finding Number 5: Forecast Population for Kecamatans.
Forecasting population based on total District population is useful when the District is a Kotamadya. However for a District such as Kabupaten Aceh Jaya populations are forecast for each Kecamatan because WATSAN infrastructure services will be organized and provided at Kecamatan and Desa level.

9. WATER INFRASTRUCTURE, SOURCES AND DEMAND

9.1. CURRENT SITUATION

Kabupaten Aceh Jaya has never had a PDAM. There were IKK systems in Lamno Calang, and Teunom before the earthquake and tsunami. See
Table 5 for details. Following is a partial list of water supply schemes in progress.

Kecamatan Jaya

In Lamno, OXFAM provided emergency water supply and is funding design of a permanent system. OXFAM activities in water supply include:

- Mon Janeng reticulated water system was in operation. The system employs a reservoir to collect water from the Mon Janeng spring. The water is then pumped through a tank for treatment into 10 public tap stands. The network reaches 597 people in 3 villages.
- Desa Mukhan (257 people) are served from the reticulated water system in the area, which supplies water from a borehole, through a tank to 7 public tap stands in Mukhan.
- Cleaning and rehabilitating existing wells (367 up to June 2005)

Kecamatan Sampoiniet and Kecamatan Setia Bakti

OXFAM provides bore holes and water trucking and storage. Other NGOs assisted rehabilitating the spring water, gravity flow system for Lhok Kruet and for villages in Setia Bakti. MERLIN is organizing Village Water Committees in Setia Bakti and providing public education and hygiene training.

Calang

IRC-Cardi rehabilitated the existing spring to provide water. OXFAM has installed pipes and filters for water supply from a waterfall; dug three boreholes; cleaned over one hundred wells and provided water trucks and storage. Thus about 4,000 to 6,000 people in Calang have water supply. At Ketapang Barracks (TLC with 400 IDPs) IRC installed a water tap from a nearby spring that is filtered via a springbox into a holding tank capacity 45,000 liters[8].

Kecamatan Krueng Sabee

Emergency water supply was provided by Thames Jaya and operated by IRC-Cardi**.** The system (pressure filter treatment) has been moved to another area since OXFAM-IRC began a piped water supply system from a spring source.

[8] IRC Aceh Newsletter, November 2005

Kecamatan Panga

Action Contre la Faim (ACF) has organized water trucking with total volume water deliver 20 m3 per day while IRC-Cardi provide a borehole complete with a pump, electrical generator and elevated tank to serve a group of tents in Kuta Tuha village. Samaritan's Purse has cleaned and rehabilitated wells in Panga.

Kecamatan Teunom

In Teunom German Red Cross (GRC) installed a mini water treatment plant that produces 40 m3 per day (8 hours a day). Half of the water produced is delivered to Teunom through GRC trucking and the other 20 m3 goes to Panga through ACF water trucking. The mini plant treats raw water from Krueng Teunom and produces a treated water of good clarity.

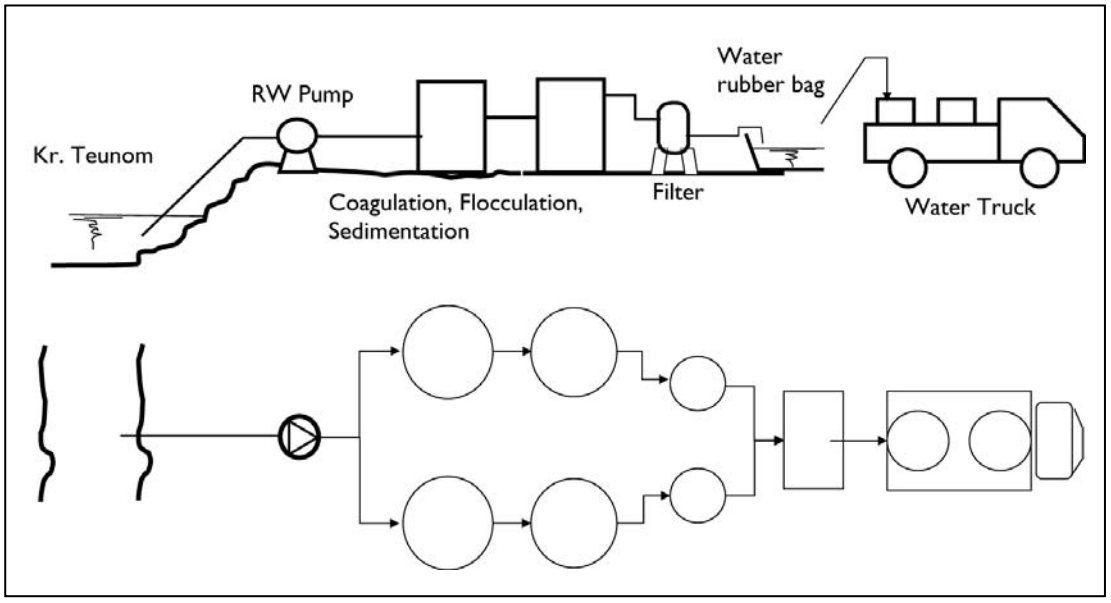


Figure 6: Sketch of German Red Cross Water System in Teunom

Dug Wells

In much of Aceh Jaya the principal water sources are dug wells for drinking and either wells or surface water for washing and bathing. The typical well is hand excavated, about 1 meter diameter with a lining of pre-cast concrete rings or brick masonry; with a surrounding wall about 0.8 meter high at the top of the well together with posts, rail, pulley, and bucket and rope system for withdrawing water. There is sometimes a concrete slab constructed around the well ("apron"). Typical depths are 2 to 5 meters with seasonal fluctuations in water availability, most likely due to the annual rainfall pattern.

Water from the wells varies in quality. In many areas there is a salty taste restricting usage to bathing and cleaning. At other locations the water shows high turbidity.

The primary sustainability issue for dug wells is the lack of routine maintenance, particularly upkeep of the well surround, ("apron"), and attention to drainage in the immediate area. Cracking of the well surround can have an adverse effect on the quality of well water because it allows dirt and other wastes to enter the well. Proper drainage is important to maintain a clean and attractive environment around the well and to keep dirty water from penetrating cracks. The routine maintenance costs of dug wells are small; and the work not technically difficult and within the existing capacity of most recipients to undertake.

9.2. WATER QUALITY

Kabupaten Aceh Jaya has rivers, springs, and ground water that can serve as water sources. The advantages of springs as water sources are gravity flow and water quality is usually better than rivers however the disadvantage is uncertain reliability of flow particularly during the dry season.

Large rivers in the Kabupaten include Kr. Lambesso (Kec. Jaya); Kr. Sabee (Kec. Krueng Sabee); Kr. Panga (Kec. Panga); and Kr. Teunom (Kec. Teunom). All are reported to have adequate year-round flow. But close to the ocean the river elevation is low and thus affected by the ocean tides, particularly during the dry season when volume of river flow is reduced. It is likely suitable locations for water out-takes are on the order of one or two kilometers from the ocean. The procedure for actual siting consists of measuring salinity during high tide periods and graphing results (concentration vs. distance from ocean).

Flow in the rivers increases after rainfall but so also does the turbidity due to soil erosion. Thus river water needs some treatment before distribution to municipal customers.

In the coastal areas groundwater can be brackish to saline and was adversely impacted by the tsunami (contaminated with salt water and human wastes). Among the first actions of GOI and NGOs was to clean these wells. However one cleaning is not sufficient and there are reports of salty water in these wells. In locations such as Kecamatan Panga individuals are digging shallow wells two to five meters deep but similar to cleaned wells there are reports of salty tasting water.

The following table lists field measurements for pH and salinity made during a site selection assessment by staff from ESP-Aceh. Measurements for Krueng Lambesso and Krueng Kuala Ligan were at locations close to the ocean.

Table 13: pH and Salinity at Locations Close to the Ocean

Kabupaten	Aceh Jaya	**Date**	mid-January 2006	
Kecamatan	**Desa**	**Source**	**pH**	**Salinity (ppm)**
Jaya	Alue Mie	Kr. Lambesso	7.9	high
	Ujong Muloh	Kr. Lambesso	7.9	high
Sampoiniet	Lho Kruet	shallow well	5	0.09
Sampoiniet	Lho Kruet	shallow well #1	4.2	0.06
Sampoiniet	Lho Kruet	shallow well #2	5.9	0.03
Sampoiniet	Lho Kruet	shallow well #3	6.7	0.06
Sampoiniet	Kuala Ligan	Kr. Kuala Ligan	7.8	3.62
Setia Bakti	Lageun	spring #1	6.8	0.19
Setia Bakti	Lageun	spring #2	4.3	0.13
Setia Bakti	Lageun	spring #3	7.2	0.17
Setia Bakti	Lageun	spring #4	6.8	0.13
Setia Bakti	Lhok Timon	spring	8	0.69
Krueng Sabee	Keude Kr. Sabee	spring	8.4	0.63
Krueng Sabee	Mon Mata	shallow well	7.6	1.2
Krueng Sabee	Kuala Meurisi	shallow well	7.5	0.69
Panga	Keude Panga	shallow well	6.3	3.66
data from ESP-Aceh Watershed Team				

Finding Number 6: Aceh Jaya Water Quality Data.
NGOs in Aceh Jaya analyze water quality for systems they install. Collecting and organizing this data is a quick, inexpensive approach to creating a reference database of Aceh Jaya water quality.

Presence of arsenic in groundwater is mentioned by various international WATSAN and Health specialists, but none can say where or when. If only a rumor it needs to be quashed; if fact it needs to be publicized.

Finding Number 7: Arsenic in the Water.
Is there arsenic in the water in Aceh? If data exists it needs to be confirmed, then publicly announced, prominently posted, and readily accessible. If there are questions or doubts, then organize a specific study with appropriate quality assurance and quality control for sample collection, transport, and analysis in order to convert rumor to fact.

9.3. WATER SOURCES

Table 14: Potential Water Sources in Kab. Aceh Jaya

Targeted Kecamatan	Potential Raw Water Sources	Potential Flow rate (L/s)	Approximate Distance and Elev. from Service Area	Proposed treatment to meet the quality of Clean water
Jaya	Meuden Spring	50 - 100	4 km; elev. +50m	disinfection and possibly simple filtration during rainy season
	Temareum spring (Mon Janeng)	+/- 10	2km; elev. + 40m	
	Meulah Spring	+/- 15	3km; elev. +40m	
Sampoiniet	Alur Buluh spring	2.5	3 km	pH adjustment & Chlorination
	Ulam Puhteubee Spring	2	2,5km	
	Krueng Masen	Adequate to meet long term and short term water demand	0	Mixing, Coagulation, Sedimentation, filtration and disinfection)
	Krueng Kalueng	< 20	4.5 km; elev. + 30 m	disinfection and possibly filtration during rainy season
Setia Bakti	Kr. Rigah	No data,	-	
	4 Springs	No data	2km - 4km	disinfection and possibly filtration during rainy season
Krueng Sabe	Springs	+/- 10	4km, 40 m	disinfection and possibly filtration during rainy season
	Krueng Sabee	Adequate to meet long term and short term water demand	1 km - 2km distance of intake location to avoid salt water intrusion	Mixing,Coagulation, Flocculation, Sedimentation, filtration and disinfection
Panga	Springs	No Data	3km from Alue Tengoh and about 6 km from Keude Panga, elev. + 50m	disinfection and possibly simple filtration during rainy season
Teunom	Kreung Teunom	sufficient to meet long term and short term water demand	0 km	Coagulation, Sedimentation, filtration and disinfection

For villages in Kecamatans Setia Bakti and Panga the most practical water sources are springs that can be developed at various locations. The basic approach is to start with walking uphill with your back to the ocean following the course of a stream to find a suitable location for a spring box. Then install a transmission pipeline using HDPE which is preferable to PVC under these circumstances because it is easier to install and more resistant to ultraviolet light from the sun.

During several months of the year individuals could harvest rainfall using their house roof and gutters to collect and convey rain to a storage container. The collected rainwater could be used for cleaning and bathing. This is appropriate technology anywhere, anytime, but cannot be considered for planning future water supply due to uncertainties about implementation and consistency of rain. MERLIN (UK NGO) is trying to implement rainfall catchment in schools in Aceh Jaya but encountering public resistance due to beliefs that rainwater is impure and complaints about tastes and odors.

Finding Number 8: Use of Rainwater.
Use of rainwater as a water source is not obvious to the people. Thus developing this source requires public education and demonstration projects.

9.4. ESTIMATED WATER DEMAND

This section forecasts for each Kecamatan water demand for the period 2006 to 2010. As discussed below, there is too much uncertainty to project further than five years.

Methodology for Estimating Water Demand

1) For each Kecamatan estimate population by year from 2006 to 2010,
   a. Start with Year 2005 population
   b. Increase by natural growth rate (assume 1.5%)

2) Assume water demand per domestic customer
   a. Start with 100 Liters per person per day (L/c/d)
   b. Add 20% for use by commercial, social, and institutional customers (low % because not so many)
   c. Add 20% for water losses (because these will be new systems)
   d. Use 140 L/c/d

NOTE: for Kab. Aceh Besar a value of 180 L/c/d was used based on PU guidelines for service area 10,000 to 100,000; more developed commercial and social accounts; older systems so higher water loss. The Master Plan for Kota Baru Calang assumed 150 L/c/d & surface coverage of 60%.

3) Assume Service Area Coverage
   a. 75% of the Kecamatan Population is in the Ibu Kota
   b. Service area coverage in year 2008 = 50%; in year 2010 = 80%.

4) Calculate Water Demand

Population x Consumption x % Service Area Coverage

There is no quantitative definition of urban or rural population. As discussed in Section 7 in this report we assume 70% to 80% of the population will be within 5 to 10 kilometers of the coast. Applying these numbers to Year 2010 population results in population densities ranging from 20 to 140 capita/km^2 .

Based on the population densities we used either 100 L/c/d (for more rural Kecamatans) or 140 L/c/d (for more urban Kecamatans) to calculate water demand.

Table 15: Estimated Population Densities and Water Demand Used

population	70%	80%	
from coast	10 km	5 km	
Year 2010 Population Density			
Kecamatan	Density A	Density B	Use L/c/d
Jaya	60	140	140
Sampoiniet	30	50	100
Setia Bakti	20	40	100
Krueng Sabee	40	80	140
Panga	40	80	140
Teunom	60	120	140

Water demand was calculated according to assumptions for:

- Population in the Service Area (75%)
- % Population Served (i.e. Service Area Coverage)
- Water Demand of either 100 L/c/d or 140 L/c/d

Table 16: Estimated Water Demand for Kab. Aceh Jaya

	WATER DEMAND (L/sec)				
Kecamatan	Year 2006	Year 2007	Year 2008	Year 2009	Year 2010
Jaya	7	7	11	12	19
Sampoiniet	3	3	5	5	8
Setia Bakti	2	2	3	3	4
Krueng Sabee	4	4	7	7	11
Panga	2	2	3	3	5
Teunom	5	5	9	9	15
Population in Service Area	75%				
% Population Served	30%		50%		80%
Water Demand (L/c/d)	Lamno; Calang; Panga, Teunom			140	
	Sampoiniet, Setia Bakti			100	

Based on data in Table 15 and rounding up to the nearest 5 L/s, the following sizes for water supply are recommended

Table 17: Recommended Size of Water Supply for Kab. Aceh Jaya

	RECOMMEND L/s		
Kecamatan	2006-2007	2008-2010	Remarks
Jaya	10	20	For Lamno
Sampoiniet	two @ 5	two @ 5	2 different locations
Setia Bakti	0	0	wells and springs
Krueng Sabee	10	15	for Calang
Panga	5	5	wells and springs
Teunom	10	15	For Core area

Population in Kecamatan Setia Bakti is too dispersed to justify construction of a centralized water supply point. A more cost effective approach is to develop several springs in the hills to the east. As will be discussed in the following section, villages in Sampoiniet are dispersed so only two centralized sources are recommended for development.

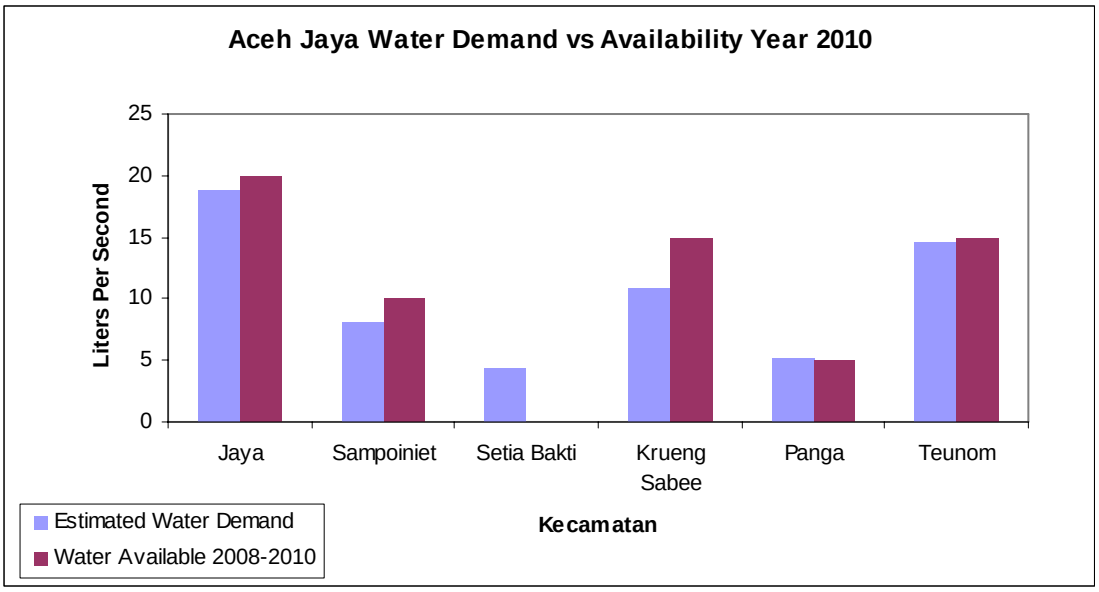


Figure 7: Graph of Water Demand by Kecamatan—Year 2010

The graph shows that installed capacity is close to estimated water demand so that if demand increases at a faster rate there is risk of water shortages. But NO action is recommended at this time because of the uncertainties in making these projections. These uncertainties include:

- Current population
- Population Growth rate
- Migration of IDP into and out of Kecamatan
- Water Demand per person
- Service Area Coverage
- Volume of Water Losses

The best course of action is to accurately measure water production and consumption; make census measurements of population; track construction of new housing during 2006 and 2007; and then if necessary, readjust the water supply construction program.

Finding Number 9: Uncertainties Forecasting Water Demand.
Forecasting Water Demand depends on estimates of population growth, water consumption, and service area coverage. Overestimating results in excess construction and underutilized facilities; underestimating in unsatisfactory service due to water shortages. At the moment there are so many uncertainties in the factors used to estimate demand that a reasonable course of action is to improve data collection and re-evaluate water demand two years from now to determine what further increases in water production might be needed.

9.5. WATER SYSTEM STRATEGY

Use of Groundwater

At the moment many people rely on shallow wells as their water source. Even with the development of piped water supply it is reasonable to assume people will continue to use

water from these wells for cleaning and washing. This would have the effect of reducing water demand from the government provided water supply system.

Gravity vs, Pumped Systems

Operating costs for water supply systems include salaries, electricity, chemicals, and maintenance. Almost always operating costs are lower when the water source is a mountain river or spring because water from these sources flows by gravity (reducing electricity costs) and the water quality is high (reducing chemical costs).

Finding Number 10: Sustainable Water Supply.
Water supply systems requiring pumping and chemical treatment are unlikely to be financially sustainable in Aceh due to insufficient money collected from user payments. Thus, where possible, develop gravity systems and high quality water requiring minimal treatment.

Water Treatment Plants

River water sources generally require chemical treatment only during the wet season when rainfall runoff carries silt and soil into the rivers. Slow Sand Filters are adequate

Bulk Water Meters:

It is important to measure the volume of water entering the distribution system and to compare it to volume of water sold to identify water losses and water consumption patterns. Provision for bulk meter should be a requirement during design and construction of new transmission pipelines.

Non-revenue water is defined as the difference between water produced and water sold. It results from physical losses (e.g. leaking pipes, overflowing reservoirs) and commercial losses (meters that do not work; unauthorized connections). Recovering non-revenue water improves the financial position of the water company but will not increase the quantity of water available unless physical losses from leaking or broken pipes are located and repaired.

Water systems in Aceh Jaya will be new so leakage should be low. It is important to continuously monitor non-revenue water because it impacts costs. Thus the importance of bulk water meters.

Pipe for Water Supply Transmission and Distribution

The material used to make pipes---steel, plastic, cement---is based on application, water pressure, soil condition, cost, and availability. In Aceh Province two pipes commonly used for water supply transmission and distribution are High Density Poly Ethylene (HDPE)[9] and Poly Vinyl Chloride (PVC). Advantages of HDPE compared to PVC are

- More flexible; bends easier; trees and other obstacles are more easily by-passed using PE-pipes.
- Longer operating life [rubber rings of PVC deteriorate causing joints to leak]
- Less joints required for same length of pipe installed
- Sections do not separate during earthquake
- Stronger resistance to ultra-violet light so HDPE does not require protection from the sun thus avoiding expense of constructing overhead cover during storage

[9] HDPE is the common but out-dated name. Technical name is PE-100.

- Smaller diameters of HDPE pipes are delivered on rolls making handling easier
- Not necessary to make prefabricated bends.

HDPE is more expensive than PVC because

(1) HDPE requires special equipment to make the fusion connection ("plastic weld")
(2) HDPE has thicker walls to achieve specifications for nominal pressure class.

Although these two factors increase cost, it is actually advantageous. For potable water pipelines fusion connection is superior to chemical welding that is typically used for PVC because chemicals in the solvent used to make the weld can leach into the water imparting tastes and odors. HDPE as a thicker walled piped is easier than PVC to handle, place, and maintain.

Table 18: Cost Comparison of HDPE and PVC Pipe

Rupiah per Meter to Supply and Install HDPE and PVC Pipe				
Nominal (Interior) Diameter (DN)				
		250	**300**	**350**
Supply	HDPE Class PE100- PN8	456,924	687,420	897,370
	PVC Class S-12.5	323,652	504,681	675,542
	% higher	29%	27%	25%
Install	HDPE Class PE100- PN8	75,595	105,285	132,756
	PVC Class S-12.5	46,226	55,471	64,715
	% higher	39%	47%	51%
Meters of pipe supplied and installed for 1 Million Rp				
	HDPE Class PE100- PN8	1.9	1.3	1.0
	PVC Class S-12.5	2.7	1.8	1.4

Data from Ir. Sudigyo for Year 2005 for Jakarta

Finding Number 11: Use of HDPE Pipe for Water Transmission Lines.
PVC is preferred in Indonesia because it costs less than HDPE. This is false economy. Even though it is more expensive, HDPE is easier to install, is stronger, and lasts longer than PVC. Therefore HDPE should be used rather than PVC for transmission pipelines.

9.6. FUTURE WATER SUPPLY INFRASTRUCTURE

Lamno (Kecamatan Jaya)

The proposed service area for water supply is the town of Lamno, which consists of 7 villages, and 26 villages surrounding. Total area is 235 km2 and estimated year 2005 population is 12,700.

The Consultant that OXFAM has hired to prepare the detailed engineering design estimates year 2010 water demand (domestic and non-domestic) to be 17 L/sec. and proposes the following water sources:

- Spring in the mountain near Meudhen village (capacity 40 to 50 L/sec) for North Zone
- Spring in the mountain (capacity 50 L/sec) for South Zone
- Stream water from the Teumareum Spring for Central Zone
- Two deep wells, each 5 L/sec, for Central West Zone.

Figure 8: Lamno Water Supply Scheme (by OXFAM)

Kecamatan Sampoiniet Water Supply

Two central systems are proposed for 17 of 38 Desa with remainder served by individually developed springs and wells.

- First system serves a new location of three villages: Lhok Kruet, Pulo Raya, and Kuala Ligan.
- Second System has two options to serve several villages. Details are in the table below and in Figure .

Table 19: Sampoiniet Water Supply Schemes

Sampoiniet Water Scheme---Option #1		
Raw Water Source	Krueng Kaleung Masen Water Fall	
WTP	None	
Delivery System	Gravity	
Transmission Pipe (HDPE)	4500 m of diameter 150 mm 18000 m of diameter 100 mm	
Served Villages	Masen	Semantok
	Babah Dua	Ligan
	Gampong Baro	Cot Pange
	Suak Bekah	Rentang
	Krueng Tho	Pajar
	Ujong Rimba	Patek
	Gunung Cut	Blang Dalam
Sampoiniet Water Scheme---Option #2		
Raw Water Source	Krueng Masen	
WTP	Yes	
Delivery System	Pumped	
Transmission Pipe (HDPE)	50 m of diameter 150 mm 18000 m of diameter 100 mm 2500 m of diameter 75 mm	
Served Villages	Same as above but without Desa Masen	

The advantages of option #1 are gravity system and no chemical treatment. The advantage of option #2 is shorter transmission line because the water treatment plant is about 4.5 km closer to the villages being served.

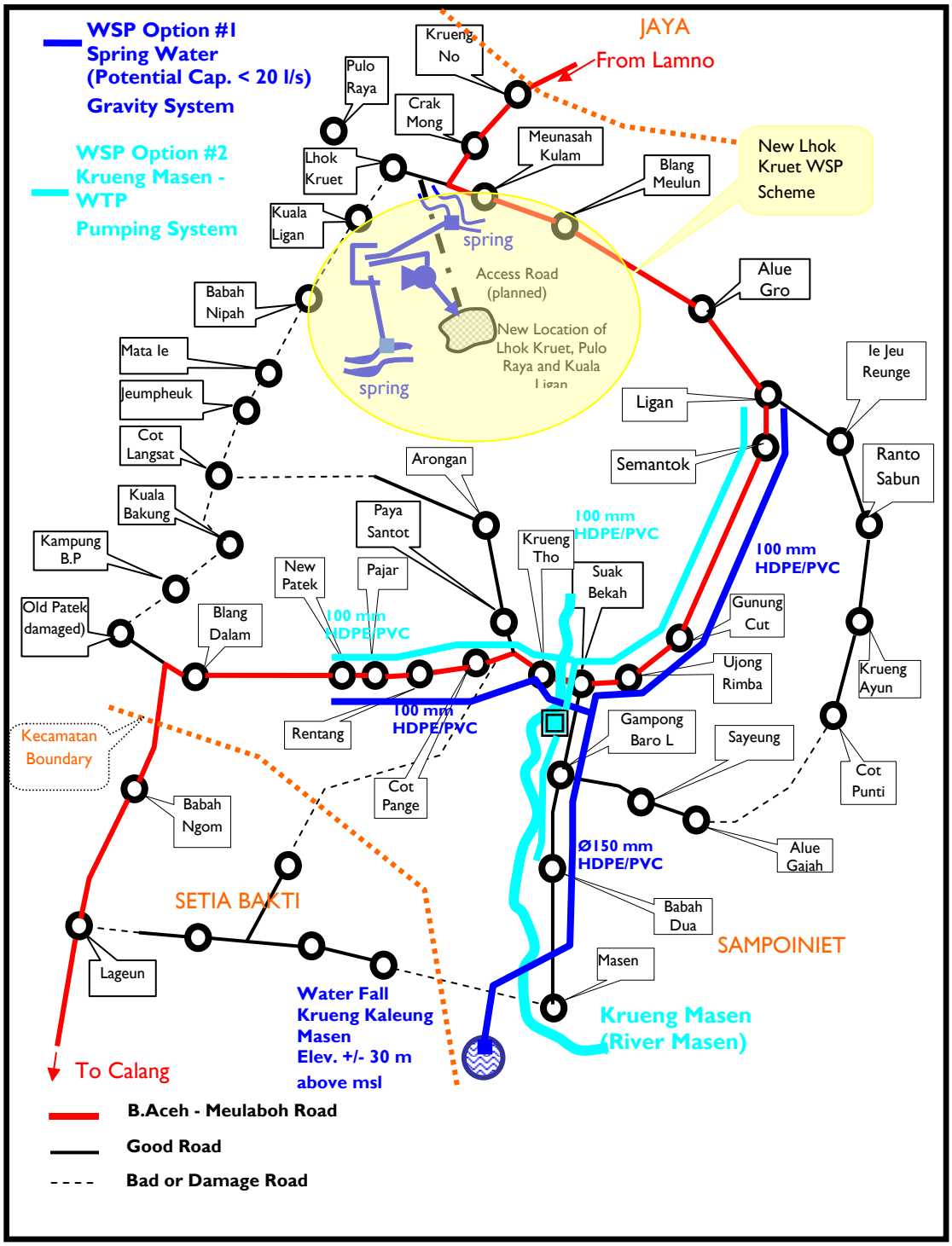


Figure 9: Sampoiniet Water Supply Scheme

Kota Calang Water Supply

There are plans to build a new city about 4 kilometers inland from existing ("old") Calang. So there will have to be either one water supply system serving both or two systems. Following are two options that could do either.

Table 20: Calang Water Supply Schemes

Calang Water Scheme---Option #1		
Raw Water Source	Kr. Lhok Bot as local people name it or Kr. Rigah as appear on the map	
WTP	Two (one at Old Calang and one at Kota Baru)	
Delivery System	Pumping	
Transmission Pipe		
Served Villages	Old Calang	New Calang
	Keutapang	2400 hectares Year 2009 projections 1600 houses; 6400 people Year 2015 projections 1750 houses; 7,100 people
	Kampong Blang	
	Daya Baro	
	Sentosa	
	Bahagia	
	Panton Makmur	
	Lhok Buya	
Calang Water Scheme---Option #2		
Raw Water Source	Krueng Sabee	
WTP	one	
Delivery System	Pumped	
Transmission Pipe		
Served Villages	Same as above	

The advantages of the Option #1 is that the source water is likely to be better quality (further away from housing settlements) and it is at a higher elevation so only low lift pumps would be needed. The advantage of Option #2 is that the Krueng Sabee is a large, reliable water source easily accessible.

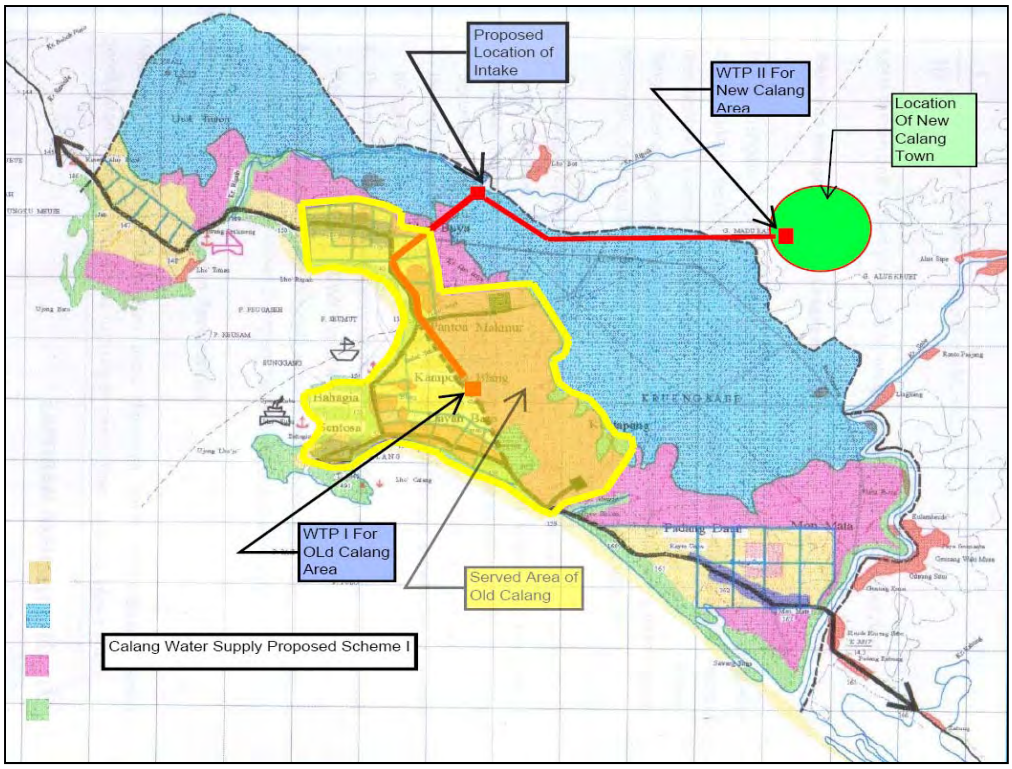


Figure 10: Calang Water Supply from Kr. Bot (Rigah)

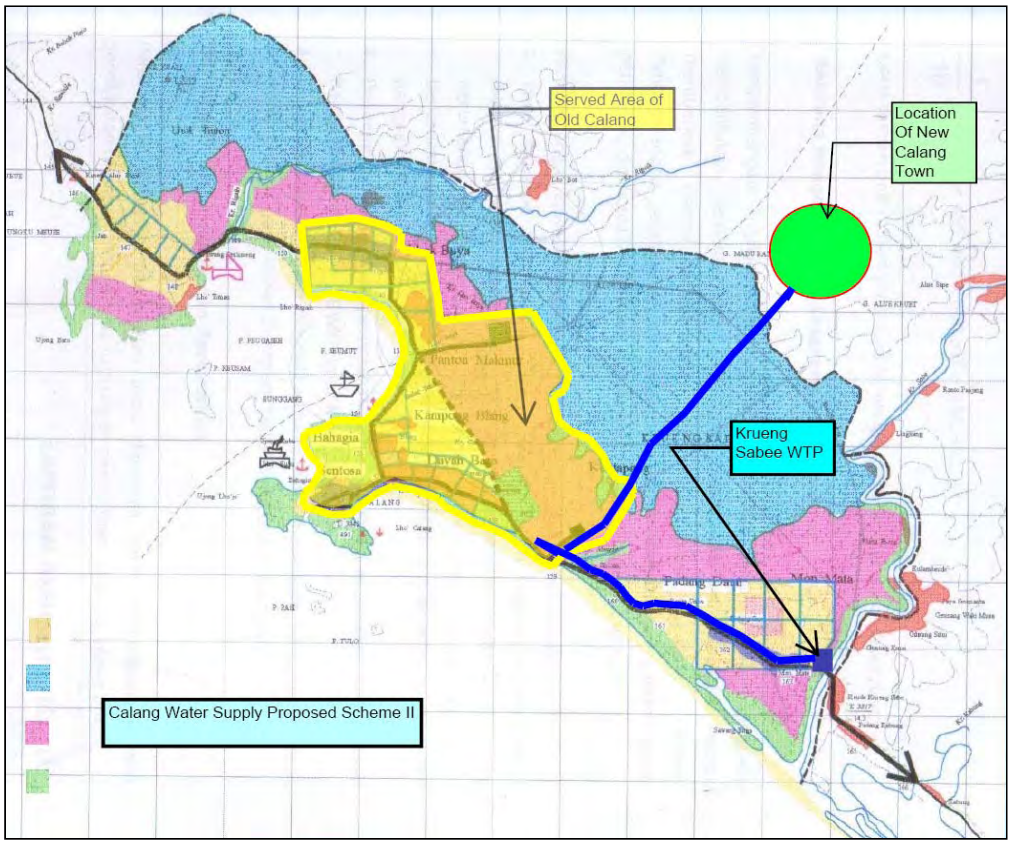


Figure 11: Calang Water Supply from Kr. Sabee

Kecamatan Teunom Water Supply

Table 21: Teunom Water Supply Schemes

Teunom Water Supply Scheme		
Raw Water Source	Krueng Teunom	
WTP	one	
Delivery System	Pumped	
Transmission Pipe		
Served Villages	Same as above	Simpang Ulim
	Padang Kleng	Tano Anoue
	Keude Teunom	Pasi Teubee
	Alue AmbangPanton	Pasi Tulak Bala

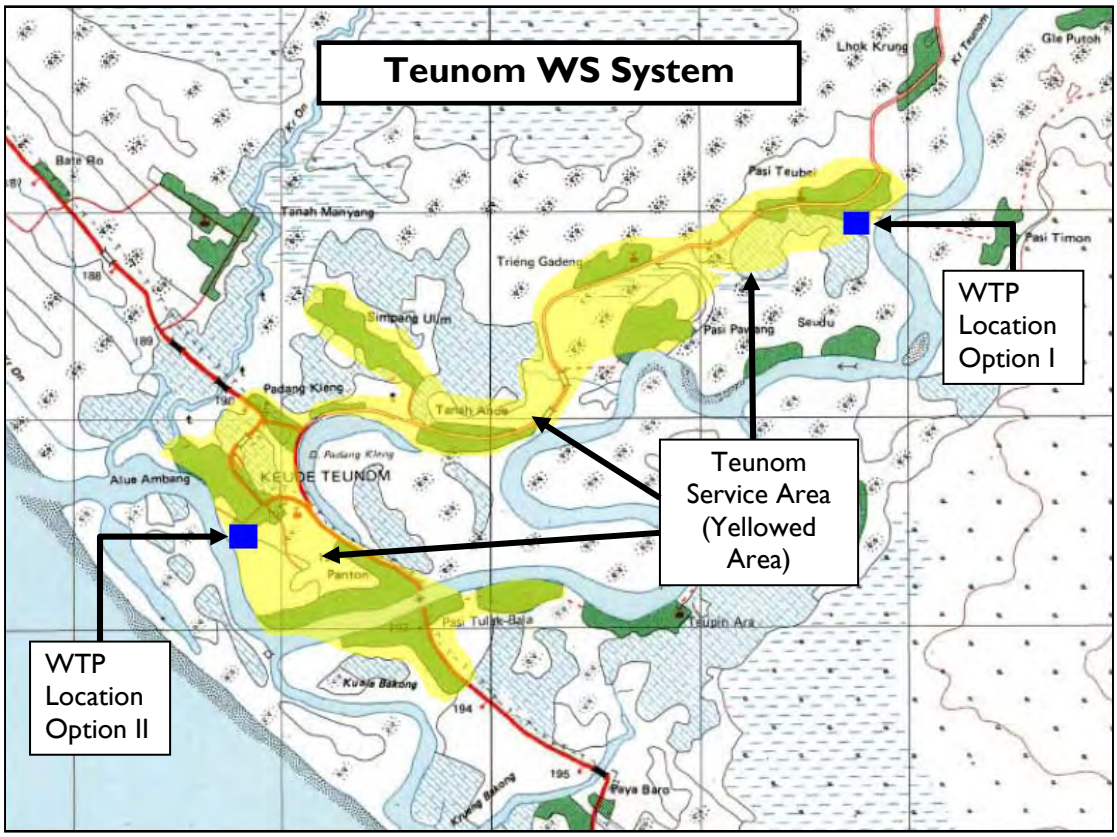


Figure 12: Teunom Water Supply

Summary of Water Supply Capital Improvement Program

- Water Supply Systems for Lamno;17 villages in Samponiet; Calang; and Teunom
- Springs and wells for Individual homes and villages elsewhere

Table 22: Aceh Jaya Water Supply Schemes

Area	Source	Capital Program Components						
		Intake or Spring Capturing	WTP	Reservoir	Pumping	Transmission	Distribution	Remarks
Jaya (Lamno)	Spring	Yes	No	Yes	No	Yes	Yes	Laboratory
Sampoiniet	Spring	Yes	No	Yes		Yes	Yes	individual and village
¦ New Location of Lhok Kruet, Kuala Ligan, Pulo Raya	Spring	Yes	No	Yes	Yes	Yes	Yes	
¦ Sampoiniet Villages along BA-M Road	Spring	Yes	No	No	No	Yes	Yes	
Setia Bakti	Spring	Yes	No	Yes	No	Yes	Yes	individual and village
Krueng Sabee	Spring	Yes	No	Yes	No	Yes	Yes	
Calang (new and old)	River	Yes	Yes	Yes	Yes	Yes	Yes	Laboratory
Panga	Spring	Yes	No	Yes	No	Yes	Yes	individual and village
Teunom	River	Yes	Yes	Yes	Yes	Yes	Yes	Laboratory

OUTLINE PLAN FOR WATER SUPPLY

Year 2006

- Construct first stage of Lamno Water Supply
- Water Source investigations (quantity, quality) for Sampoiniet Water Schemes; Calang, and Teunom Systems
- Field Investigations to locate suitable springs for Setia Bakti and Panga and construction of at least one spring supply system in each to serve as model
- Organize Water Quality Database and publicize

Year 2007

- Continue construction of Lamno Water Supply
- Detailed Engineering Design and Construction for Sampoiniet Water Schemes; Calang, and Teunom Systems
- Continue installation of spring water supply systems to villages in Setia Bakti and Panga

Year 2008--2010

- Evaluate current population and water demand data to determine when water supply systems should be expanded.
- Expand water supply systems as needed
- Continue water quality database

10. SANITATION (HUMAN WASTE) INFRASTRUCTURE

This section is about the collection, treatment, and disposal of human wastes. Hazardous and Industrial wastewaters are not discussed.

10.1. CURRENT SITUATION FOR DISPOSAL OF WASTEWATER

All sanitation in Aceh is on-site, mainly using septic tanks or pit latrines, both in urban and rural areas. For housing and commercial buildings human wastes ("black water") go to a septic tank and water from sinks and baths ("grey water") goes to the drainage system outside. It appears that the relevant GOI Ministerial Decree only specifies separation of these wastewaters; it does not exclude treatment for the grey water.

Guidance for minimum service standards on spatial planning, housing, settlement and public works (including waste water and sanitation):

- Grey water should be separated from black water
- Black water should be discharged into a septic tank with no leaks or odors
- There should be no contamination of ground water
- Removal efficiencies for Biochemical Oxygen Demand (BOD) and Suspended Solids (SS) > 85%
- No complaint on septage treated in sludge treatment plant (IPLT)

On site sanitation should be provided where

- population density ≤ 200 persons/hectare
- with groundwater level > 2 meter
- and potential cost recovery is not sufficient to support full sewerage system (e.g. collection and centralized off-site treatment).

Figure 13: Excerpts from Decree of the Ministry of Settlements and Regional Infrastructure No. 534 / 2001

There are no organized wastewater collection or disposal systems in Kab. Aceh Jaya. NGO and Donor organizations responsible for TLC's organize emptying of communal septic tanks at the camps. Disposal of truck contents is reported to be haphazard, mostly going into the ocean.

Household Toilets and Septic Tanks

The typical toilet is a pour flush squat plate of polypropylene or ceramic in a concrete plinth, with a discharge pipe to a pit or septic tank. The basic design includes a concrete "bak" to store water for flushing and cleansing. The siting of wells and toilets are subject to the NAD Building Coded which specifies specific separation distances (see Chapter 5.5.1. this report) to ensure that water wells were not contaminated by discharge from the septic tanks.

The typical septic tank consists of three concrete rings about 0.8 meter in diameter, 5 cm thick, and 0.3 meter high placed in the ground to form a circular chamber with unsealed bottom (i.e. open to the ground) and a concrete top that can be lifted. Cost of three rings and a top is about Rp 100,000. Installation can be done by unskilled labor. The open bottom allows liquid to pollute the shallow ground water with human wastes. This is a major problem in areas with high ground water. To keep wastes in the tank either a concrete bottom can be used to make the tank bottom water-tight. However the septic tank need to be filled with water to avoid it from floating with high groundwater. If PE liner sacks can be found in Aceh (or Jakarta) they can also be used when the tank is empty the bag floats on the ground water. As the tank fills, the bag sinks, keeping wastes inside.

A better on-site septic system is the one used by the NGO Samaritan's Purse in Kec. Panga, Kab. Aceh Jaya which consists of two tanks:

1) toilet waste enters the first tank which is about 1.5 meter deep (3 rings) with cement bottom, and exit line about 0.5 meter from top.
2) Second tank is about 0.5 meter deep (1 ring) with bottom of coconut or rock, ijuk (palm tree fiber), and charcoal.

Toilet waste flows into a tank with sealed bottom; solids stay in the first tank and liquid flows to a second tank. There it can be mixed with grey water before discharge to a sewer-drain.

Samaritan's Purse uses concrete rings 0.8 meter in diameter, 5 cm thick, and 0.5 meter in height. This is about 0.2 to 0.3 meters higher than rings commonly used in Kabupaten Aceh Besar and illustrates the misunderstanding that can occur when systems are specified or described according to "number of concrete rings". Others are doing similar installations including OXFAM in houses it constructs and the USAID-ESP project for a wastewater pilot study it is conducting.

A Community based piped wastewater collection system leading to a decentralized wastewater treatment plant is the preferred method in (peri-) urban areas because it is more economical than individual systems and provides better public health protection. Examples can be found in different locations in Indonesia, built by BORDA (Local NGO based in Yogyakarta) or in Kabupaten Bandung, another Indonesian NGO, Warga Peduli Lingkungan recently worked with local communities to install a piped wastewater collection system leading to a communal septic tank that discharges to a nearby river.

Benefits include a significant reduction in the number of wastewater discharge points and some treatment of wastewater before discharge.

Finding Number 12: Sanitation Needs Improvement.
Design and construction of sanitary wastewater collection, treatment, and disposal systems and the development and strengthening of utility institutions is a major unsatisfied need in the water supply environmental infrastructure sector. Resolving this requires Province and National support.

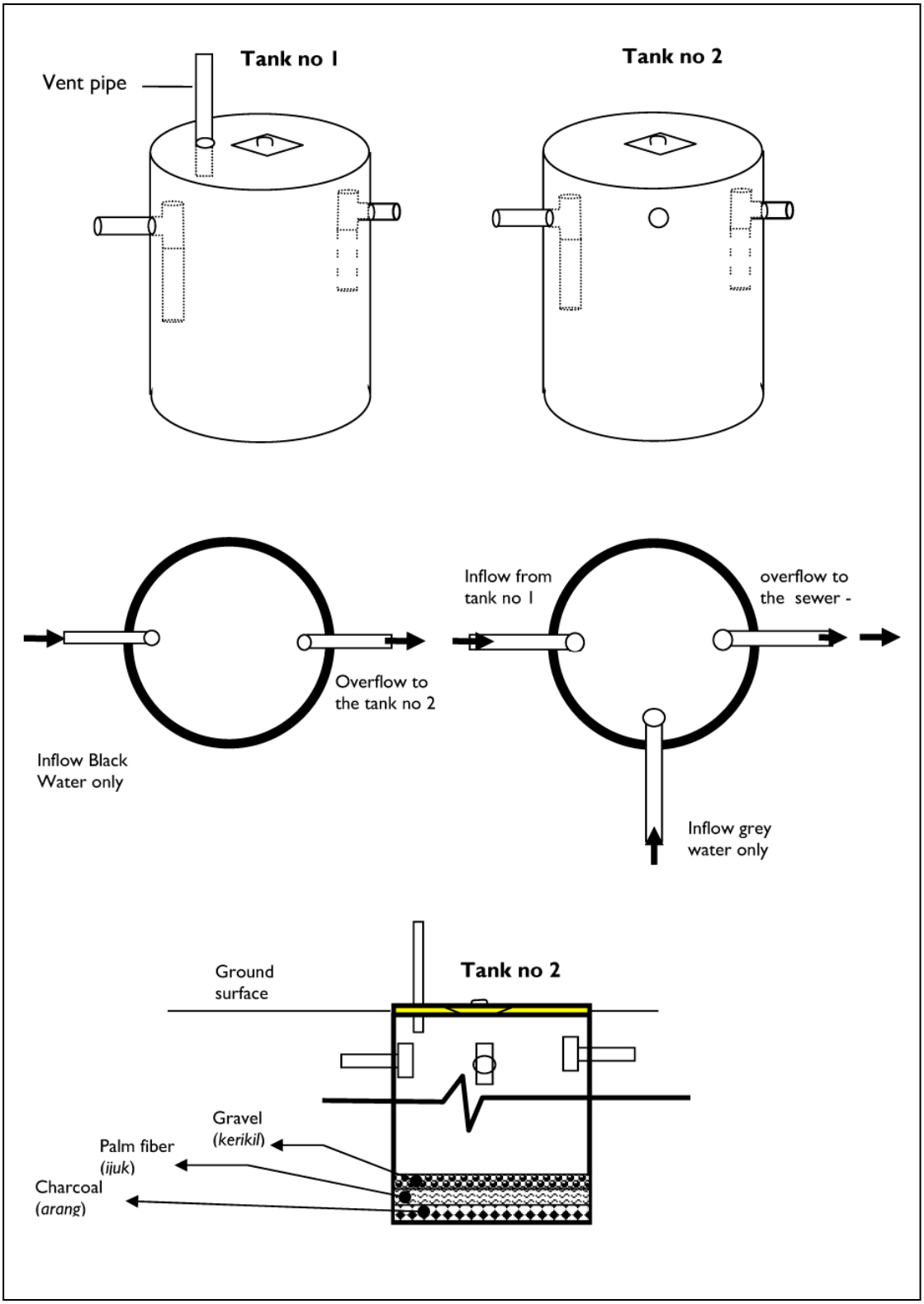


Figure 6: Typical Two Tanks Septic System

10.2. SEPTAGE COLLECTION AND TREATMENT

Periodically septic tanks need emptying. Septage is the liquid and solid material pumped from a septic tank or cesspool when it is cleaned. Pumping is not always complete because the suction pump for sludge is not strong enough to empty the thick solids that accumulate at the bottom of a septic tank. The problem is worsened with the need to use long hoses to access septic tanks in housing areas with high density of buildings. Thick, stiff sludge at tank bottom needs to be mechanically stirred before it can be sucked up into the truck. This is difficult, dirty work so truck operators are not motivated to do it. Possible approaches to upgrading performance are:
train operators and provide protective equipment (gloves, boots, goggles)
inform the public the necessary steps for complete, effective tank cleaning[10].

The purpose of treatment is to "stabilize" the septage to reduce pathogens and odors, thus making it easier to handle and dispose. Methods for treatment and disposal of septage are:

1. land treatment and disposal
2. co-treatment at existing wastewater treatment facilities
3. independent facilities for treatment and disposal.

Land application is relatively simple, generally the most economic disposal technique, and utilizes the nutrient value of septage. It is useful for land that is damaged by mining or fire or otherwise impoverished of nutrients and vegetation. Three techniques of land disposal are (1) surface spreading, (2) burial, and (3) subsurface injection. Most of the organic and inorganic chemicals and pathogens remain in the upper 10 to 25 centimeters of soil.

Land application can adversely impact ground and surface water. Typical guidelines are minimum distance to groundwater of 1 to 2 meters and minimum distance to surface water (lake, river, stream) of 100 meters.

For surface spreading the truck goes to a designated location and dumps its load while driving to spread the septage into a thin layer on the ground. Sun, wind, and gravity will eventually remove the water, but it is best practice to mix the septage into the soil using for example the agricultural disc-harrow machine that farmers use to plough their fields. Assuming a truck with volume of 4 cubic meters spreading septage to thickness 5 cm, the area required would be 80 m^2.

Co-treatment of septage and wastewater can not now be done in Aceh because there are no wastewater treatment plants. When WWTP are built, provisions to receive septage should be included, i.e. a holding tank that allows a slow, continuous addition at a location upstream of the treatment plant headworks at a rate proportional to the plant inflow. Adding at this point enables the septage to pass through the grit removal system and to become diluted with wastewater influent as it enters.

Common in Indonesia are IPLT (Instalasi Pengolahan Limbah Tinja). Septage is collected by a pumper truck, transported to the IPLT, and processed through a series of lagoons. Liquid effluent is discharged to a nearby water drainage channel and the thicker solids portion put onto sludge drying beds. After drying to a consistency where it can be moved by a shovel,

[10] Dominique Maison & Herlina Sjaifuddin, "Who Report Of Mission To Aceh Singkil", Sep 05.

the solids are removed and disposed. Drying time is a function of drainage and evaporation, and can range from 2 to 4 weeks. These solids can be applied to land.

Typical components of IPLT are[11]:

1. Entrance gate and driveway
2. Ramp and Platform (for the truck to empty the sludge)
3. Stabilization Ponds to reduce suspended solids and BOD
4. Sludge Drying Beds (to remove water from the sludge)

At the IPLT the liquid waste flows in sequence through three different types of ponds: anaerobic→ facultative → maturation. Operating in series provides a larger removal of BOD and coliform reduction. Typical design: 1 anaerobic pond, 2 aerobic ponds (in parallel so one can be taken out of service for solids removal) and 2 maturation ponds (connected in series to get a better quality effluent).

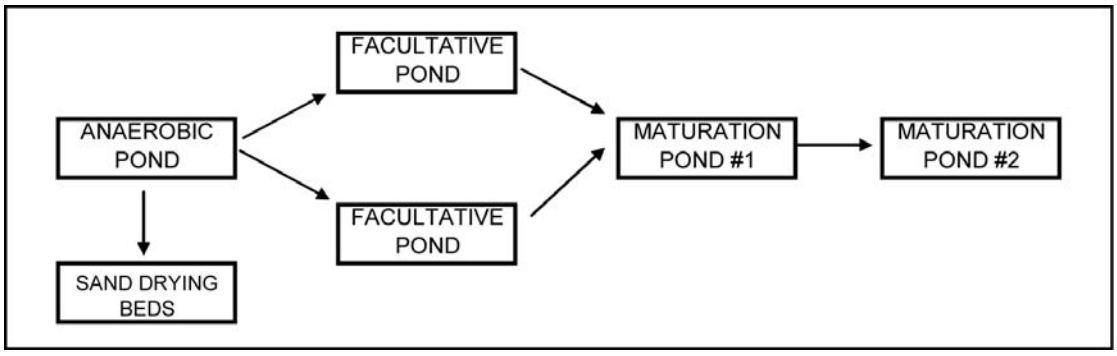


Figure 7: Flow Scheme for IPLT Stabilization Ponds

Maturation ponds in series are not necessary where the IPLT discharges directly to the ocean. Note that ocean discharge should be at a location that does not affect beaches or aquaculture but does get vigorous mixing from ocean currents.

10.3. FUTURE FACILITIES FOR SANITATION

To calculate the size of a septic tank it is appropriate to use a value of 40 Liters/person/year faecal sludge[12] production, but to determine the capacity of an IPLT a better approach is to estimate the volume of septic tanks emptied.

The quantity of septage is calculated as follows:

Number of houses	= (population / people per house)
m^3 / year septage	= (houses x septic tank volume)
Collected per week	= (m3 / year) x (% houses with septic tanks) x (% emptied per year) / working weeks per year

[11] IPLT in West Java start with Imhoff Cone but it is not necessary.

[12] World Health Organization (WHO) guideline is 100 L/capita/day for an adult weighing 70 kg and eating an average diet. Thus it is reasonable to assume 40 L/capita/day for Indonesia.

Assumptions:

People per House	5	
Septic Tank Volume (m3)	0.8	[0.8 m diameter, 1.5 m deep]
% houses with septic tanks	80%	
% septic tanks emptied per year	50%	
working weeks per year =	50	

Estimated quantities of septage for Year 2010 are shown in Table 23.

Table 23: Estimated Septage Production Year 2010

		Year 2010				
No.	Kecamatan	Number of Houses	Septic Tanks Emptied Per Year	Septic Tanks Emptied Per Week	Septage (m3/week)	Truck Loads Per Week
1	Jaya	3900	1560	31	25	6
2	Sampoiniet	2300	920	18	15	4
3	Setia Bakti	1200	480	10	8	2
4	Krueng Sabee	2200	880	18	14	4
5	Panga	1100	440	9	7	2
6	Teunom	3000	1200	24	19	5
		13700		110	88	22

It is recommended that three septic tank pumper trucks be procured:
One for Kec. Jaya and Kec. Sampoiniet
One for Kota Calang that also would serve Kecamatan Setia Bakti and Kecamatan Krueng Sabee
One to serve Kec. Panga and Kec. Teunom

Assuming a detention time of 22 days for the IPLT and adding a safety factor of 20%, the following is recommended:

Table 24: Size and Area for IPLTs in Aceh Jaya

Kecamatan	Septage (m3/week)	Design (m3/day)	Area (m2)
Jaya	25	5	400
Sampoiniet	15	3	250
Calang	15	3	250
Panga and Teunom	26	5	400

Concept for Sanitation

- Collect septage by septic tank pumper truck for treatment at IPLT
- Co-locate IPLT with TPA
- In rural areas try spreading on land
  - 4 m^3 spread 5 cm thick requires 80 m2 land
  - mix into land using agricultural disc-harrow machine
    - Major Concerns:
      1) Contamination of water sources
      2) Public acceptance of this disposal method

Outline Plan for Sanitation

Current Year (2006/2007)

- Procure three (3) septic tank pumper trucks and equipment: one for Kecamatans Jaya and Sampoiniet; one for Kec. Panga and Teunom; and one for Kota Calang and surrounding area. Primary use at this time is for MCKs at TLCs.
- Develop temporary disposal sites for septage [primary concern is to avoid contamination of ground water and surface water
- Organize public education campaign about importance of sanitation collection and disposal and guidelines for constructing septic tanks
- Locate suitable sites for septage treatment facilities with goal of co-locating septage and solid waste disposal sites
- Construct MCKs at Pasars in each Kecamatan
- Conduct pilot projects for alternative treatment and disposal methods and publicize results

Year 2007/2008

- Design, construct, and put into operation IPLTs to serve Jaya, Calang, and Teunom
- Test land disposal of septage in Kecamatans Sampoiniet and Setia Bakti
- Locate land that can use treated septage sludge from the IPLT

Year 2008—2010

- Evaluate conditions and operations, then if necessary design, construct, and put into operation IPLTs to serve other areas in the Kabupaten

NGOs providing replacement housing are cognizant of WATSAN requirements and usually organize an adequate water supply but they are leaving sanitation to the usual practice. With construction of new and replacement housing, pollution and risk to public health will only get worse without action now to develop wastewater collection and disposal systems. Reconstruction of settlements is an opportunity to develop working sanitation systems that collect both grey and black water and provide adequate treatment and disposal in properly designed and functioning septic systems.

For example where houses are close together it might be possible to install a wastewater collection system of PVC pipe to convey all wastewater---toilet, sink, and bath---to a properly[13] built, multi-chamber septic tank that serves multiple houses. Solids can be pumped out periodically (1 to 2 years). Effluent can be further treated by constructed wetlands; used for landscape irrigation or certain types of agricultural crops; or discharged into the sea at a location with vigorous mixing.

There are already some pilot projects investigating alternative collection and treatment methods, for example ESP-Aceh is developing a pilot project at Lham Kruet (Kec. Lhoknga) for several homes to use communal septic tanks with the liquid wastes disposal through a garden plantation. OXFAM is demonstrating an Australian system called Bioremediation Infield Personal Unit (BIPU).

Long term these projects could lead to simpler and more effective residential wastewater collection and disposal. However in the short term, IPLT facilities should be planned and constructed.

[13] By definition a septic tank holds the wastewater, provides treatment, discharges to a leaching field. The Indonesian version is not sealed thus allowing liquid to escape.

11. SOLID WASTE INFRASTRUCTURE

11.1. CURRENT SITUATION FOR SOLID WASTE COLLECTION AND DISPOSAL

In Kab. Aceh Jaya each community manages its own solid waste collection and disposal. At the moment the Kabupaten DISPENDA (local income office) has been assigned responsibility for solid waste.

UNDP Tsunami Recovery Waste Management Program (TRWMP) provides local governments with financial and technical support including:

- rehabilitation of landfill sites and provision of equipment;
- organized recycling and reuse of tsunami debris;
- demolition of damaged structures.

One of UNDP's strategies is to provide interim disposal sites while a permanent, engineered disposal site is planned and constructed. Later the interim site would be cleared and rehabilitated. This strategy is applicable to Kab. Aceh Jaya.

Collection is usually assigned to the community and neighborhoods, so that will not be considered further except for socialization and training.

11.2. ESTIMATED SOLID WASTE PRODUCTION

Solid waste production for year 2010 was estimated using

(a) population projections as shown in Table 12

(b) solid waste characteristics for Kota Banda Aceh

- 65% organic material, remainder inorganic
- no construction debris (it is recycled or disposed in a separate location exclusive for this type of waste)
- initial density 200 to 300 kilograms per cubic meter (i.e. 0.2 to 0.3 kg/L) before compaction

(c) Government of Indonesia Standards [Metode, Spesifikasi Dan Tata Cara, Bagian: 11 Lalu Lintas, Lingkungan Jalan, Sanitasi dan Persampahan, Departemen Permukiman dan Prasarana Wilayah, Badan Penelitian dan Pengembangan, Jakarta, December 2002.]

Table 25: Solid Waste Production from Various Sources

SOURCE	QUANTITY	UNITS
Residential House	2.5	Liter (L) per person per day
Market	0.2	L/square meter (m^2)
Commercial	2.5	Liters per Employee/Day
School	0.1	L/student/day
Roads	0.1	L/lineal meter/day

Solid Waste (SW) from residential housing = Population x 2.5 L/person/day

Assume area of market = 1m^2 for 25 people and operates daily
Then SW from Market = (Population/25) x 0.2 L/m^2/day

Assume 5% of population works in office or commercial business
Then SW from Office/Commercial = (5% of Pop) x 2.5 L/day

SW from roads = (length of road in meters) x 0.1 L/lineal meter/day
Roads in Kabupaten for Year 2005 (per BPS):
145 km (Jl. Negara) + 35 (Jl. Propinsi) + 307 (Jl. Kabupaten) + 664 (Jl. Lingkungan) = 1152 km, [*round up to nearest 100 km for calculation*]
(1200 km road) x (0.1 L/Lineal Meter/Day) x (conversion factors) = 120 m3/day for the entire Kabupaten, which is negligible compared to SW from other sources

Field verification is required to confirm data estimates.

Solid waste accumulates so the landfill site must be sized to accommodate wastes generated over a period of several years.

Table 26: Solid Waste Production 2006-2010

	Solid Waste Produced (m3)						
	ANNUAL PRODUCTION					TOTAL	Area (ha)
Kecamatan	2006	2007	2008	2009	2010	2006 -10	2006 - 10
Jaya	17,207	17,465	17,727	17,993	18,262	88,700	3.1
Sampoiniet	10,269	10,423	10,579	10,738	10,899	52,900	1.9
Setia Bakti	5,542	5,625	5,710	5,796	5,882	28,600	1.0
Krueng Sabee	9,845	9,993	10,143	10,295	10,449	50,700	1.8
Panga	4,698	4,768	4,840	4,912	4,986	24,200	0.8
Teunom	13,504	13,706	13,912	14,120	14,332	69,600	2.4
							11
						depth = 2m; compaction = 30%	

Three assumptions are made to estimate land area required:

1. All solid waste generated will be collected and transported to the landfill. In practice that does not happen---some blows away in the wind; is burned; recycled; lost at the transfer station; illegally dumped on the way to disposal site.

2. Solid waste placed in the landfill will be reduced 30% in volume from evaporation, decomposition, and compression from the weight above it. If mechanical compression is provided, for example from bulldozer or compactor, then volume reduction would be greater and less land area required

3. Depth of solid waste landfill will be 2.0 meters. Greater depth means less land required but larger size equipment is needed to excavate, place, and compact.

The following table illustrates impacts of depth and compression assumptions.

Impact of Assumptions		
Depth	Compression	Total Ha
2.0	30%	11
3.0	30%	7
2.0	50%	8
3.0	50%	5

11.3. PRIVATE SECTOR PARTICIPATION IN SOLID WASTE SECTOR

Unlike sectors of water supply or sanitation, there is more opportunity for Private Sector Participation (PSP) in the solid Waste sector because it does not require specialized equipment or technical skills. Collection and transport of solid waste requires (1) a truck with a cover to prevent debris from falling or blowing out; (2) a destination (i.e. TPA). So contracting out these services can stimulate the economy, not burden government with vehicles and staff; and allow government to focus its efforts on operating and maintaining the TPA.

There are two basic methods for Private Sector Participation in Solid Waste:

- Under contract to a government agency to collect and transport residential and commercial solid waste to a transfer station or disposal site.
- Under contract to a private sector or institutional waste generator to collect and haul waste to a waste disposal site. For example a hospital could contract with a private company to manage its health care wastes.

For transparency, contracting arrangements should be conducted through competitive bidding by contractors who are pre-qualified. To assure acceptable performance the contracting agency must follow up and evaluate.

11.4. STRATEGY FOR SOLID WASTE INFRASTRUCTURE

- With assistance of UNDP and others, develop disposal sites for building debris from earthquake and tsunami
  In ground decomposition of tsunami debris (defined as concrete, brick, metal, wood, and construction rubble) is slow to none, so contamination of groundwater is small

to nil. Metal can be recycled; wood burned for heat or cooking. Useful as fill material to raise ground level, make a barrier, cover trash in a landfill, foundation for road.

- Establish disposal sites in each Kecamatan for domestic solid wastes. Start with "dig and bury" sites at suitable locations
- Establish TPS in each Kecamatan located at or close to the Pasar or other commercial center
- Medical Waste disposed by on-site incinerator located near Hospital or other medical services such as Puskesmas or Clinic.
- Each Kecamatan should have at least one Truck to collect solid wastes.
- Provide Carts and Bins according to demand of services.
- Implement Community Participation and Public Awareness campaigns for Source Based Treatment (Separation, Recycling, and Household Composting)

11.5. FUTURE FACILITIES FOR SOLID WASTE COLLECTION AND DISPOSAL

11.5.1. TRANSFER SITES

There are currently no sanitary landfills in Kab. Aceh Jaya. Solid waste is dumped and left to decompose or to be burned. Transfer Stations (TPS) have to be placed close to the area where solid wastes are generated. In Kecamatan the primary generation sources are markets (Pasars). A TPS is typically a container made from cement bricks with capacity 6 m3 – 12 m3. The operating lifetime of a TPS is 15 – 20 years. Delivery to the TPS is by individual container or cart and collection frequency is every 1 to 3 days, but preferably daily.

Initially Transfer Stations should be located at Pasars (Markets) because this is an open area, centrally located, close to road network, and typically the largest single source of solid waste in the Kecamatan.

11.5.2. FINAL DISPOSAL SITES

The Final Disposal Site (TPA) should be located[14]:

- Not in a flood prone area
- Within distance of 20 to 30 kilometers (km) to Source or Transfer Station
- At least 2 kilometers from Housing Areas
- Down stream from water supply sources
- At least one kilometer from rivers

[14] SNI 03-3242-1994---SK SNI T-12-1991-03, Methode, Spesifikasi dan Tata Cara, Bagian 11, Lalu Lintas, Lingkungan Jalan, Sanitasi dan Persampahan, NSPM KIMPRASWIL, Jakarta.

- At least three kilometers from airports
- Slope < 20%
- Capacity for 15 years of waste disposal
- Entry/exit road not to pass close to high population center and able to accommodate two way traffic of container trucks (10-12m)

The exact location has to be supported by technical, social, and financial considerations and must be agreed by all stake holders. Refer to Table 26 for estimated sizes.

Outline Plan for Solid Waste

Year 2006/2007

- Establish disposal sites for earthquake and tsunami debris in Sampoiniet, Krueng Sabee, and Panga (also serves Teunom)
- Establish TPS and provide Collection Truck to each Kecamatan
- Establish domestic solid waste disposal sites for domestic solid waste for each Kecamatan

Year 2007/2008

- Improve the TPAs that serve Lamno, Calang, and Teunom
- Community Development in all TPA area

Year 2008/2009

- Promote "Sources Based Solid Waste Management" (separation method)

Finding Number 13: Kab. Aceh Jaya Needs Multiple Landfill Sites.
No one single location for TPA can adequately serve the entire Kabupaten due to travel distances. Therefore multiple sites need to be identified and developed.

Public awareness of waste management issues tends to focus on removal of waste from neighborhoods. Issues of where waste is disposed, how it should be managed, how best to allocate waste management resources, the human health and environmental implications of poor waste disposal and related issues are generally not discussed in a public context except in connection with the development of new waste disposal facilities. There should be an on-going program of public education and awareness, combined with other environmental sanitation sectors (e.g. sanitation, drainage) to maximize benefit.

12. DRAINAGE INFRASTRUCTURE

The purpose of drainage is to remove unwanted water from the human environment. Kabupaten Aceh Jaya needs drainage facilities to protect buildings and infrastructure from water in rivers and from ocean tides and from storm water. Irrigation drainage for agriculture is not discussed in this report.

Macro drainage refers to rivers and channels; micro-drainage to roads and buildings. Flood Control infrastructure is constructed under supervision of Public Works (PU). The classification of the river or road (National, Province, Local) determines which PU level (Central, Province, District) is responsible. For this type of micro-drainage the Camat [administrator of sub-district] is usually responsible, even though they do not have paid staff or funds to do this. It will be advantageous to involve the Mukim in this responsibility to clean drains and do routine maintenance and repairs, not because the Mukim do have paid staff or budget, but because they have the closest contact with the people most likely to be affected, who could be engaged in the clean-up and small repairs of the micro-drains.

Regarding roads, it is the practice elsewhere in Indonesia to budget 10% of the cost of the road for drainage. However in Aceh Province it appears that 100% of the budget is used for road construction and no money is available for drainage. In Aceh Jaya in year 2005 there were 307 kilometers of road classified as "Kabupaten" and 664 as Jalan Lingkungan so there are about 1000 kilometers of road for Kabupaten staff to inspect for drainage[15].

Where new land is cleared for housing, it will need drainage. This should be the responsibility of the organization or individual building the house. For example in Calang, UNHCR is constructing housing and is arranging for the NGO IRC to do drainage. However in other locations new houses are constructed without drainage.

Finding Number 14: Lack of Drainage for New Housing.
Several NGOs constructing new housing are not considering drainage. Some don't know its importance, others do not have sufficient budget, many think it will be done by local government as part of road network. Thus BRR should (1) issue a policy statement about the importance of drainage and the obligation of the organization providing the house to construct drainage, and (2) develop drawings, specifications and Bill of Quantities for typical house drainage systems.

In some places there are properly sized and adequately constructed drainage channels but still the surrounding area has ponded water because, due to erosion, the land is at a lower elevation than the channel. Another reason for ponded water is that in commercial areas the open drains in the street are often paved over to provide parking and sidewalks. This keeps trash out but may not be sufficient to allow water to enter.

[15] Data from BPS.

Typically PU uses the "*observational principle*" for drainage, i.e., when funding is available PU decides on the basis of observation which areas have the greatest need and which particular drainage intervention is best. Thus during the current wet season government staff at all levels and from all work units should observe areas that flood and report this to PU Kabupaten These reports can be evaluated and prioritized to develop an infrastructure investment plan for drainage. This is particularly relevant at this time because land subsidence and new construction may have changed drainage patterns.

12.1. RIVER FLOODING

There is flooding from three major rivers in Kabupaten Aceh Jaya16.

Krueng Lambesso (Kec. Jaya) floods for two to seven days during the rainy season affecting about 30% to 40% of the areas of 12 villages to depths of one to three meters

1	Didrieng	---	7	Mentara
2	Alue Mie	---	8	Alue Rayan
3	Cat Dulang	---	9	Lam Ayam
4	Tev Maram	---	10	Sangan
5	Lau Drian	---	11	Pante Ceureumen
6	Babah Dua	---	12	Sabet

Krueng Sabee (Kec. Kr. Sabee) floods for four to seven days during the rainy season affecting about 30% of four villages and 100% of two villages to depths of one to three meters.

Affected 30%	Keude Krueng Sabee
	Datar Luas
	Payak Semento
	Bunta
Affected 100%	Mon Mata
	Rantan Pangajng

Krueng Teunom is reported to flood every time there is a heavy rain, thus several times a year. There is a break in the river embankment about two meters wide and during high water flows a considerable amount of river water enters the "Sungai Mati" which floods all or parts of 12 desas and several hectares of land that were farmed for rice. Province Public Works constructed a system of levees and earthen embankments about 30 kilometers long in 1993 to 1998. The tsunami flooded the river and that is probably when the break occurred.

[16] "Laporan Pendahuluan Sid. Sungai Kr. Lambesso dan Sungai Kr. Sabee, Kab. Aceh Jaya", KU.08.08/PBPP/BRR/42 by PT. Geodinamik Konsultan (Bandung), Nov-05. and site visits to Teunom 12 Jan-06 and 4 Feb-06.

Table 27: Teunom Desa Affected by River Flooding

DESA	Estimated Population (2005)		DESA	Est. Pop. (2005)
Alue Ambang	1303		Pasi Pawang	249
Blang Baro	377		Pasi Tulak Bala	211
Gampong Baro	190		Pulo Tinggi	251
Keude Teunom	673		Rambong Payong	250
Padang Kleng	1161		Tanoh Anou	700
Panton	638		Tanoh Manyang	625
Affected by Flooding			12	6628
Total in Kecamatan			37	14051
% affected by Flooding			32%	47%

Sources of Data

Population from BPS, 2005

Desa that Flood from Pak Abdullah Radin, member Kab. DPRD

Site visits 12 Jan and 4 Feb 2006

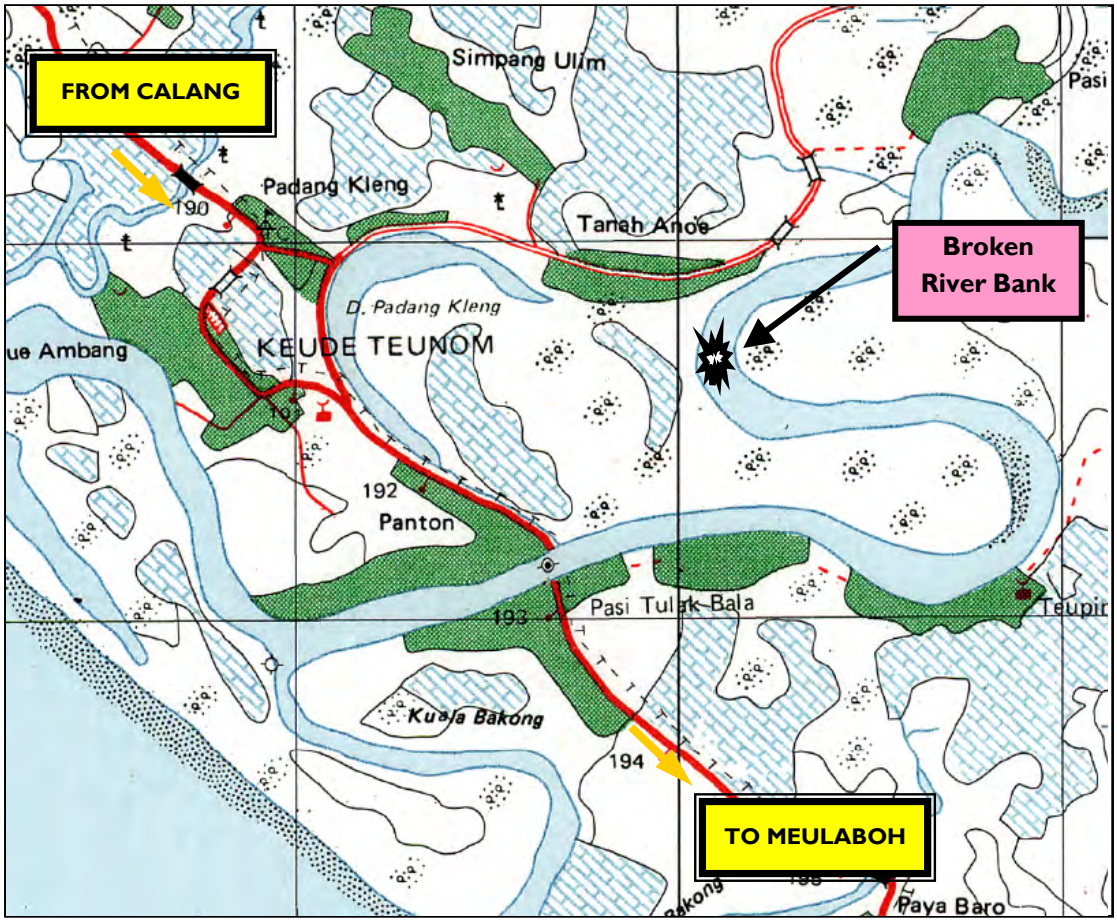


Figure 8: Krueng Teunom River Embankment Break

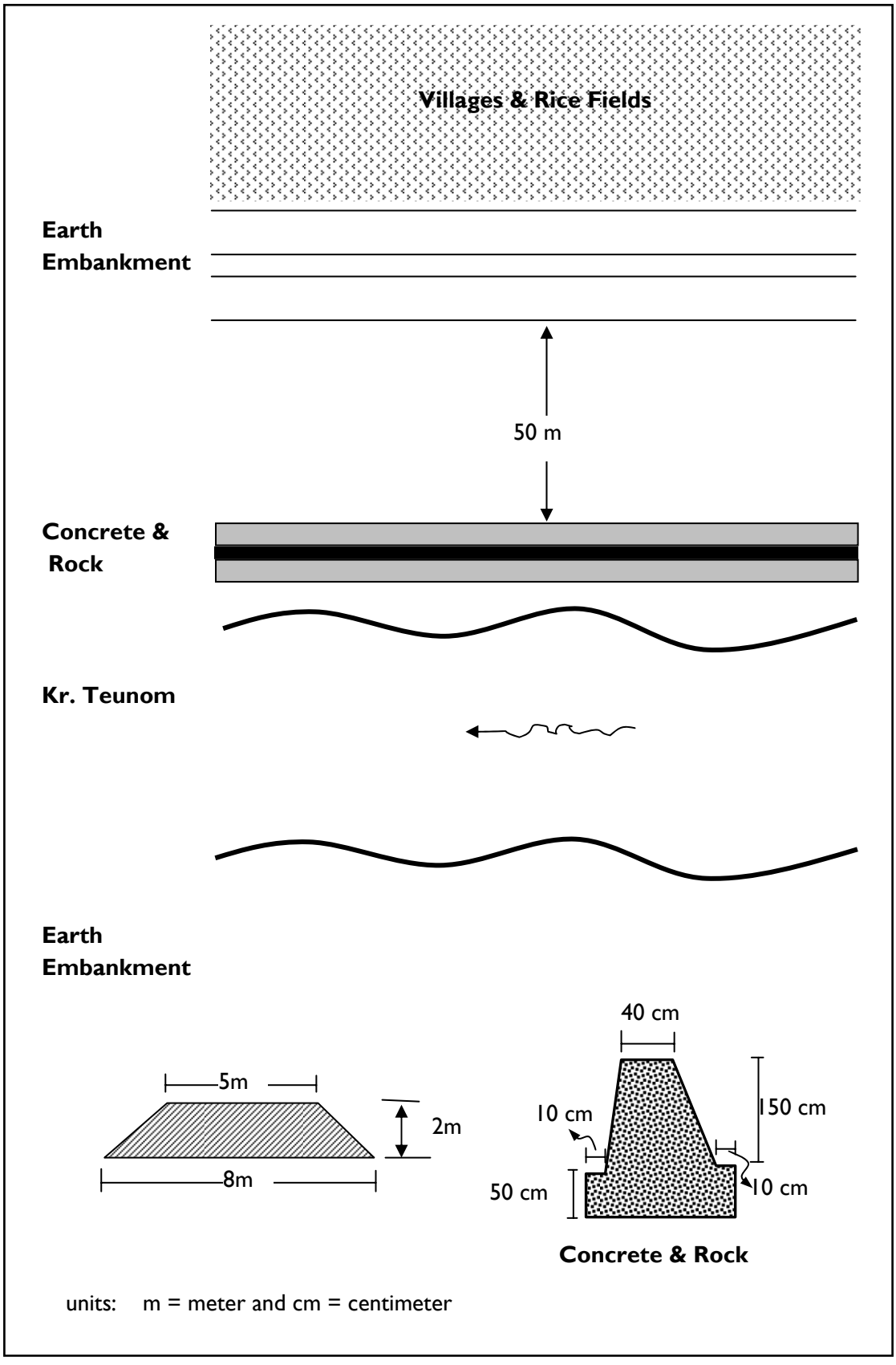


Figure 9: Krueng Teunom Embankment Sketch

12.2. COASTAL FLOODING AND PROTECTION

Driving through Kabupaten Aceh Jaya from Lamno to Teunom, the effects of ocean erosion on the road are visually evident. Large chunks of asphalt and sub-grade are missing; waves wash across the road. In some places, e.g. near Calang, rock is being placed along the shoreline to provide protection.

It has been observed in Aceh that ocean tides are penetrating further inland, the result of a combination of land subsidence, erosion of sand and shore, and destruction of coastal protections. The Province Building Code, Section 1.1.3f specifies for dwellings (i.e. houses)

- Minimum distance from the edge of a beach is 1,000 meters
- Border of the most outer part of the foundation is 100 meters minimum from the highest tide line (which is considered to be 1.4 meters above mean sea level).

The level of rivers such as Kr. Sabee and Kr. Panga increases during high tide. This has two implications. First, building along the river should be controlled because of risk of flooding during a combination of high tide and heavy rainfall. Second, water in these rivers at locations close to the ocean, say one to two kilometers, is likely to be affected by salt water and not suitable as a source of water supply. That can be overcome by construction of a rubber dam that would raise river water level, allow river water to flow unimpeded yet restrict salt water intrusion.

Coastal protection barriers can be both natural (e.g. mangrove trees) and man-made (seawalls). Natural barriers are less expensive but take longer to develop.

Where rivers flow into the ocean there is a mix of salt and fresh waters and of sand, silt, and soil. This environment can support vegetation that can stabilize the soil, provide some protection from tidal erosion, and reduce damage from violent storms. This tropical inter-tidal forest and vegetation is called "mangrove" and can refer to a species, plant, forest, or community of flora and fauna. In Aceh these communities were a mixture of mangroves and Nipa palms.

About 70 species of trees and shrubs are considered principal or true mangrove forms. Some species have economic value and can be harvested for sawn timber, poles, fuel wood and charcoal (*arang*), tannins and dyes, or as raw materials for manufacture of newspaper and cardboard.

Not all locations are suitable for mangrove. Although mangrove trees are adapted to grow in salt water, they require regular flushing with freshwater and will die if immersed in saltwater all the time. So before proceeding with raising seedlings and trans-planting, there should first be a study to identify types of natural barriers and suitable locations.

Finding Number 15: Developing Mangrove Barriers Requires Study.
A mangrove community of trees, vegetation, and animals provides some protection from erosion and storms. There are a variety of mangrove species and not all locations are suitable so study is needed to select appropriate species and to identify suitable locations.

Figure 10 shows distribution of mangroves in Aceh Province in Year 2000. District names have been added because in Year 2000 Kabupaten Aceh Jaya was still part of Kabupaten Aceh Barat. The locations shown for Aceh Jaya on the map are

- Krueng Lambesso (Kec. Jaya)
- Lhok Kruet and vicinity
- Krueng Sabee

According to local residents before the tsunami there were also mangrove concentrations around Krueng Panga and Krueng Teunom although these are not shown in Figure 10.

Thus the first step toward developing a mangrove refurbishment program would be to assess current conditions in previously existing mangrove areas. The second step would be to identifying mangrove species based on suitability for specific site conditions and on economic potential of harvested wood (e.g. for lumber, charcoal, chemicals).

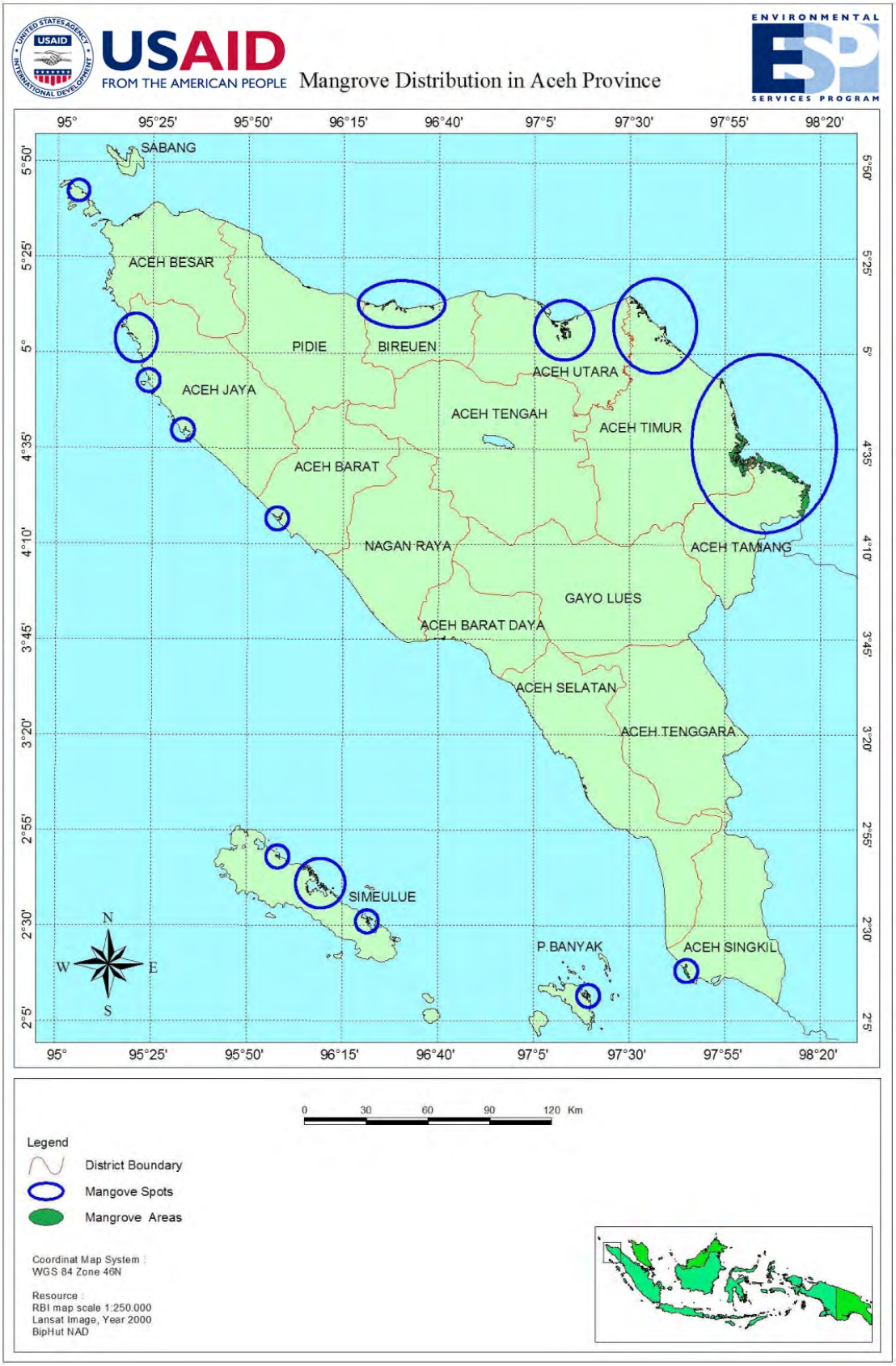


Figure 10: Map of Mangrove Locations—Aceh Year 2000

12.3. REBUILDING HOUSES ON FLOOD PRONE LAND

There is no obligation or requirement to relocate people. The decision to return to the previous location of their house or to move to a new location is decided by the people concerned. So if the people insist to rebuild on their previous house which is within 1000 meters of the beach or within 100 meters of the full moon high tide, then the government will not prevent it.

When an individual insists on rebuilding "on my land" where it was previously and the location does not meet Province Building Standards, then the NGO committed to providing housing can take one of four actions:

1) Refuse to participate
2) Build it and get a letter of release from the homeowner and from the village leader
3) Organize relocation within the village or outside the village (e.g. owner gives original land to the government to make into open space and in exchange receives land in a more secure location)
4) Engineer flood control measures
    (a) construct a protective embankment (dike)
    [expensive, needs geo-technical study; failure catastrophic]
    (b) elevate the house
        (i) stilts for wooden houses [least expensive]
        (ii) concrete blocks (piers) for concrete & masonry houses [expensive because for earthquake protection a massive concrete footer is needed to provide stability during earth movement]
        (iii) raise level of the land then proceed with construction (e.g. import soil and rock, then construct slab-on-grade)

Government should <u>not</u> be obligated to provide complicated or expensive protections for people deliberately building in flood-prone areas. Actions Government can take include:

- prepare and publish maps showing land elevations, distances from the ocean, and recommended "no build" areas
- facilitate land exchanges
- demonstrate mitigation measures such as elevating the house
- improve coastal protections.

Outline Plan for Drainage Infrastructure

<u>Year 2006-2007</u>

- Repair broken river embankment of Kr. Teunom
- Coordinate with NAD Propinsi PU to complete DED for Kr. Lambesso and Kr. Sabee

Years 2008-2010

- Complete improvements of river flooding projects

13. OTHER INFRASTRUCTURE

The focus of this assessment is on WATSAN infrastructure but in Aceh Jaya it is equally important to emphasize infrastructure that will promote the economy, for example roads, fishing industry, and markets.

1. Roads

The earthquake and tsunami destroyed bridges and roads throughout the Kabupaten making travel by motor vehicle into and out the Kabupaten and between Kecamatan almost impossible. Initial assistance for many areas in the Kabupaten came by boat and plane. As discussed earlier, USAID is financing a new road from Banda Aceh to Meulaboh and organization such as Catholic Relief Services and Japanese International Cooperation Society (JICS) are repairing the existing road. Roads will continue to be a priority during the next several years.

2. Fishing Industry

This was one of the major economic sectors before the earthquake and tsunami. Major impediments to current development include limitations of roads to transport fish to neighboring areas and lack of ice to keep the catch cold. Constructing an ice factory should be a priority at a location that can serve the area from Calang south to Teunom.

3. Markets

In Aceh Province the market (pasar) is located in the Ibu Kota Kecamatan and is a major economic center within the Kabupaten. Markets in Aceh Jaya appear to be hastily constructed from wood and without any infrastructure (water supply, drainage), perhaps waiting plans and funding for more permanent facilities. Needed is a Market Infrastructure Improvement Program (MIIP) similar to those implemented through the Integrated Urban Infrastructure Development Program (IUIDP) funded by World Bank and Asian Development Bank elsewhere in Indonesia.

Typically markets are in an open area, centrally located, close to road network, and typically the largest single source of solid waste in the Kecamatan. Market infrastrucuture ususally includes

- Water supply (one or two public taps)
- Sanitation (toilet or MCK)
- Solid Waste Transfer Station
- Drainage
- Connecting roads for vehicles to deliver and pick-up items

It is common to locate the central bus terminal close to the market so some infrastructure facilities can be shared.

Public taps need to be strongly built to withstand multiple users and equipped with catch basins or gravel drains to keep water off the ground and from ponding. Toilets need a large septic tank that can be pumped at least once a year and accessed by a septic tank pumper. Solid waste bins need to be situated so people can put trash inside it, thus either low height or accessed by an elevated ramp so the person drops trash down and into the bin. Drainage channels are needed inside the market particularly where fruit, vegetables, meat, and fish are sold. Improving exterior drainage can positively impact public health by reducing mosquito breeding places. No one single structure will correct water ponding at most markets. It will

require a combination of earthwork to create sloped land, and installation of drainage channels to convey water away. The road network round the market needs to be sufficiently wide to accommodate flow of traffic past vehicles stopped to unload and load items.

Infrastructure facilities for markets are not complicated; can have an immediate, positive impact; need to be strongly built due to large number of users; and should be sized to accommodate typical users.

Finding Number 16: Market Infrastructure Improvement Program (MIIP).
Markets are a major economic center in sub-districts (Kecamatans) and would benefit from an organized, focused program to provide basic infrastructure for water supply (public taps), sanitation (MCK), solid waste (collection point), and drainage. This can be a fast, positive, visual demonstration of government action to help the people.

Institutions to Implement and Manage Infrastructure
This section describes current status of institutions responsible for managing infrastructure and recommends an approach for each infrastructure sector.

13.1. WATER SUPPLY

The usual progression for development of water agencies in Indonesia is:

HIPAM to PDAM[17]

- HIPAM (Himpunan Pengelola Air Minum) is a community managed system. NGOs developing village water systems are establishing village water management committees.

- PDAM (Perusahan Daerah Air Minum) is the water supply enterprise established by a District (Kabupaten or Kotamadya) and that earns sufficient revenues to cover costs. It is possible to have more than one PDAM in a District. Within the PDAM there can be
    a. IKK (Ibu Kota Kecamatan) is a water system established in a sub-district capital
    b. Cabang is a branch of a PDAM

PDAM is not responsible for water supply in rural area; it is the Camat and the local government. There has never been a PDAM in Kabupaten Aceh Jaya. Water Supply in Lamno was BPAM and in IKK in Calang, and Teunom.

Considering present conditions, the most practical management scheme would be to continue establishing HIPAM in villages and as water systems are constructed in Lamno, Calang, and Teunom to establish IKK.

[17] In previous years there was an intermediate agency called BPAM (Badan Perusahan Daerah Air Minum) that was managed by Public Works. Lamno was a BPAM.

The health departments at Kabupaten and Kecamatan are supposed to monitor water quality but lack staff and equipment. The Province Health Department has trained staff and adequate laboratory equipment and reagents to monitor chemical and biological water quality. In Aceh Jaya NGOs such as MERLIN, IRC, and OXFAM are providing training and equipment to local Health Departments.

13.2. SANITATION

There is no institution in the Kabupaten responsible for treatment or disposal of human wastes. One method of control would be for the Kabupaten agency that issues building permits (Izin Mendirikan Bangunan, IMB) to include a requirement for waste disposal and specify each homeowner is responsible. Additionally the IMB should specify access to the septic tank, i.e. sufficient space for a truck or a hand-pulled cart with a tank and pump to place a hose into the septic tank to empty its contents.

As a general policy, when waste disposal is centralized wastewater collection and treatment (i.e. "pipe") responsibility should be assigned to PDAM because:

- PDAM has experience installing and maintaining pipes and operating treatment facilities
- PDAM has customer data and already invoices for water so adding an additional fee for wastewater disposal is simple and straight forward.

An example is PDAM Kota Bandung which has a Divisi Air Kotor (Wastewater Division) to operate IPAL Bonjongsoang.

However when human wastes are transported by truck (i.e. "wheels") to a disposal site, then the Kabupaten Dinas Kebersihan should be responsible for the pumper trucks and disposal site (IPLT) because they have similar experience with solid waste.

13.3. SOLID WASTE

Kabupaten Aceh Jaya has no Dinas Kebersihan to organize and manage solid waste facilities. At the moment DISPENDA (finance department) is planning solid waste. The strategy for developing an organized solid waste management system is to:

1. Establish a work unit responsible for solid waste
2. Locate and design an appropriate TPA (Final Disposal Site)
3. Define transporting systems and locate TPS (Transfer Station)
4. Tender and construct TPS and TPA
5. Train operators (Collection, Transfer, Transport, Disposal)
6. Promote and develop solid waste management systems for recycling and composting

The Mukim, an adat organization unique to Propinsi NAD can be an active participant promoting proper placement of solid waste, but is more oriented toward community matters than infrastructure management.

Since collection is done at neighborhood level, the Desa government staff will need equipment and training for collection activities. For transfer and disposal activities it is

recommended to establish a Solid Waste Management Unit at Kecamatan level. The Camat is likely to have more control than the Kabupaten over facilities in their sub-district because:

- Kabupaten agency for SW is not yet established; and
- Travel distances from Kabupaten IbuKota in Calang to proposed TPS and TPA locations are very long probably resulting in infrequent site visits by Kabupaten staff.

The Solid Waste Management Unit would be placed under supervision of the Camat Services and Social Affairs unit (Seksi Pelayanan dan Masalah Sosial, "YANSOS"). This can be done by the Kabupaten (Bupati, DPRD). Placing the SW Unit as a sub-section rather than a section avoids having to convince Central Government to change national laws and regulations relating to Kecamatan government structure.

The Sub-unit for Solid Waste Infrastructure Management [Sub-SWIM] would consist of one individual whose duties include:
Inspect TPS and TPA facilities, operations, and maintenance according to standard checklists
Monitor condition and usage of equipment used for collection and disposal according to standard checklists
Coordinate with other Camat agencies to assess level of service and public's willingness-to-pay
Contact Kabupaten and Province Technical Advisors to explain problems and get their advice and assistance to resolve

Finding Number 17: Manage Solid Waste at Kecamatan.
Kab. Aceh Jaya does not now have a Dinas Kebersihan and the infrastructure recommended for solid waste----TPS and TPA in each Kecamatan---can be managed by the Kecamatan. Thus it is recommended to develop a Sub-unit for Solid Waste Management under supervision of the Camat.

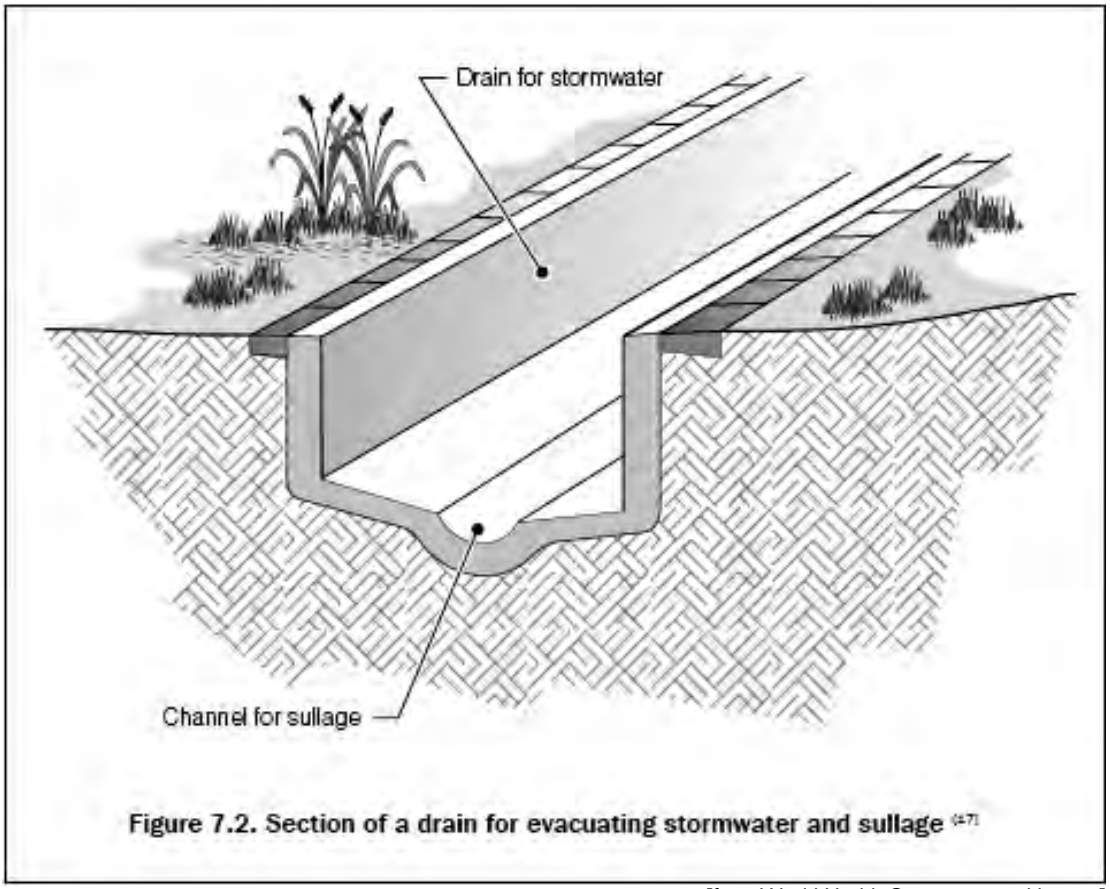
13.4. DRAINAGE

Public Works (PU) is the organization responsible for macro-drainage, flood protection, and shoreline protection. PU also designs and constructs micro-drainage however it would be better to make the builder of the road, or house or market or building responsible for design and construction, and for making the interconnection with existing drainage structures. Similar to Sanitation, this could be enforced through the IMB (building permit). This is important because some NGOs now building houses are <u>not</u> doing anything about drainage, leaving it to the new homeowner to complete. Dinas (Local Government Office) is responsible for maintenance of drains however there are too many drains and not enough staff or money. A better approach for micro-drainage is to involve the community in the planning and development in order to create a sense of ownership and responsibility. . In some places people maintain their neighborhood by *kerja bakti* (dedicated work by unpaid volunteers). In Aceh this could be organized by the *Keuchik*, who is already involved in community matters.

In summary:

- Public Works---macro drainage
- Kecamatan---enforce requirements of micro-drainage for housing; develop and maintain Pasar drainage
- Community---plan, design, implement, and manage local drains

Finding Number 18: Make Community Responsible for Drainage O&M.
"Strategically the highest likelihood for success rests on the devolution of design, implementation, ownership, and management responsibilities to local communities" .



[from World Health Organization publication]

Figure 19: Combined Sullage and Stormwater Drain

The small channel in the drain is to discharge sullage, and its rounded form allows small amounts of water to flow at sufficient velocity to keep solids in suspension. This practice is not ideal as people, animals, and insects can come into direct contact with the waste water and build up of solid waste restricts flow, but it is better than allowing waste water to pond.

14. ENVIRONMENTAL ANALYSIS OF INFRASTRUCTURE PROJECTS

The Government of Indonesia requires all development projects be studied to determine potential environmental impacts and to establish suitable mitigating measures. The scope of analysis depends on size and location of the project as shown in the table below. In Indonesia the required documents before a project begins are:

- AMDAL = Analisis Mengenai Dampak Lingkungan---Environmental Impact Assessment
- UKL = Upaya Pengelolaan [Kelola] Lingkungan Hidup—Environmental Management Plan
- UPL = Upaya Pemantauan Lingkungan Hidup---Environmental Monitoring Plan

Table 28: Government of Indonesia Threshold Criteria for Projects Requiring Environmental Review (AMDAL or UKL/UPL)

Sector and Activity	SCALE	AMDAL	UKL / UPL
WATER SUPPLY			
Water Intake from Surface Sources (River, Lake) or Springs	Debit	≥ 250 L/sec	50 – 250 L/sec
Ground Water Intake	Debit	≥ 50 L/sec	5 -50 L/sec
Piped Transmission Line	Length	≥ 10 km	2 – 10 km
Water Treatment Plant	Production	'---	> 50 L/sec
Distribution Network	Area served	≥ 500 Ha	100 – 500 Ha
WASTEWATER			
Septage Disposal Plant (IPLT)	Plant area	≥ 2 Ha	< 2 Ha
SOLID WASTE			
Development of transfer station	Throughput (tons / day)	≥ 1000 TPD	< 1000 TPD
Final disposal with open dumping system		all	'---
Final disposal in tides area	Area or capacity	≥ 5 Ha or ≥ 5000 tons	< 5 Ha or < 5000 T
Controlled landfill system/sanitary landfill (non-hazardous waste)	Area or capacity	≥ 10 Ha or ≥ 10,000 tons	< 10 Ha or < 10,000 tons
DRAINAGE			
Drainage in small-sized city	Length		> 5 km

References: Decree of the State Minister of the Environment No. 17/2001, dated 22 May 2001 and No. 86/2002, dated 28 October 2002; and Decree of the Minister of Settlements and Regional Infrastructure No. 17/KPTS/2003, dated 3 February 2003.
Ha = Hectares; km = kilometers; L/sec = Liters per second; tpd = tons per day

Donors such as World Bank and USAID have their own requirements and regulations for environmental analysis, public hearings, and documentation. Best practice is to do the environmental assessment on parallel track to complete both Indonesian and Donor requirements at the same time.

Finding Number 19: Environmental Impact Analysis.
Scope of Environmental Impact Analysis depends on size of project and source of funding as individual donors have requirements different from Government of Indonesia. For almost all proposed infrastructure projects GOI UKL / UPL is sufficient.

15. ESTABLISHING PRIORITIES

There are significant differences among the six kecamatans so with limited resources it is necessary to assign priorities for infrastructure development. The method used to establish priorities for Kecamatan development consisted of these steps:

1) Develop criteria and assign a point value
2) Collect data about Kecamatans
3) Assign points according to the criteria
4) Add points to establish a ranking.

BRR states its top three priorities as "Number 1 Housing; Number 2 Housing; and Number 3 Housing". Based on further discussions with BRR and others, the following criteria and priorities are proposed for kecamatan development in Kabupaten Aceh Jaya.

Table 29: Criteria, Sub-Divisions, and Assigned Points

Criteria	Sub-Divisions	Pts	Criteria	Sub-Divisions	Pts
Services to New Housing	>3,000	10	Economic Develop-ment	A = Kab. Capital, Port, Airport	10
	2,000 to 3,000	7		B = Proximity to Banda Aceh or Meulaboh	5
	<2,000	5			
Services to IDP	>6,000	10	Expand Water Supply	Gravity	10
	3,000 to 6,000	7		Pumped	7
	<3,000	5		Wells	5
Flooding	>40% of Pop	10	San. & SW Infra-structure	Pop.> 15,000	10
	20% to 39%	7		10,00 to15,000	7
	<20%	5		Pop. < 10,000	5

Values of 10—7—5 are used to create recognizable differences among the Kecamatans being evaluated.

Criteria

- NGOs are constructing new housing in all six Kecamatans. To make a house livable there must be water supply and a system to remove wastewater.
- IDP's are living in tents and barracks (Temporary Living Centers). Water is provided by pipeline, tanker truck, or dug wells. Although efforts are being made to build houses quickly, TLCs are likely to be in use for the next several years so water supply should become piped.
- River flooding adversely affects people, housing, land used for agriculture
- Calang is designated as the Kabupaten capital. An ocean harbor is under construction and there are plans for an airport. Lamno is close to Banda Aceh and Teunom to Meulaboh so these two towns will have larger economies than those in the interior of the Kabupaten
- It will be more financially sustainable to provide water by gravity rather than by pumped systems. Shallow wells are least expensive but likely to become contaminated due to the current system of human waste disposal.
- Sanitation and solid waste services involve collecting and transporting waste materials by truck which is more economical where populations are large.

Table 30: Data for Establishing Priorities for Kecamatan Development

Kecamatan	New Housing	No. of IDP	Flooding	Development Region	Water Supply	Pop. Yr. 2010
Jaya	3,250	>1,000	Yes	B	G	19,400
Sampoiniet	2,649	1,731			P	11,600
Setia Bakti	1,950	3,670		A	G	6,300
Krueng Sabee	1,460	7,590	Yes	A	G	11,200
Panga	1,416	1,946			W	5,400
Teunom	3,145	4,211	44% of Pop	B	P	15,100

Table 31: Kecamatans Prioritized for Development

Kecamatan	New Housing	No. of IDP	Flooding	Development Region	Water Supply	Pop. Yr. 2010	Points	Rank
Teunom	10	7	10	5	7	10	49	**1**
Jaya	10	5	5	5	10	10	45	**2**
Krueng Sabee	5	10	5	5	10	7	42	**3**
Setia Bakti	5	7		5	10	5	32	**4**
Sampoiniet	7	5			7	7	26	**5**
Panga	5	5			5	5	20	**6**

16. PROPOSED COMMITMENTS

There are three main sources of financing for the reconstruction program: Government of Indonesia resources, donor contributions (e.g. UNICEF, USAID), and voluntary contributions through NGOs.

BRR policy is that the agency providing shelter should also provide water supply and sanitation. For the most part NGOs are doing this and also for other buildings they construct such as schools and health clinics. Some are also doing drainage but this is not consistent so BRR should add a requirement to NGOs to be responsible for drainage.

Known commitments are:

1. Lamno (Kec. Jaya) Water Supply Scheme---OXFAM has funded Detailed Engineering Design. Not clear who will fund construction. that should be done in stages to assure financial sustainability.

2. Sampoiniet 15-Village Water Supply Scheme---CAM (Indonesian NGO) has expressed interest in developing the waterfall in Sampoiniet that can serve approximately 15 villages in Sampoiniet and Setia Bakti. See Option #1 in Table 19 and Figure for a description. Follow-up is needed to confirm this NGO's intent to proceed.

3. Calang Water Supply---For Old Calang, particularly the government and NGO camp area, IRC plans to do a water distribution system with possible technical and financial assistance from American Red Cross.

4. Kabupaten Water Quality Laboratory---Calang NGOs (MERLIN, OXFAM, ACF, IRC) are preparing a Memorandum of Understanding to construct a water quality laboratory. USAID ESP-Aceh has agreed to provide equipment, chemicals, and training if there is assurance the laboratory can be sustainable, e.g. by getting an Indonesian agency such as the Kabupaten Health Department to assume responsibility for the lab.

5. Solid Waste Facilities---UNICEF and UNDP is committed to providing technical assistance and equipment for development of TPS and TPA.
   - UNICEF will donate 1 garbage-dump-truck to be operated in the TLCs
   - UNICEF will support IRC to build one permanent septage dump site to serve Calang Barracks and will provide a de-sludging truck
   - UNDP will provide one 3 trucks to cover garbage collection in Setia Bakti, Krueng Sabee, Panga, Teunom; and a bulldozer and backhoe for use at the dump-site at Keutapang (Krueng Sabee)

6. Krueng Teunom Drainage Repair---Danish Red Cross is preparing a Concept Note conveying their commitment to patch the embankment of Kr. Teunom.

17. SUMMARY OF INFRASTRUCTURE NEEDS

The following tables summarize infrastructure projects and estimated costs that do NOT include

- Land Acquisition
- Detailed Engineering Design, Environmental Impact Assessments, Construction Management (typically 12.5% of construction cost)
- Commercial Contingencies (inflation, currency exchange)
- Physical Contingencies (changes to quantities or unit costs)
- Value Added Tax (*Pajak Pertambahan Nilai*, 10%)

Cost data is from fourth quarter of 2005.

Table 32: Water Supply Program & Indicative Costs

Program Components	Qty	Units	Unit Cost (X1000 Rp)	Cost (in million Rp)
Jaya Water Supply System DED by OXFAM's Consultant (Design horizon yr. 2025)				
North Zone (Meudeun Spring)				6,000
East Zone (Gle Melha Spring)				6,000
South Zone (Teumarem Sp.)				11,900
Total System				23,900
Sampoiniet Water Supply System				
New Location of Lhok Kruet + other 2 villages				
Spring Capturing Structure	2	unit	15,000	30
Disinfection Equipment	1	unit	600	1
Reservoir	1	unit	70,000	70
Pumping Station	1	unit	50,000	50
Transmission Mains Ø100 mm (HDPE)	1,000	m	405	405
Distribution Mains (HDPE)				
Ø75 mm	2,000	m	125	250
Ø50 mm	3,568	m	115	410
House Connections	278	unit	500	139
Total System				1,355
Targeted to 12 Villages				
Option I				
Spring Capturing Structure	1	unit	200,000	200
Disinfection Equipment	1	unit	600	1
Transmission Mains Ø150 mm/HDPE	4,500	m	405	1,823
Distribution Mains (HDPE)				
Ø100 mm	18,000	m	215	3,870
Ø75 mm	2,400	m	125	300
Ø50 mm	3,000	m	115	345
House Connections	1,114	unit	500	557
Total System				7,095
Option II				
Intake Structure	1	unit	50,000	50
Intake pump (4L/s) Complete	3	unit	10,000	30
WTP (10 L/s)	1	unit	500,000	500
Dist. Pumps (5L/s) Complete	3	unit	30,000	90
Treated Water Trans. Mains	50	m	405	20
Distribution Mains (HDPE)				
Ø100 mm	18,000	m	215	3,870
Ø75 mm	4,900	m	125	613
Ø50 mm	3,000	m	115	345
House Connections	1,114	**unit**	500	557
Total System				**5,995**

Water Supply Program & Indicative Costs (continued)

Program Components	Qty	Units	Unit Cost (X1000 Rp)	Cost (in million Rp)
Setia Bakti Water Supply System				
Spring Capturing Structure	3 units Existing			
Disinfection Equipment	3	unit	600	2
Transmission Mains 100 mm HDPE	5,500	m	215	1,183
Distribution Mains				
Ø75 mm	6,000	m	125	750
Ø50 mm	7,000	m	115	805
House Connections	756	unit	500	378
Total System				**3,117**
Calang Water Supply System				
Intake Structure	1	unit	150,000	150
Intake pump (7.5 L/s)	3	unit	20,000	60
Raw water Transmission Mains Ø150 mm/HDPE	12,000	m	405	4,860
Package Treatment				
10 L/sec	1	unit	500,000	500
5 L/sec	1	unit	250,000	250
Distribution Mains				
Ø100 mm	5,376	m	215	1,156
Ø75 mm	10,752	m	125	1,344
Ø50 mm	10,752	m	115	1,236
House Connections	1,344	unit	500	672
Total System				10,228
Krueng Sabee Water Supply System (Keude K. Sabee & It's Surrounding Villages)				
Spring Capturing Structure	(Existing)			
Disinfection Equipment	1	unit	600	1
Transmission Mains	Existing			
Distribution Mains				
Ø75 mm	2,000	m	125	250
Ø50 mm	3,360	m	115	386
House Connections	268	unit	500	134
Total System				771
Panga Water Supply System				
Spring Capturing Structure	1	unit	150,000	150
Disinfection Equipment	1	unit	600	1
Transmission Mains 100 mm HDPE	6,500	m	215	1,398
Distribution Mains				
Ø75 mm	6,000	m	125	750
Ø50 mm	7,000	m	115	805
House Connections				
Total System				**4,395**

Water Supply Program & Indicative Costs (continued)

Teunom Water Supply System				
Intake Structure	1	unit	100,000	100
Intake Pumps 7.5 L/sec	3	unit	20,000	60
Package Treatment (15 L/s)	1	unit	750,000	750
Ground Distribution Reservoir	1	unit	150,000	150
Distribution Pumps	3	unit	30,000	90
Treated Water Transmission Mains (Ø150 mm/HDPE Pipes)	1,000	m	405	405
Distribution Mains				
Ø100 mm	14,000	m	215	3,010
Ø75 mm	7,248	m	125	906
Ø50 mm	14,992	m	115	1,724
House Connections	1,812	unit	500	906
Total System				**8,101**
Detailed Engineering Design for 5 Kecamatan				300

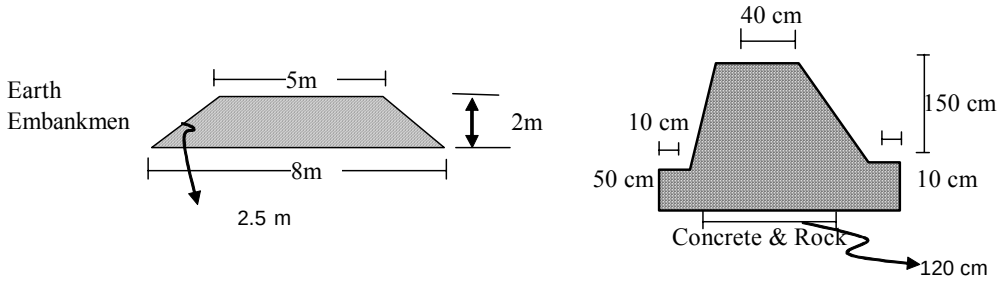
Table 33: Sanitation Program & Indicative Costs

	2006 - 2007	COST Million Rp	2008 - 2010	COST Million Rp
STUDIES	Location for IPLT			
	Pilot Studies for Alternative Wastewater Treatments			
CAMPAIGN	Public Education			
PROCUREMENT	Septic Tank Truck & Pump (3)	825		
	(Rp 275 million/unit)			
DESIGN & CONSTRUCT	MCK at Pasars (3)	300	MCK at Pasars (3)	300
	(Rp 100 million/unit)			
			IPLT:	
			Jaya (5 m3/day)	1140
			Sampoiniet (3 m3/day)	950
			Calang (3 m3/day)	950
			Teunom (5 m3/day)	1140
Total Cost for Aceh Jaya		**1125**		**3340**

Table 34: Solid Waste Program & Indicative Costs

Program Components	2006 - 2007	COST Million Rp	2008 - 2010	COST Million Rp
STUDIES	Field Studies to Confirm Data Estimates (e.g. Quantity and Type of SW Produced)	**50**		
	Technical Studies to Develop Locations for TPS & TPA Jaya, Sampoiniet, Calang and Teunom	**240**		
	Community Discussions to Agree TPS and TPA Locations	**50**		
	Simplified Leachate and Landfill Gas Collections Systems	**150**	Evaluation of Solid Waste and Lessons Learned (Benefits Evaluation)	**150**
CAMPAIGN	Community Development in TPA areas		"Sources Based Solid Waste Management"	
DESIGN & CONSTRUCT	TPS at Pasar for the six (3) kecamatan; all are close to pasar or other commercial area	**120**	TPS at Pasar for the six (3) kecamatan; all are close to pasar or other commercial area	**120**
	TPA Jaya (3.1Ha), including access road	**1,127**	TPA Sampoiniet (1.9 Ha), including access road	**691**
	TPA Calang(2.8Ha)	**1,018**	TPA Teunom (3.2 Ha)	**1,164**
PROCUREMENT	Total 2 collection trucks each has capacity of $4m^3$, 1(one) Collection Trucks for Jaya and the other for	**600**	1 (one) collection trucks for Teunom which will serve Panga as well.	**300**
	2 units Front-End Loader for TPA	**2,200**	2 Front-End Loader for TPA	**2,200**
Total SW Aceh Jaya Program Cost		**5,555**		**4,625**

Table 35: Drainage Program & Indicative Costs



Description	Volume	Units	Cost	Total (Rupiah)	Total Cost (Million Rp)
Earth Embankment Construction (1 m length)					
Earth (compacted)	13	m3			
Loose Earth	16.9	m3	120,000	2,028,000	
Compaction Work				300,000	
Grass	10	m2	15,000	150,000	
Total Cost of 1 m length			**Rp**	2,478,000	**2.5**
Concrete Rock Construction (1 m length)					
Vol. of Concrete Rock	1.75	m3	---	---	
Rock	1.4	m3	280,000	392,000	
Sand & Portland Cement Mixtures of 1:3	0.35	m3	1,200,000	420,000	
Labour Cost	1.75	m3	150,000	262,500	
Total Cost of 1 m length			**Rp**	1,074,500	**1.1**

			COST (million Rupiah)		
			Earth	Concrete	
LOCATION	Quantity	Units	Embnk	Rock	Total Cost
Kr. Teunom	200	m	500	220	720

Muslim Aid, an Indonesian NGO, is doing emergency rehabilitation of the Kotamadya Banda Aceh drainage and flood protection system. For one component of their work they propose to use one-way flow control valves in place of the usual steel or wooden sluice gates to prevent back-flooding which can occur when river water volume is larger than usual, for example after an intense rain storm.

The design is known generically as variable orifice with an elastomer material made of neoprene (more resistant to ultra-violet light). The valve has no moving parts and is low maintenance because it is designed to be self-cleaning, i.e. flow velocity at low heads is sufficient to scour debris from the valve. Budget-level cost estimates are US$ 15,000 for one valve and $10,000 for installation.

For more information about these valves, contact

Muslim Aid-Indonesia, Jalan Bintara Pineung No. 27, Banda Aceh, Indonesia
H. Fadlullah Wilmot, Director, Muslim Aid Indonesia;
Cell phone 081-3624-84859 and e-mail fadlullah@gmail.com

APPENDICES

APPENDIX A
SOURCES OF DATA

APPENDIX B
NGO AND DONOR ORGANIZATIONS INTERVIEWED FOR THIS REPORT

APPENDIX C
EXAMPLES OF NGO ACTIVITIES OCT 05 - JAN 06 (REPORTED BY KECAMATAN)

APPENDIX A
SOURCES OF DATA

APPENDIX A
DATA SOURCES FOR NEEDS ASSESSMENT

Indonesian Acronyms
www.asia-pacific-action.org/southeastasia/indonesia/resources/language/

Population, Location, and Land Areas

- Bureau of Statistics (Badan Pusat Statistik, BPS) for each Kabupaten (District) publishes each year data about population; organization (sub-districts, villages); production; economy.

- Each Camat (Sub-District) has data about its population

- Data on dead and missing organized by District http://www.humanitarianinfo.org/sumatra/products/statistics/docs/DeathStatisticMay2005.pdf

- "Dissemination Population Census Data of Nanggroe Aceh Darussalam and Nias 2005", Presented in Badan Pusat Statistik, Jakarta November 29th 2005. Has data on Year 2005 populations of Districts

Population Growth Rate
"Dissemination Population Census Data of Nanggroe Aceh Darussalam and Nias 2005", Presented in Badan Pusat Statistik, Jakarta November 29th 2005. provides historic population data for the Province. From data in this presentation the growth rate for the Province for the period 1990 to 2000 is calculated to be 1.5%. Historic data for the District shows a decrease then four year increase, then decrease.

District Development Plans
Indonesia requires District government to prepare

- *Rencana Pengembangan Wilyah* which is typically a five-year development plan for economy, housing, and infrastructure.
- Rencana Tata Ruang Wilayah which is a spatial plan

Within the Kabupaten or Kotamadya this is done by BAPPEDA

Damage assessment as of March 2005 and National Government Plans
Aceh Blueprint consisting of main volume (English and Indonesian) and 11 sub-volumes (Indonesian), for example Book 3 on infrastructure
http://www.humanitarianinfo.org/sumatra/inc/blueprint_index.asp

Status of Reconstruction and Rehabilitation
"Tsunami Recovery Status Report (As of 8 December 2005)" available form HIC web site. Data processed by the United Nations Information Management Service, Office of the UN Recovery Coordinator for Aceh and Nias, in collaboration with the Badan Rehabilitasi dan Rekonstruksi (BRR).

"Aceh and Nias One Year After The Tsunami: The Recovery Effort and Way Forward", a joint report of the BRR and International Partners, Dec-05.

BRR's recovery and reconstruction web-site www.e-aceh-nias.org

UN's web-site for reconstruction, www.humanitariainfo.org.

Building Standards including Utilities; Sources of Materials; Procedures for Land Mapping and Community Planning, Humanitarian Information Center for Sumatra, "HIC Shelter Data Pack – 30 July 2005" available from web site http://www.humanitarianinfo.org/sumatra/
This web site is now administered by United Nations Information Management Systems (UNIMS)

Maps
The HIC web site has a tab for maps.
http://www.humanitarianinfo.org/sumatra/

NGO Relief Activities in the District
http://www.humanitarianinfo.org/sumatra/reliefrecovery/watsan/
has maps and lists of Who is doing What Where

- It is preferable to ask the NGO to provide lists of locations and activities in whatever format they use rather than ask them to complete a specially prepared data collection because NGO's are burdened with large number of requests for data.

- For Kab. Aceh Jaya, UN Office of Recovery provided list of NGO's and their activities

Major Projects---Proposed
Any NGO or relief agency wanting to do a major project should prepare a *Project Concept Note* and submit to BRR. Purpose is to inform other organizations in order to avoid conflict and duplication; and to assure the proposing organization is serious. These notes are available at the BRR Central Program Operation Center. Contact Ir. Truly Kartika or Ir. Ferdian

Water Supply
- PDAM (Perusahan Daerah Air Minum) is the District agency providing water service. They have records of production, distribution, customers, and tariffs,
- PDAM Tirta Mountala (Kab. Aceh Besar) has a Master Plan dated Oct05.
- IWACO reports of 1993 provide data about water resources in NAD according to Watershed Basin and for some Districts (e.g. Aceh Barat and Aceh Jaya)

Solid Waste
- GTZ Project is identifying sites for a landfill for Kota Banda Aceh which will be located in Kab. Aceh Besar. Data they use to estimate generation, density, composition could be applied elsewhere in the Province

- Guidelines to estimate generation and equipment for collection and disposal operations are in *Bagian 11: Lalu Lintas, Lingkungan Jalan, Sanitasi dan Persampahan. Methode, Spesifikasi dan Tata Cara* December 2002 by Departemen Permukiman dan Prasarana Wilayah, Baden Penelitian dan Pengembangan, Jl. Raden Patah No. 1, Kebayoran Baru, Jakarta

Drainage

- The World Bank, Infrastructure Department, East Asia and the Pacific Region: "Appraisal Report for a Proposed Grant to Muslim Aid for the Emergency Rehabilitation of the Drainage and Flood Protection System of Banda Aceh", December 15, 2005

- NAD Propinsi Proyek Pengendalian Banjir and Pengamanan Pantai (Proyek PBPP NAD) (located on same site as BRR) for details about Province projects. Kepala Ir. Mahdani, (081-168-4328)

BRR Contact
Ir. Bambang Sudiatmo, Director for WATSAN
Wim Stolte, WATSAN International Advisor
Staff include Pak Hayat; Pak Darmawel Umar; Pak Hotma

APPENDIX B
NGO AND DONOR ORGANIZATIONS INTERVIEWED FOR THIS REPORT

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NGO AND DONOR ORGANIZATIONS INTERVIEWED FOR THIS REPORT

Individuals Interviewed during Data Collection and Analysis for Infrastructure Assessment of Kabupaten Aceh Jaya

WORKING	NAME	ORGANIZATION	POSITION	LOCATION	CONTACT	E-MAIL
Aceh Jaya	Saliza Mohamadar	Badan Rehabilitasi dan Rekonstruksi (BRR)	Head of Aceh Jaya Regional Office	Calang	---	saliza@brr.go.id
Aceh Jaya	David Sanfiel	MERLIN	WATSAN Coordinator	Calang	081-2600-1446	watsan@merlin-indonesia.org
Aceh Jaya	Marion van der Reijden	MERLIN	Project Coordinator West Coast	Calang	---	pcwestcoast@merlin-indonesia.org
Aceh Jaya	Joel Anderson	UN Office of Recovery Coordinator	Assistant	Calang	left country	left country
Aceh Jaya	Jorg Meier	UN Office of Recovery Coordinator	Officer In Charge, Aceh Field Office	Calang	081-2107-9394	acehjaya@gmail.com meierj@un.org
Aceh Province	Ir. Mahdani	NAD Propinsi PU Proyek PBPP	Assisten Perencenaan	Banda Aceh	081-1684328	macro-drainage and coastal protection
Aceh Province	Tim Walsh	UN Development Programme (UNDP)	Solid Waste Coordinator	Banda Aceh	---	---
Calang	Chairul Anwar	BAPPEDA-Aceh Jaya	Kabid Perencanan	Calang	081-5163-52505	---
Calang	Kim Conolly	International Rescue Committee	Field Coordinator Calang	Calang	---	---
Calang	Lisa Owen	International Rescue Committee	Field Coordinator Calang	Calang	---	---
Calang	Jhon Sriven	UN Development Programme (UNDP)	Programme Assistant	Calang	081-2809-7565	jhon.sriven@undp.org
Calang	Sean Mulcair	UN High Commisioner for Refugees (UNHCR)	Construction Engineer, Shelter Programme	Calang	081-2107-9554 (may have left country)	mulcair@unhcr.org
Lamno, Calang	Nicholas Brooks	OXFAM	Solid Waste Management Coordinator	Banda Aceh	081-360-413615	nbrooks@oxfam.org.uk
northern Aceh	Jeffrey Jewett	American Red Cross	Senior WATSAN	Banda Aceh	081-2698-9390	jewett@amredcross.org

WORKING	NAME	ORGANIZATION	POSITION	LOCATION	CONTACT	E-MAIL
northern Aceh	Teh Tai Ring	American Red Cross	Project Manager WATSAN	Banda Aceh	081-2698-9388	the@amredcross.org
northern Aceh	Melody Munz	International Rescue Committee	Environmental Health Advisor	Banda Aceh	left country	left country
Panga	Douglas Wilson	Samartian's Purse	Construction Engineer, Shelter Programme	Panga	left country	left country
Panga	Duncan Scow Eu Wei	Samartian's Purse	Site Coordinator & Childhood Development Construction	Panga	081-37004-1091	duncanseow@yahoo.com
Sampoiniet, Setia Bakti, Krueng Sabee	Gazaly Malek	Canadian Red Cross	Program Manager	Calang	081-2698-8601	gazaly.malek@redcross.ca
Sampoiniet, Setia Bakti, Krueng Sabee	Prasad Raswal	OXFAM	WATSAN Coordinator	Calang	---	prasal@oxfam.org.uk
Sampoiniet, Setia Bakti, Krueng Sabee	Yayat Kurniawan	OXFAM	WATSAN Engineer	Calang	0813 159 66605	---
Teunom	Hans Jakob Hausmann	Danish Red Cross	Livelihood Delegate	Teunom	081-11876269	hjhd@drk.dk
Teunom	Mads Brinch Hansen	Danish Red Cross	Livelihood Delegate Programme Manager	Teunom	081-21068824	mabd@drk.dk
Teunom	Heike Kemper	German Red Cross	Construction Delegate/Architect	Teunom	---	construction03@grc-indo.org
Teunom	Ronald Ritchey	International Disaster Emergency Services (IDES)	Field Supervisor	Teunom	085260-148361	rwrear@yahoo.com

APPENDIX C
EXAMPLES OF NGO ACTIVITIES OCT 05 - JAN 06 (REPORTED BY KECAMATAN)

APPENDIX C
EXAMPLES OF NGO ACTIVITIES (not a complete list)
OCT 05 - JAN 06 (REPORTED BY KECAMATAN)

Kecamatan Jaya

- International Medical Corps (IMC) conducts integrated programs on mental health, livelihoods, WATSAN, and some constructions (also in Sampoiniet). For UNICEF IMC is doing WATSAN at temporary schools.

- OXFAM is doing shelter and WATSAN in Lamno and surrounding villages including solid waste programs promoting recycling and composting.

Kecamatan Sampoiniet

- Comite d'aide Medicale (CAM) is rehabilitating (cleaning, roofing, etc.) wells along with hygiene promotion.

- IMC conducts integrated programs on mental health, livelihoods, WATSAN, and some constructions (also in Jaya). IMC constructed family latrines (60 units) in Masen; drainage in Ujong Rimba School; gravity flow water system at Gunung Cut that included house connections. IMC conducted water hygiene promotion in Cot Pange and Arongan that included giving water filtration equipment.

  Future plans of IMC include building gravity flow water system (capacity 20 Litres/second) at Gunung Kaleung for 3 villages (Masen, Gampong Baro, and Babah Dua) and in Babanipah; and providing garbage bins for small stores and shops in Sampoinet (approximately 200 garbage bins).

- International Rescue Committee (IRC)[18] completed a stream catchment in Rigah.

- OXFAM conducted hygiene promotion in Blang Dalam and cleaned wells (7 in Sayeung, 5 in Rigah, and 7 in Blang Dalam).

Kecamatan Setia Bakti

- Action Contre la Faime (ACF) constructed wells for washing area and latrines; developing stream catchments in Jabie and Kualado (spelling?)

- IRC constructed latrines for Lhok Timon (4)

- OXFAM conducted hygiene promotion in Lhok Bot, Completed 7 latrines in Kabong Baba Nagom, Sawang, and Rigah.

Krueng Sabee (including Calang)

- ACF constructed latrines in Mon Mata (2)

[18] IRC sometimes associates with another NGO and thus appears in some reports as CARDI-IRC or IRC-CARDI. In this Activity Summary report it is reported as IRC.

- IRC built/repaired water supply to Keutapang and Walubi Barracks (TLC); conducted hygiene promotion in Mon Mata; worked on water gravity flow system for Panton Makmur; constructed latrines for Bahagia (2), Panton Makmur (5 units) Sentosa (2) and MDM Spain Housing (3) and Hospital (1); constructed concrete drains in Mon Mata and Panton Makmur.

  In Calang, IRC is operating the spring water system in Bate Tutoneng; repairing and upgrading roads including drainage; taking active role in locating solid waste and septage disposal sites.

- MERLIN worked on water gravity flow system for Keutapang

- OXFAM trucking water to Kabong; constructed MCK in Paya Seumantok (3), Mon Mata (2) Padang Datar (1), Sentosa (4), Dayah Baro (6), Panton Makmur (3), Keutapang (5), Padang Datar (5); conducted hygiene promotion in Mon Mata; drilled drinking water boreholes in Kabong and Padang Datar, and in Calang at Bate Tutoeng, Dayah Baro, and Sawang.

- UNHCR is building houses in Krueng Sabee and intends to contract with other NGOs (e.g. IRC) to provide WATSAN.

Kecamatan Panga

- ACF trucks water; has built septic tanks at houses built by Samaritan's Purse (NGO); conducted well-cleaning and rehabilitation (1 well serves 2-4 households); and constructed wells for washing (2), washing areas (3), and latrines (12).

- IRC built permanent latrine (1 units)

- MERLIN is building gravity water supply system in Gunong Mantok

- OXFAM constructed drinking water boreholes in Keude Panga, Kuta Tuha, Ladang Baro, and Tuwi Kareung Panga.

Kecamatan Teunom

- ACF is trucking water to villages and TLCs

- German Red Cross is operating water treatment plant and trucking water

- IMC plans to build permanent MCK in Padang Kleng and has completed community latrine in Krueng No Meunasah.

- International Disaster Emergency Services (IDES) is constructing 50 "temporary" houses [6 m by 6 m; concrete slab; wood frame and siding; tin roof; glass windows; will last 10 to 15 years; takes about one month to build]. To be considered "permanent" the house has to have some brick or cement blocks in the walls.

- IRC built permanent latrines (15 units) including Padang Kleng (2), Lueng Gayo (1), Seumira (1); constructed drains. IRC plans to provide water supply to former transmigration areas, abandoned before the tsunami and due to GAM conflict, now repopulating; specifically Keude Teunom, (940 people), Panton (970); Padang Kleng (502 people); and Alue Ambang (1430 people).

Donor Activities in More Than One Kecamatan

- UNICEF will donate 1 garbage-dump-truck to be operated in the TLCs and will support IRC to build one permanent sludge dump site to serve Calang Barracks

- UNICEF will provide WATSAN facility at 45 temporary schools through agreements with NGOs working in the area.

- UNDP will provide 3 garbage-dump-trucks to cover garbage collection in Setia Bakti, Krueng Sabee, Panga, Teunom; and Bulldozer and Backhoe (for making and fixing the dump-site at Keutapang (Krueng Sabee)

- World Health Organization (WHO) is providing one de-sludging truck (rented for 4 months until UNICEF permanent heavy equipment arrive),

SUB DISTRICT	SHELTER		WATER	SANITATION
JAYA	Canadian Red Cross International Blue Crescent OBI with Habitat for Humanity Int. (HfHI) OXFAM Palang Merah Indonesia (PMI) World Vision		AmCross Int. Med.Corps PMI OXFAM	AmCross Int. Med.Corps PMI OXFAM
SAMPOINIET	Canadian Red Cross Obor Berkat Indonesia (OBI) with HfHI OIKOS Portugal OXFAM West-South Humanitarian Relief Center		AmCross CARDI-IRC Int. Med.Corps OXFAM WS-HRC MERLIN CAM	AmCross CARDI-IRC Int. Med.Corps OXFAM WS-HRC MERLIN
SETIA BAKTI	Canadian Red Cross CARITAS Czechia Obor Berkat Indonesia (OBI) with HfHI Oman Charity Org WS-HRC		ACF AmCross CARDI-IRC OXFAM WS-HRC	ACF AmCross CARDI-IRC OXFAM WS-HRC
KRUENG SABEE	German Red Cross OXFAM UNDP UNHCR		ACF AmCross CARDI-IRC OXFAM	ACF AmCross CARDI-IRC OXFAM
PANGA	Samaritan's Purse		ACF IRC MERLIN OXFAM	ACF IRC MERLIN OXFAM
TEUNOM	ADRA (temporary housing) British Red Cross German Red Cross Int. Disaster Emergency Service		ACF ACTED AmCross CARDI-IRC OXFAM	ACF AmCross CARDI-IRC OXFAM

Temporary Shelters---Jawa Pos/E.Java Province Govt. and ADRA

Read each column independently, i.e. up or down. There is not necessarily a relationship among NGO listed in SHELTER and the NGO directly to the left under WATER or SANITATION.

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