The Consultative Group on Indonesia
January 19-20, 2005

INDONESIA:
Preliminary Damage and Loss Assessment
The December 26, 2004 Natural Disaster

BAPPENAS

A Technical Report Prepared by BAPPENAS
and The International Donor Community

FOREWORD

The December 26 earthquake and tsunami devastated the lives of millions of people, leaving a wake of destruction from Asia to Africa. This was the worst natural disaster in Indonesia's history, and Aceh and North Sumatra suffered the most. Over 110,000 people lost their lives, an estimated 700,000 people were displaced, and many orphaned. The scale of the damages to the local economy, infrastructure, and administration were unprecedented. In an instant, the livelihoods and security of hundreds of thousands of the survivors were ruined.

But this tragedy has galvanized the humanitarian spirit in Indonesia and throughout the world. While it is impossible to replace the loses from this truly horrific event – the Government of Indonesia, along with the support of the international community, is prepared to take on the challenges of reconstruction. Ultimately this task is less about replacing physical assets than it is about rebuilding livelihoods and communities. This can only happen by developing a credible and inclusive recovery plan, relying on a bottom-up participatory approach that truly captures the aspirations and vision of the people of Aceh and North Sumatra.

The Government of Indonesia's response to the immediate needs of the relief efforts has been swift and effective. As this critical work makes the transition to reconstruction, and the communities begin to recover from the initial shock and face the future, a comprehensive strategy is needed to help guide the reconstruction process. This report, *Indonesia: Preliminary Damage and Loss Assessment*, presents an initial assessment of the impact in terms of damages and losses to Indonesia of this huge natural disaster. Its sister report, *Indonesia: Preliminary Notes on Reconstruction* sets the groundwork by highlighting a range of possible responses based on existing domestic programs and borrowing from global best practices. In the next few months the government will develop the reconstruction strategy for Aceh and North Sumatra – one that is crafted in close consultation with the affected communities.

Indonesia's leaders have already expressed their guiding principles for reconstruction, and they can count on the full support of the international community. If adhered to, they will ensure reconstruction will be as equitable and efficient as possible – while also offering new hope and stability for Aceh, a province that has experienced its share of hardships.

The reports were prepared under the guidance of Bappenas, and in close consultation with the Government of Indonesia's line agencies and its international partners. This was an intense collaborative effort, one that strengthened the working relationships and camaraderie between all participants. We hope the findings from these reports will serve as a sound basis to make informed decisions and, more critically, help empower the people of Aceh and North Sumatra to rebuild their lives and determine their own future.

Sri Mulyani Indrawati

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ACKNOWLEDGEMENT

This report was a collaborative effort between the Government of Indonesia and the international donor community. The magnitude of the tragedy was an added motivation for all of those involved.

This effort was guided by Bappenas, with invaluable contributions from many government line agencies. The Government's quick mobilization in the field, its organization in Jakarta, and its rapid dissemination and analysis of data were key foundations for the preliminary assessment of damages.

The donor community, together with its partners in government, rallied its collective resources to respond to the urgent reconstruction efforts. Many bilateral and multilateral agencies participated in a two-week effort, working together with Bappenas to complete these reports. The following organizations were key contributors: ADB, AusAID, Danida, DFID, ECLAC, EU, FAO, GTZ, IFAD, IFC, ILO, IMF, JBIC, KfW Development Bank, Perpamsi, The Asia Foundation, UN Habitat, UNHCR, UNDP, UNEP, UNESCO, UNFPA, UNICEF, UNISDR, USAID, WHO, WSP and the World Bank.

We also acknowledge the dedication of all of the local and international NGOs, relief organizations, volunteers, universities, trade unions, and the residents of Aceh – who provided invaluable information for the content of this report. We would also like to thank Jez O'hare for donating his photographs of Aceh, and to Perry Mandeville, for working around the clock to provide satellite imagery for our analysis.

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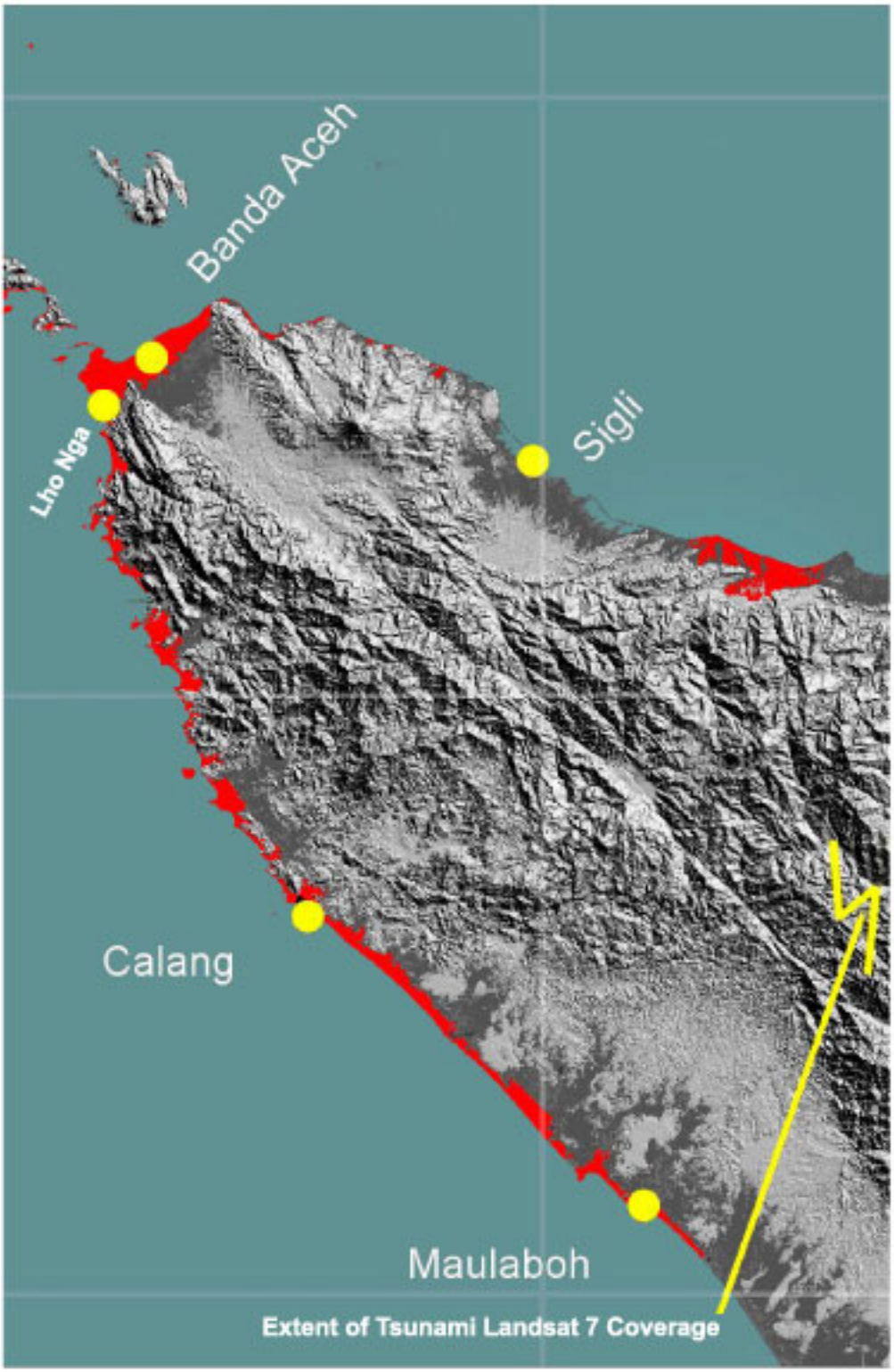
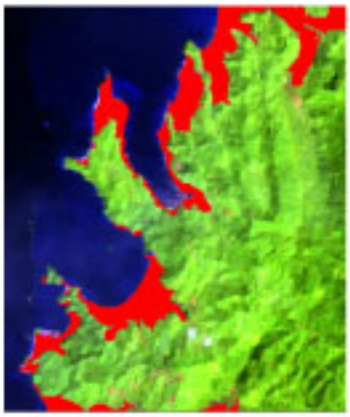
Aceh Tsunami Impact Zone





This map estimates the impacted areas on the coast of Aceh. The areas marked in red illustrate the water line and extent of penetration from the tsunami on December 26th, 2004.

The areas were defined using multispectral analysis (bands 5,4,2) of Landsat Imagery to capture the extent of water damage/loss of vegetation.

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Region Map

INDONESIA
WEST COAST OF SUMATRA
MAIN ROADS
MAIN RAILROADS
RIVERS
INTERNATIONAL BOUNDARIES
Strait of Malacca
MALAYSIA
Sumatra
Danau Toba
Simeulue
Nias
Siberut
Sipora
Pagai Utara
Pini
Tanahmasa
Tanahbala
Langkawi
Pinang
Sabang
Banda Aceh
Lhokseumawe
Medan
Pekanbaru
Padang
Bukittinggi
Jambi
Palembang
Bengkulu
Kuala Lumpur
Ipoh
Kota Bahru
Alor Setar
Kuala Lipis
Raub
Bentong
Seremban
Melaka
Batusangkar
Dumai
Bengkalis
Muaralabuh
Muarabungo
Muarasebat
Sungaipenuh
Tapan
Mukomuko
Pasarbantal
Sawangteng
Mentawai
Sikakat
Sigapokenan
Siberut
Sioban
Muarasebat
Tuapejat
Sikakat
Sawahlunto
Padangpanjang
Pariaman
Solok
Sawahlunto
Pekanbaru
Rengat
Tanjungpinang
Tanjungpinang
Tanjungpinang

GLOSSARY

ADB	Asian Development Bank
ATM	Automated Teller Machine
BAPPENAS	National Development Planning Agency
BI	Bank Indonesia
BMG	Badan Meteorologi dan Geofisika
BPD	Regional Development Bank
BPDs	Village Councils
BPS	Central Statistics Bureau
BRI	Bank Rakyat Indonesia
CAMP	Coordination of Aid and Monitoring of Projects System
CBO	Community Based Organization
CCLC	Creating Learning Communities for Children Program
CDD	Community Driven Development
CHARM	Community Hazard and Risk Management Program
COFISH	Coastal Community and Fisheries Resource Management Project
CZMP	Coastal Zone Management Plan
DAK	Special Local Government Grant
DAU	Consolidated Block Grant
DGLC	Directorate-General of Land Communications
DGSC	Directorate-General of Sea Communications
DGWR	Directorate-General of Water Resources
DIP	Budget Warrents
DMI	Disaster Mitigation Institute
DPRD	Local Council
DPUP	Provincial Office of Ministry of Public Works
DRM	Disaster Risk Management
ECLAC	United Nations Economic Commission for Latin America and the Caribbean
EIA	Environment Impact Assessment
EIII	Employment-intensive Infrastructure Investment
FAO	Food and Agriculture Organization
FIRP	Financial Intermediation Revival Program
GAM	Free Aceh Movement, Gerakan Aceh Merdeka
GoI	Government of Indonesia
HCC	Housing Coordinating Committee
IDP	Internally Displaced Person
IFMS	Integrated Financial Management Systems
IPLT	Septage Treatment Plants
Kabupaten	District Government
KDP	Kecematan Development Program
Kelurahan	Administrative Sub-district (lower level of government administrative unit in a Kota)
Kota	City District
KPKN	Central Treasury Office
MCK	Communal Sanitation Facilities

MCRMP	Marine and Coastal Resources Management Project
MMAF	Ministry of Marine Affairs and Fisheries
MOC	Ministry of Communication
MOC	Ministry of Communication
MoHa	Ministry of Home Affairs
MORA	Ministry of Religious Affairs
MP-SEI	Management Plans for Strategic Environmental Impacts
MPW	Ministry of Public Works
MUI	Indonesia Ulamas Council
NAD	Nanggroe Aceh Darussalam
NGO	Non-governmental Organization
NSC	National Steering Committee
PDAM	Government-owned water enterprises
PERPAMSI	Association of Indonesian Water Supply Enterprises
pesantren	religious boarding schools
PLN	State-owned electricity company
PME	Participatory Monitoring and Evaluation
PODES	Village survey
PSRP	Payment System Restoration Program
PT PLN	the National Electricity Company
PUP	PU Pengaiaran, or Water Resources Service Office
RRSP	Rural Roads Sumatra Project
Satkorlak	Provincial level co-ordinating unit of Bakornas
Satlak	District or municipal level co-ordinating unit of Bakornas
SGP	National Scholarships and Grants Program
SIGP	School Improvement Grants Program
SPBU	Road Side Fuel Stations
SRRP	Sumatra Region Roads Project
SSWP	Small-scale Water Providers
SUMUT	North Sumatra
Susenas	National Household Expenditure Survey
SUSI	Survei Terintegrasi
TA	Technical Assistance
TNI	Indonesian Army
UN	United Nations
UNHCR	United Nations High Commission for Refugees
UPP	Community-driven development project
USB	Unit Sekolah Baru
USO	Universal Service Obligation
USO	Universal Service Obligation
warungs	roadside stalls
WFP	World Food Program
WHO	World Health Organization

EXECUTIVE SUMMARY

We were fishermen and lived right on the beach. I lost my entire family, all my assets, everything. … we need help to build houses, wherever we go. We will need capital to rebuild our businesses.

Fisherman in temporary camp Banda Aceh

INTRODUCTION

On the morning of December 26, 2004, a massive earthquake, registering 9.0 on the Richter scale hit Indonesia with its epicenter in the Indian Ocean, within 150 kilometers of Aceh Province, on the northern tip of Sumatra. The earthquake was followed by a massive tsunami that devastated the human population living on the coastline of Aceh Province, and parts of North Sumatra Province. The same tsunamis caused death and destruction throughout southern Asia and as far away as Africa.

The human toll in Indonesia due the earthquake and the tsunamis has been massive, and larger than in any other country in the region. As of January 14, 2005, 110,229 were accounted for as dead, 12,132 as missing and 703,518 as displaced. The huge natural disaster, one of the largest ever on a global scale, has triggered a massive international relief effort that continues at this moment. The immediate tasks are huge: from retrieving and sheltering and feeding the displaced; to clearing up rubble to allow even basic access and ensuring that main supply lines are open and set up for the basic logistics of relief, including food aid, water, medical supplies and the like. In addition to the Government of Indonesia and its military, thousands of Indonesians of all walks of life are contributing to the effort as are many international agencies, foreign governments and NGOs. Significant and quick assistance also came from military personnel from some 12 other countries and volunteers from all over the world.

PURPOSE AND METHODOLOGY

This document represents a preliminary assessment of damages and losses due to the natural disaster. It has been quickly produced to convey the scale of the damage to the international Consultative Group of Indonesia meeting on January 19-20, and also to provide a basis for the national and local Governments, as well as the people of Aceh and North Sumatra, to quickly start making decisions on setting priorities and considering how to develop a strategy for reconstruction.

This Preliminary Damage and Loss Assessment does not attempt to ascertain the reconstruction costs that would be implied by an eventual reconstruction strategy. Rather, it uses internationally accepted methodology to make an economic evaluation of (i) damages – e.g. destruction of public and private assets such as infrastructure, houses and boats; and (ii) losses – e.g. the loss of income streams such as personal incomes and private sector revenues during the reconstruction phase. It must be emphasized that this report estimates *replacement costs* rather than *reconstruction costs*. In other words, it estimates actual damages and losses – how much it would cost to replace all the original assets that were damaged and income lost at their original location and specifications. Reconstruction costs would eventually be calculated on the basis of a reconstruction plan that may envision rebuilding in different locations or to different specifications; and

building up more assets in order to improve services in the affected areas; or less, given the number of casualties.

This Preliminary Damage and Loss Assessment work started within one week of the disaster and was completed within three weeks of the disaster. In most disaster situations, damage and loss assessment teams do not begin work until at least three weeks after the disaster and complete assessments a month or two later. It is likely that the transition from emergency relief to reconstruction will be rapid and, thus, the process has been accelerated. The damage and loss assessment team that produced this report worked as quickly as possible to compile all possible data from a multitude of sources in a manner that did not impose on the relief effort. This has meant using information from line ministry assessments, relief, donor and NGO agencies on the ground, satellite imagery and aerial photography, and intensive use of what was known about the area before the disaster from survey data (village survey data, household survey data, satellite imagery, government data and other data compiled by the national statistical agency). The assessment work also benefited from several field trips, both by the Government core team and members of the international team. It should be emphasized, nevertheless, that given the timing, this report is a preliminary damage and loss assessment. As more information becomes available and can be compiled over time, the information base can be updated as well as the valuation of damages and losses. This Preliminary Damage and Loss Assessment is the best possible estimate of damages and losses at this point in time.

PROCESS

This damage and loss assessment was anchored by a core team of the Government of Indonesia, based in Bappenas and constituting Bappenas and line ministry staff. This core team was assisted by a significant team of international expertise. At the request of Government, the World Bank coordinated a multi-donor team that included the ADB, Japan and many other multilateral and bilateral agencies, as well as NGOs, that voluntarily lent their expertise to the effort, including the UN whose expertise and knowledge based on its role as a coordinating agency of the ongoing relief effort proved invaluable. The international team worked intensively with the government team over the course of this two week effort. Government and donors organized themselves into sub-sectoral sub-teams to undertake this work, which was then coordinated by the core team.

A strong positive outcome of this process was the development of networks and working relationships among sectoral and thematic professionals from Government, the donor community and others. People come together in a time of crisis. Going forward, it will be important to retain this momentum, as there is much to do. This report constitutes a preliminary step. An assessment of damages and losses needs to be followed by the development and implementation of a reconstruction strategy for the affected population and by the affected population. The community and process that has come together to produce this report can continue to work together to help the people of Aceh and North Sumatra recover from this natural disaster and rebuild their livelihoods.

THE PRELIMINARY DAMAGE AND LOSS ASSESSMENT

The total estimate of damages and losses from this catastrophe in Indonesia is Rp. 41.4 trillion, or $4.45 billion. Of the total, 66% constitutes damages, while 34% constitutes losses in the terms of income flows lost to the economy. The damage provides both an idea of the destruction of assets in the country as well as a baseline for defining the program of reconstruction. The amount of losses will directly impinge on the future economic performance of the country.

Summary Table of Damages And Losses (US$ million)

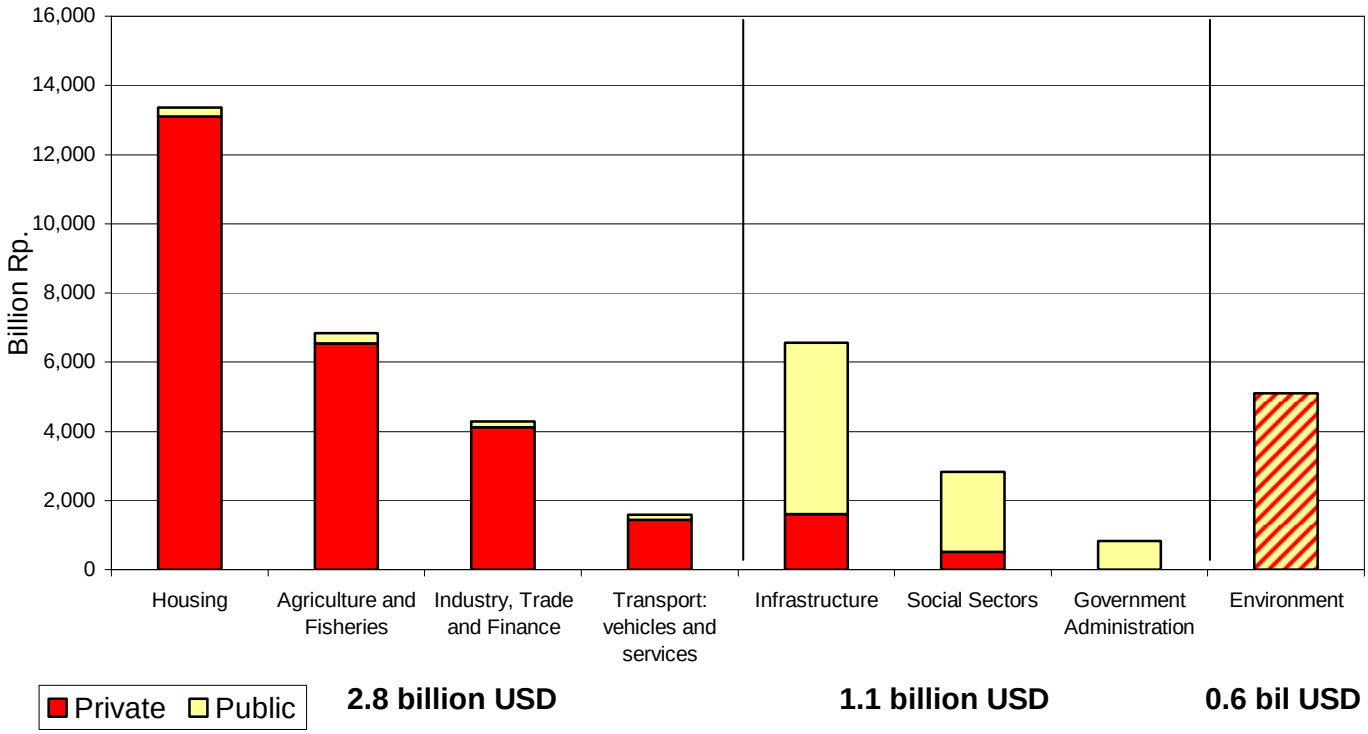
	Total Impact			Property	
	Damage	**Losses**	**Total**	**Private**	**Public**
Social Sectors	**1674.9**	**65.8**	**1740.7**	**1440.6**	**300.1**
Housing	1398.3	38.8	1437.1	1408.4	28.7
Education	110.8	17.6	128.4	9	119.4
Health	82.5	9.4	91.9	23.2	68.6
Culture and religion	83.4		83.4		83.4
Infrastructure	**636**	**240.8**	**876.8**	**325.9**	**550.8**
Transport	390.5	145.4	535.9	165.8	370.1
Communications	18.9	2.9	21.8	8.6	13.2
Energy	67.8	0.1	67.9	1.1	66.9
Water and Sanitation	26.6	3.2	29.8	18.3	11.4
Flood control, irrigation and sea protection works	132.1	89.1	221.2	132.1	89.1
Productive Sectors	**351.9**	**830.2**	**1182.1**	**1132**	**50.1**
Agriculture and Livestock	83.9	140.9	224.8	194.7	29.9
Fisheries	101.5	409.4	510.9	508.5	2.5
Enterprises	166.6	280	446.6	428.9	17.7
Cross sectoral	**257.6**	**394.4**	**652**	**562.9**	**89.1**
Environment	154.5		154.5	548.9	
Governance and administration	89.1		89.1		89.1
Bank and Finance	14		14	14	
Total Impact	**2920.4**	**1531.2**	**4451.6**	**3461.4**	**990.1**

There are several story-lines that emerge from this preliminary assessment that are important to understanding the disaster and its implications as well as guiding thinking on the reconstruction strategy that must follow.

The impact of the disaster on the national economy will be moderate, but it is huge for the local economy of the affected areas. National GDP growth may be lowered by 0.1 – 0.4% in 2005. In contrast, total damages and losses amount to 97% of Aceh's GDP. Considering that a large part of Aceh's GDP is from oil and gas, which was not affected, and that most people get their livelihoods primarily from other sectors such as agriculture, fisheries, and commerce, this is all the more significant. International experience shows that economies that when impact-to-GDP ratios exceed 40%, the affected economy will likely face significant difficulties in recovering and require substantial external assistance to reconstruct. To recover from this disaster, Aceh and North Sumatra will need significant help from the Government, its fellow citizens, and the rest of the world.

The disaster primarily impacted private, not public, assets and revenues. Some 78% of total damages and losses accrued to the private sector, including households, whereas about 22% of damages and losses were borne by the public sector. This has important implications and poses particular challenges for the reconstruction strategy.

Livelihoods Lost - Private sector and households bear brunt of damages and losses



The huge human toll and the preponderant brunt of the disaster to the private sector translates into lost or severely impacted livelihoods. These localized social and livelihood considerations, rather than national economic ramifications, are the biggest story to this disaster. The summary figure tells above this story: the sectors most impacted were primarily private-sector dominated assets and activities that relate directly to the personal livelihoods of the affected urban and rural communities: housing, commerce, agriculture and fisheries, and transport vehicles and services ($2.8 billion, or 63% of total damage and losses). The biggest public sector damages were to infrastructure, the social sectors, and government administration ($1.1 billion, or 25% of total damage and losses). Monetized environmental damages are also significant ($0.55 billion, or 12% of total damage and losses), although they belong in a separate category as the environment will partially recover with the help of nature and time, as well as human intervention. These include damage to coral reefs and mangrove swamps, loss of land use and restoration of the coastal zone. Total damage and losses of this disaster -- net of environmental impacts -- are $3.9 billion.

The damage and loss profile indicates that the priorities for reconstruction must lie in ways to rebuild the livelihoods and social fabric of the devastated communities.

- **Housing and shelter**. Reconstruction of homes needs to be the first step in rehabilitating livelihoods in the disaster-struck area as almost half of the total damage is due to the loss of housing. Repairing and constructing homes will be less costly when carried out at the community level and will also generate income at the local level. Local housing programs need to be based on public and participatory planning.

- **Generating enterprise, commerce, and income creation**. A local economic revival strategy should also focus on local entrepreneurship and the promotion of micro/small enterprises, enhancing their capacity to respond to emerging market opportunities and encouraging new initiatives. During the rehabilitation phase many people will turn to micro-enterprise activities to generate an income. These re-emerging entrepreneurs will need to access to ideas, micro-finance, and know-how. Strategies that reach large numbers of people using mass-media and community-based approaches are often effective in disseminating this type of information.
- **Rebuilding rural livelihoods: agriculture and fisheries**. The livelihoods of people in the agricultural sector and fisheries have been hardest hit. The loss of income in agriculture and fisheries make up more than one-third of total losses due to the disaster. In order to minimize losses in the flow of income, it is important to resuscitate these sectors as quickly as possible, possibly through extended micro-credit and grant programs.
- **Providing public services**. In many areas, local administrations no longer function. They should be re-launched as quickly as possible, through standard procedures for village elections. Village councils (BPDs) should be elected early, in order to aid in local reconstruction and to help prevent local capture of development aid.
- **Assisting the newly vulnerable**. The aid and reconstruction effort has to pay particular attention to the newly created vulnerable populations, such as single-mothers and orphans. It is estimated that 75% of children who have a surviving mother do not live in extended families. These single mothers lack any support mechanism especially as the communal networks and social capital around them have also disappeared. On a striking note, the number of children who are estimated to have lost both parents is as high as 7,700 and going forward the aid effort needs to focus particular attention on the needs of these orphans.
- **Rebuilding communities**. The reconstruction not only of houses and markets but also of social structures and communities provides an opportunity for Acehnese to participate in their own governance and society building. Revival of the social fabric after the disaster requires empowering *pesantren* leaders to take an active part in rebuilding communities.

Developing a reconstruction strategy needs vision, the focus and involvement of the communities affected, strong implementation arrangements and monitoring systems. In devising a strategy to guide the reconstruction process, decision makers should build on the damage assessment by: (i) developing a reconstruction strategy through a consultative process; (ii) rapidly mobilizing of reconstruction funds and activities; (iii) focusing on the needs of the local population; (iv) establishing the highest fiduciary standards and efficient system managing the funds, and (v) updating and monitoring needs and results. Community consultation is imperative to devising the plan for reconstructing Aceh and North Sumatra. Implementing that plan and coordinating all elements of what will be an extremely complex undertaking is just as crucial. Rebuilding the devastated provinces will involve all levels of government from national to village as well as domestic and international organizations, bilateral and multilateral institutions, donors and community groups. Coordinating all these organizations within the overall recovery and reconstruction process, while promoting the interests of the local communities, is a major task. Bappenas is well placed for the role of coordinating the recovery and reconstruction activities but whoever assumes the role will only be first among equals. All stakeholders will have valuable contributions in planning the strategy, financing that recovery and ensuring the money and reconstruction are transparent, accountable and directed at those who need it.

Introduction

INTRODUCTION

This was my kampung. My home is gone. All my family is gone. I am the only survivor. I am a driver by profession and I was in the car when the first wave came, just arriving back at the house. The road here was busy with a lot of people walking along here, lots of cars and motorcycles. I didn't manage to get to my house. Somehow I was thrown from the car and I lost consciousness. When I woke up I was clinging to a tree about 12 km away.

From the area of Ujung Punge about 2 km from the beach. It is from here that one can see the almost complete devastation stretching away into the distance in all directions.

This report is a preliminary assessment of damages and losses due to the natural disaster. It has been rapidly prepared to convey the scale of the damage to participants in the Consultative Group of Indonesia meeting on January 19-20, 2005, and also to provide a basis for the people of Aceh and North Sumatra, as well as their national and local Governments, to quickly start making decisions on setting priorities and developing a strategy for rehabilitation and reconstruction.

The document is organized in three blocks: background information on the disaster and its context; the impact of the earthquake and tsunami in human and economic terms; and consequences for follow-up. The report begins with an **Executive Summary** that presents the main findings of the analysis. It is complemented by a separate document, **Technical Annexes**, covering specific methodologies and data used to calculate the damage and losses.

The initial block of background information begins with a chapter on **The Disaster** that summarizes the latest available information on the earthquake and ensuing tsunami. Next, a chapter on **The Human Toll** provides the most recent official statistics on deaths, missing persons and internally-displaced people due to the disaster. Finally, a chapter on **The Context** consolidates a range of background information about the affected provinces of Aceh and North Sumatra.

The next block on the impact of the disaster contains the heart of the report – the **Assessment of Damage and Losses**. This assessment summarizes total damage and losses for both the private and public sectors, and then presents assessments for infrastructure, the productive sectors, the social sectors and cross-sectoral themes (regional governance and the environment). The following chapter, **Livelihoods Lost**, is a more qualitative look at the consequences of the disaster for housing and shelter, income generation, public service delivery and other cross-cutting issues, with a special emphasis on vulnerable populations. Finally, a chapter on **Economic Impacts** evaluates the macroeconomic impacts of the earthquake and tsunami on national growth, unemployment and balance of payments.

The last block seeks to draw lessons and guidance from the damage and loss assessment for the rehabilitation and reconstruction process. It begins with a chapter on **Disaster Preparedness and Mitigation** with recommendations in this area. The next chapter, **Moving Toward a Reconstruction Strategy**, reinforces key Government principles for reconstruction and recovery, and makes specific recommendations for this process.

The Disaster

THE DISASTER

We were terrified. Then the sea became very strange, with the water receding over 200 metres. Suddenly we saw that fish had been left on the beach, and some people were happy at their luck at finding them. They tried to gather them up, but then we saw a huge wave coming, and people tried to run and save themselves. But many people died because they were not fast enough. It was particularly bad for the children. All of the children in this village have died. About half of the 300 people from the village are gone.

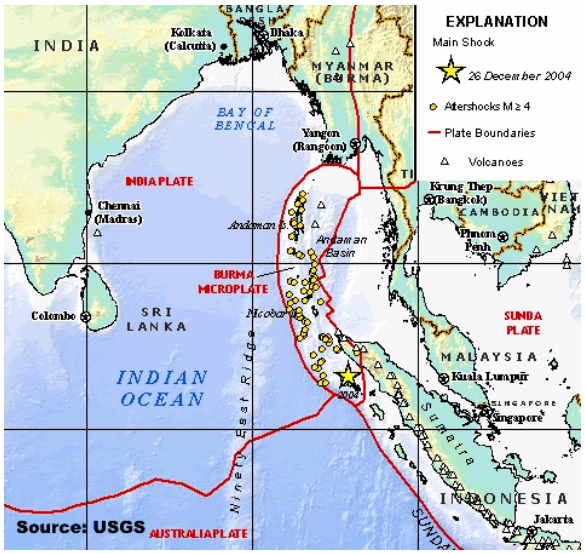
Two men from Alu Naga village, a traditional settlement right on the beach next to the estuary. The remaining half kilometer to Alu Naga has been wrecked and is only usable by foot with some considerable difficulty.

THE EARTHQUAKE

Millions of Indonesian lives were about to change abruptly soon after 8am on Sunday morning, December 26, 2004, when the largest earthquake in 40 years shook Northern Sumatra.

The United States Geological Survey[1] measured the earthquake at 9.0 on the Richter scale, making it one of the largest recorded[2]. The epicenter was some 150 kilometers south of Meulaboh and about 250 kilometers from Banda Aceh, the capital of Aceh province. The earthquake originated at a shallow point, some 30 kilometers below the Indian Ocean. In terms of energy released, it is the worst natural event in Indonesia since the eruption of Krakatoa in 1883, according to the Badan Meteorologi dan Geofisika (BMG or the National Meteorology and Geophysics Agency).

Map 2.1 The December 26, 2004 Earthquake



The earthquake was a megathrust event, where one tectonic plate subducts beneath another. In this case, the quake occurred along the boundary of the India and Burma plates, along the Sunda Trench. The India plate moves an average of 6 centimeters per year in relation to the Burma plate, and generates strike-slip faulting several hundred kilometers east of the Sunda Trench (see map 2.1 left). Many strong aftershocks followed the initial earthquake. Analyses of their characteristics indicate that nearly 1200 kilometers of the plate boundary fractured and slipped, with a likely width of more than 100 kilometers and a displacement of about 15 meters.

[1] See hhtp://neic.usgs.gov/neis/

[2] The following are the largest measured earthquakes: Valdivia, Chile, 1960, magnitude 9.5; Prince Williams Sound, Alaska, 1964, magnitude 9.2; Andreanof Islands, Alaska, 1957, magnitude 9.1; and Kamchatka, 1952, magnitude 9.0

THE TSUNAMI

The earthquake generated a large tsunami that traveled rapidly throughout the Indian Ocean, striking beachfront areas in many countries with catastrophic results in Indonesia, Thailand, Sri Lanka, India and Bangladesh, as well as other Asian and East African countries. More than 150,000 people died with many more still missing, while infrastructure, productive activities and the natural environment were either destroyed or damaged.

The tsunami traveled at high speeds. BMG estimates the tsunami took 45 minutes to reach places 120 kilometers from the epicenter; in 2 hours, it had traveled 1000 kilometers.[3] Without effective early warning systems, people were unaware of the incoming tsunami, and the death toll was extremely high as a result, as shown in Table 2.1.

Table 2.1 Human Toll in the Asian Earthquake and Tsunami in 2004[4]

Continent and Country	Deaths	Missing	Displaced
Asia	**157,314**	**27,303**	**1,162,006**
Indonesia	110,229	12,132	703,518[5]
Sri Lanka	30,899	6,034	425,620
India	10,672	5,711	NA
Thailand	5,303	3,396	NA
Maldives Is.	81	21	21,663
Malaysia	68	6	8,000
Myanmar	59	3	3,205
Seychelles	3	NA	NA
Africa	**150**		**5,000**
Somalia	150	NA	5,000
Total	**157,464**	**27,303**	**1,167,006**

Records show the earthquake and associated tsunami is the second most lethal event of its kind after the 1976 Tangshan earthquake in China that killed an estimated 255,000 people.

[3] Personal communication from the Director, Badan Meteorologi dan Geofisika, Jakarta, 9 January 2004.
[4] Regional overview data shown up to 14 January 2005. Source: UN/OCHA Reliefweb.
[5] UN/OCHA situation report, January 17, 2005 indicates the IDP estimate may be reduced by around 100,000 to 603,518 people

Box 2.1 Other Notable Tsunami

July 17, 1998: An offshore quake triggers a wave that strikes the north coast of Papua-New Guinea, killing some 2,000 people and leaving thousands more homeless.

August 16, 1976: A tsunami kills more than 5,000 people in the Moro Gulf region of the Philippines.

March 28, 1964: The Good Friday earthquake in Alaska sends out a wave swamping much of the Alaskan coast and destroying three villages. The wave kills 107 people in Alaska, four in Oregon and 11 in California as it sweeps down the US West Coast.

May 22, 1960: A wave reported as up to 35 feet high kills 1,000 people in Chile and causes damage in Hawaii, where 61 people die, and in the Philippines, Okinawa and Japan as it sweeps across the Pacific.

April 1, 1946: An Alaskan quake generates a tsunami that destroys North Cape Lighthouse, killing five. Hours later the wave arrives at Hilo, Hawaii, killing 159 people and doing millions of dollars in damage.

January 31, 1906: A devastating offshore quake submerges part of Tumaco, Colombia, and washes away every house on the coast between Rioverde, Ecuador, and Micay, Colombia. Death toll estimated at 500 to 1,500 people.

June 15, 1896: The Sanriku tsunami strikes Japan without warning. A wave estimated at more than 70 feet high hits a crowd gathered to celebrate a religious festival, killing more than 26,000 people.

August 27, 1883: The eruption of the volcano Krakatau (also spelled Krakatoa) generates a massive wave that sweeps over the shores of nearby Java and Sumatra, killing 36,000 people.

INDONESIA'S DEVASTATION

In many of Aceh's coastal towns, people had rushed out of buildings after the earthquake and were trying to help victims buried under the rubble. They were caught by the tsunami as the wave poured through the streets. As a result of the earthquake and tsunami, approximately 110,000 people died in Indonesia. The worst affected areas were Banda Aceh, the capital of Aceh province, and the north-west coast and islands off the coast, where hundreds of villages remain isolated and cut off from land transport and communication. Many buildings and infrastructure collapsed or failed due to the quake, and there is some evidence of land subsidence in coastal areas. The ensuing tsunami swept debris and sea water into homes and buildings up to 5 kilometers inland, crushing them and further damaging roads, bridges,

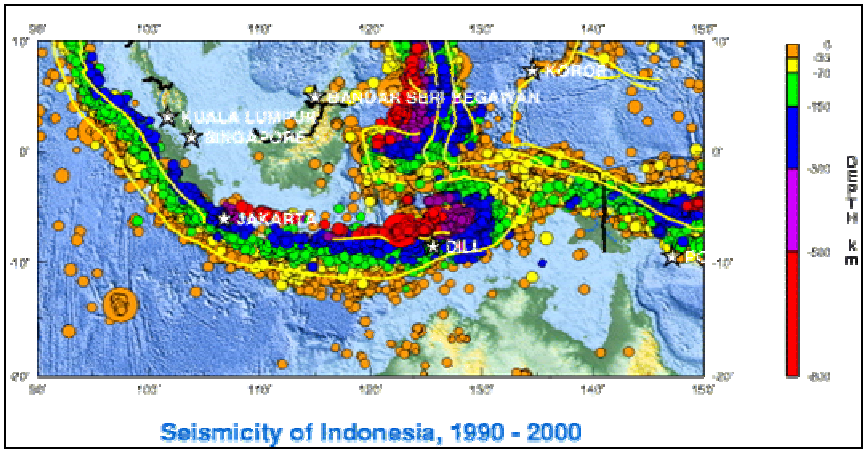
telecommunications, water and electricity systems, crops, irrigation, fishery infrastructure, food and fuel outlets. It is estimated that as many as 2.0 million people are in need as a result of the wider impact of the disaster[6].

The map below shows the areas affected in Nanggroe Aceh Darussalam (NAD) and North Sumatra (Sumut) provinces.

Map 2.2. Coastal Areas in Aceh and North Sumatra Provinces (Areas Affected)

The December 26 event is not an isolated one for Indonesia, the region has a high frequency of seismic events, as seen in the following map. Earthquakes of the size of the December 26 disaster are rare, but Indonesia has had many smaller earthquakes.

Map 2.3 Past Earthquakes in Indonesia



The extent of the devastation caused in the cities of Banda Aceh and Meulaboh can be seen in the satellite and other photos in the technical annexes.

[6] United Nations, Indian Ocean Earthquake-Tsunami 2005 Flash Appeal.

The Human Toll

THE HUMAN TOLL

There were about 2000 people living in my neighborhood. I am told that only 350 have been found alive. Some are at Mata Ai, some at the airport. This area had a mixture of people – university lecturers, teachers, government workers and drivers like me. When we managed to get back, we found a lot of bodies. I knew every one of them.

From Ujung Punge

PEOPLE DEAD, MISSING OR DISPLACED

An enormous media blitz has shown just how hard this disaster hit Indonesia in terms of death and destruction. The greatest human loss is due to the massive tsunami that swept away and killed tens of thousands of people living on the coast, particularly in Aceh province but hitting North Sumatra as well. Estimated figures for the death toll are 110,229 people in Aceh and North Sumatra (Dept. of Social Affairs Data), with around 12,000 people reported missing. According to the Government, more than 600,000[7] Internally Displaced Persons (IDPs) are living in temporary shelters and camps within Aceh and North Sumatra. This figure is incomplete as not all IDPs have been accounted for. However, it does represent a minimum figure of those displaced and needing assistance. Most IDPs have so far been reported in the area around Banda Aceh, with other large concentrations around and to the north of Meulaboh. Lack of information on the population along the west coast suggests this number might rise. Local NGOs also report IDPs living in private houses, many of whom are not receiving aid due to the difficulties in identification and targeting.

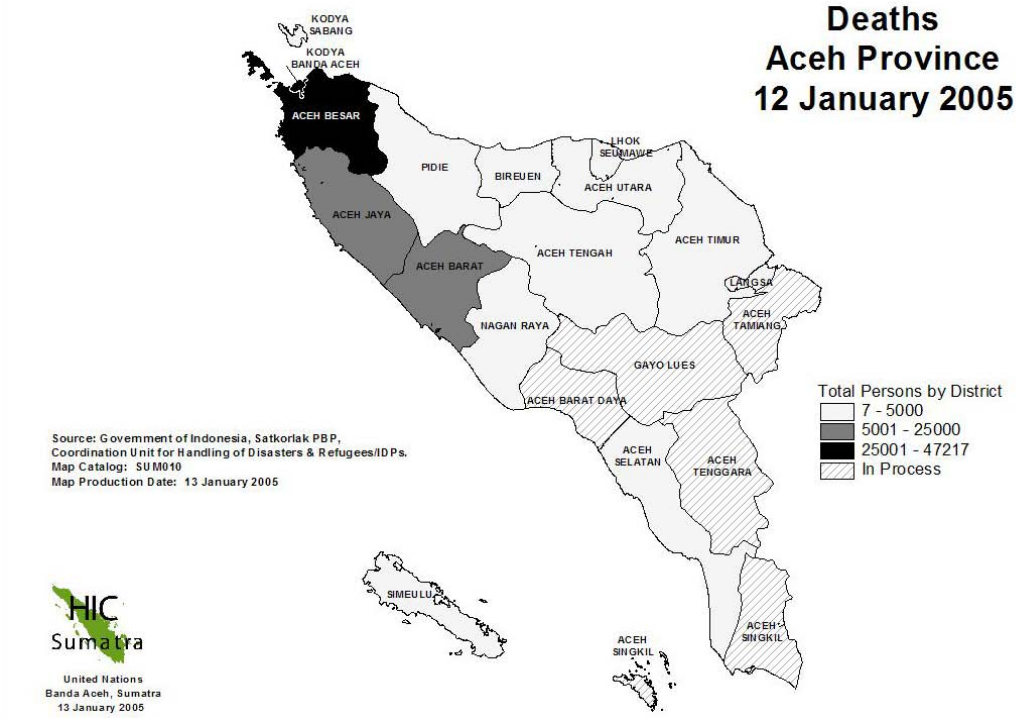
The west and north-west parts of Aceh were the most heavily hit by the tsunami which followed the earthquake. The human toll is highest in Banda Aceh and the nearby districts of Aceh Besar and Aceh Jaya (see Map 3.1). Lack of access means data is still unreliable for many areas, including the capital of West Aceh, Meulaboh. Areas such as East Aceh, Nagan Raya, North Aceh, Pidie and Bireuen may not have been heavily affected in terms of deaths and property damage but have received an influx of tens of thousands of IDPs from surrounding districts.

IDPs have gathered in over 430 locations in Banda Aceh, Aceh Besar and Pidie alone, including in mosques, meunasahs, campus and government buildings and IDP camps – detailed data is not yet in for other districts. Many assessments are presently being carried out in terms of the composition of those who survived. There is as yet, for example, no specific data on the number of women and children IDPs.

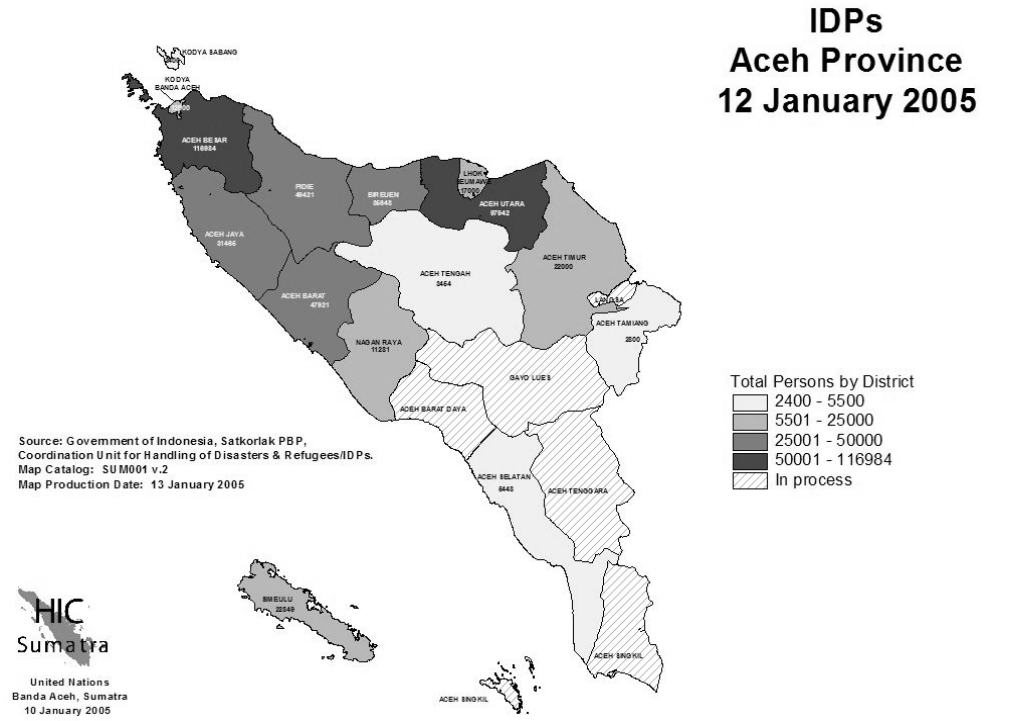
The affected communities are highly vulnerable to disease and mental health problems; they lack basic medical attention, clean water, food and access to sanitation. Service provision, schooling, business and trade are running at minimum levels. Many inhabitants of Banda Aceh, Lhokseumawe, Aceh Jaya, West Aceh, Nagan Raya, Central Aceh, Gayo Luwes, Singkil, and North Aceh are living in IDP temporary sites and makeshift shelters (see Map 3.2). Many survivors are suffering psychological trauma and acute shock from their loss and the sight of so many scattered bodies.

[7] UN/OCHA situation report, January 17, 2005

Map 3.1 Deaths in Aceh



Map 3.2 IDPs in Aceh



THE RESPONSE

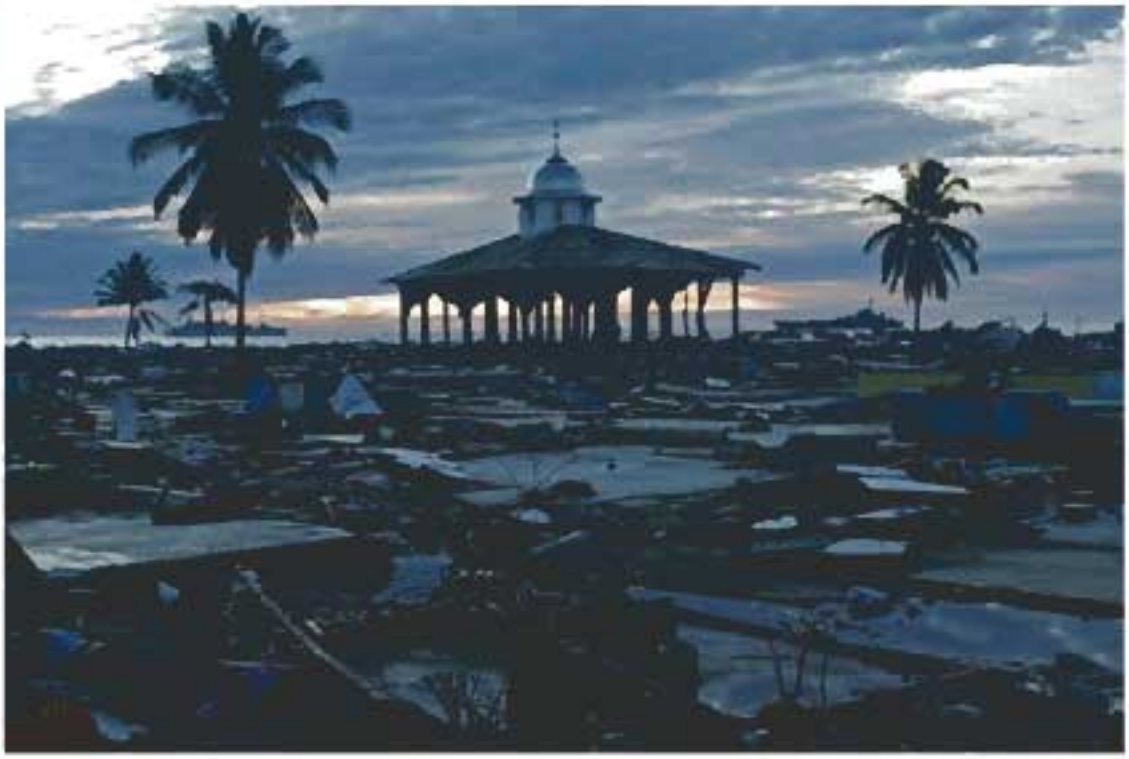
President Susilo Bambang Yudhoyono immediately declared this a national disaster and ordered his Ministers to provide emergency relief, including medical assistance, shelter, food and blankets.

The Indonesian public responded with an unprecedented outpouring of cash and goods donations. Scores of people lined up to volunteer and provide support to the relief effort. Cash and in-kind donations for Aceh came in from across the country. Parliamentarians gave their salary to the cause. Pedicab drivers donated their daily wages. Employees gave a portion of their annual bonus. Doctors and engineers lent their talents. Corporations gave out cash and in-kind contributions. Airlines provided free cargo space for transporting relief. TV stations staged impromptu telethons to raise donations - one television-based appeal raised over $13 million in donations. Other examples, such as the district government of Banyumas, East Java, which raised $16,667 and the Indonesian Students' Association in Germany, which raised $78,637, show how this disaster has touched all Indonesians.

The international reaction to the disaster was generous, and plans for the large-scale rescue and relief operation were underway by the end of week one. Personnel from at least 13 countries provided immediate assistance in terms of labor, transport and medical facilities. A total of $738 million was raised in the UN Flash appeal for a total request of $977 million for immediate relief efforts. Of this total request, $474 million is earmarked for Indonesia.

The extremely generous contributions from countries around the world take the form of government pledges, corporate contributions and donations from private citizens to charitable organizations. Foreign government pledges in response to the disaster have been significant, exceeding $5 billion, while more pledges are being made. How this money will be divided between the massive relief effort and the reconstruction effort is not yet clear. Nor is it clear how much will be directed through the Indonesian Government's budget. A rough estimate based on early specific country-specific pledges, and the UN Flash Appeal, is that more than half of total regional pledges would be allocated for Indonesia.

The Special Context of Aceh and North Sumatra



THE CONTEXT: ACEH AND NORTH SUMATRA

Every time the children hear a rumbling sound they cower. They don't want to go anywhere at present. But we have got nothing; no spare clothes. And to make things worse a police friend of ours was killed up in the hills last Sunday.

Woman temporarily staying in PKK building, Djanto

Aceh and North Sumatra provinces were affected directly by the earthquake and tsunami. While some kabupaten in North Sumatra were affected, and one in particular, the devastation was far greater in Aceh, where 14 out of 21 kabupaten were significantly damaged.

NORTH SUMATRA – NIAS DISTRICT

Outside Java**,** North Sumatra is the most populous province, with 5.53% of the total population of Indonesia. With its 2003 regional GDP of Rp. 96.2 trillion, North Sumatra is also the largest economy off Java after East Kalimantan. Agriculture, especially estate crops is the dominant sector of North Sumatra's economy, followed by manufacturing.

Out of the 20 kabupaten and kotamadya of North Sumatra, Nias is the most affected district. The total population of Nias is 711,661. This district incurred about 216 casualties and 20% of the district's area was damaged. The population is relatively young, with 42% of the population aged less than 15 and 61% of the population less than 26. Nias is the poorest kabupaten in North Sumatra with a share of only 4.43% of regional GDP. About 45% of household heads in Nias have a primary school certificate as their final educational attainment. The reported net enrollment rates in the affected areas of Nias are lower than in Aceh, and lower than the average Indonesian enrollment rate for primary school (92.2%), junior secondary school (58.2%) and senior secondary school (32.6%).

ACEH SOCIO-ECONOMIC BACKGROUND

As Aceh is by far the province most affected by the disaster, most of this chapter concentrates on giving a picture of the socio-economic context of Aceh.

GEOGRAPHY AND POPULATION

Aceh is at the western-most tip of Indonesia. The total population of Aceh is 4.4 million, and the province is divided into 17 kabupaten (regencies) and 4 kota (municipalities). See Table 4.1 below.

Table 4.1 Geography and Population

		Indonesia	Aceh	% of Indonesia
Area (km2)		1,890,754	51937	2.7%
Number of regencies (kabupaten)	2003	348	17	4.9%
Number of municipalities (kota)	2003	92	4	4.3%
Number of sub districts (kecamatan)	2003	4994	227	4.5%
Number of villages (desa)	2003	70921	5947	8.4%
Population (million)	2003	218.6	4.4	2.0%
Number of households (thousands)	2003	56623	1004	1.8%

Source. BPS, World Bank staff calculations

The population in the province of Aceh affected by the disaster is estimated to be around 2.8 million people. A quarter of the affected areas are urban and the remaining 75% are rural. In Aceh, the affected areas with the largest number of inhabitants are Bireuen (pop. 348,000) North Aceh (pop. 328,500), East Aceh (pop 292,000) and Banda Aceh (pop 239,000). These areas had a young population with those older than 55 constituting only 8% of the population of the province. Children younger than 15 make up a third of the population while 55% of the population is younger than 26.

CONFLICT

Aceh has experienced two decades of continued, albeit low-intensity, conflict in the province. The conflict has taken the lives of some 10,000 people, and led to the destruction of infrastructure and basic services such as health and education. This natural disaster came at a time when the Indonesian Government has scaled-down martial law status in Aceh to that of a civil emergency status.

It is estimated that 35,000 people, predominantly women, children and the aged, had already been displaced by the conflict. Some of those displaced have also been affected by the tsunami (many conflict IDPs are from West Sumatra, one of the areas most heavily hit by the tsunami).

ECONOMY

Oil and gas production is important for the economy of Aceh, accounting for 43% of regional GDP in 2003, see Table 4.2 below. In 2003, Aceh's nominal GDP was Rp.38.6 trillion (about $4.5 billion), 2.3% of national GDP. Aceh's real GDP growth rate in 2003 was 3.4%, about 1 percentage point below the national growth rate at 4.3%[8].

[8] 1993 base GDP, regional accounts are not updated to the latest 2000 base GDP.

Table 4.2 Economic Structure of Aceh in 2003 (Share in total GDP, nominal, %) - Production Account

	National		Aceh		
	Share in GDP (%)	Rp. Trillion	Share in GDP (%)	Rp. Trillion	Share in national GDP (%)
GDP	100.0	1,786.7	100.0	38.6	2.3
o/w oil and gas	10.7	1,594.9	43.0	16.6	1.0
o/w Non-oil and gas	89.3	191.7	57.0	22.0	11.5
Agriculture	16.6	296.2	32.2	12.4	4.2
Mining	10.7	191.2	28.8	10.8	5.7
Manufacturing	24.7	440.5	21.2	8.2	1.9
o/w oil and gas	3.8	68.1	15.6	6.0	8.8
o/w non-oil and gas	20.8	372.3	5.6	2.2	0.6
Utility	2.2	39.7	0.3	0.1	0.3
Construction	6.0	107.1	2.7	1.0	1.0
Trade	16.3	291.6	6.4	2.5	0.8
Transportation & Communication	6.3	111.7	5.1	2.0	1.8
Finance	6.9	123.0	1.2	0.5	0.4
Services	10.4	185.7	2.9	1.1	0.6

Note. National GDP is not equal to the aggregate number of regional GDP due to technical issues. 1993 base GDP
Source. CEIC, World Bank staff calculation

On a sectoral basis, outside of oil and gas, agriculture has the largest share of GDP at 32%. In agriculture, livestock (10%) and food crops (10%) have the largest shares. Almost half the people in Aceh (47.6%) are employed in agriculture.

Together with the eastern-most province of Papua, Aceh has special autonomy status. Because of this status, Aceh has been granted a greater share of revenue from its natural resources, including oil and gas, compared to other provinces (with the exception of Papua).

In Indonesia the normal net revenue sharing with provinces for oil is 15% of the revenue generated, but on top of this Aceh receives an additional 55% of the net revenue until 2009 (after this the additional net revenue will be reduced to 35%). For gas, normal provincial revenue sharing is 30% of net revenue generated, but Aceh receives an additional 40% of the net revenue until 2009 (additional net revenue then declining to 20%). Because regional and local governments in the province received revenue sharing from Aceh's gas wealth (in addition to the block grant transfer from central government), the combined budget of Aceh's provincial and district governments grew six times between 2000 and 2002.

Because of its natural resources, Aceh is not a poor province (see Table 4.3 below). GDP per capita in 2003 was above the national average at Rp. 8.7 million compared to Rp. 7.9 million. However, GDP growth was below the national level.

Table 4.3 Regional Gross Domestic Products and Price

		Indonesia	Aceh	% of Indonesia
GDP (93 base, rupiah trillion, nominal)	2003	1,709	39	2.3
US$ billion	2003	199.2	4.5	-
Per capita GDP (Rp. Million)	2003	7.8	8.7	-
Real GDP growth rate (93 base)	2003	4.1%	3.4%	-
CPI growth rate (average)	2003	6.6%	6.0%	-

Source. BPS, CEIC, World Bank staff calculation

Unemployment in Aceh was already higher before the disaster than the national average – see Table 4.4 below. Of the labor force in Aceh of 2.3 million people, approximately 300,000 were unemployed, an unemployment rate of 11.2% compared to the national average of 9.5%.

4.4 Labor Markets

		Indonesia	Aceh	% of Indonesia
Employment in million	2003	90.8	2.3	2.5%
Unemployment in million	2003	9.5	0.3	3.0%
Unemployment Rate in	2003	9.5%	11.2%	-
Minimum Wages (Rp. Thousands) 1/ The figure used for Indonesia's minimum wage is in Jakarta	2004	671	550	82.0%

Source. BPS, CEIC, World Bank staff calculation

The conflict has exacerbated the main woes faced by businesspeople in Aceh – lack of security, poor infrastructure, lack of access to bank credit and an unresponsive provincial government. A decline in manufacturing and drying up of investment in the oil and gas sector has led to the increase in the relative importance of agriculture to Aceh's economy. Between 1997 and 2001 the province accounted for only 2% of Indonesia's approved non-oil and gas investment and only 1.78% of approved oil and gas investment. Economic output in Aceh declined 20% during this period.

SOCIAL CONDITIONS AND SERVICE DELIVERY

Poverty in Aceh is severe among those directly affected by the long-running conflict, such as widows and internally displaced people. However, poverty comprises many other aspects than just consumption, and it is in these areas that Aceh faces the greatest challenges. For example, because of the conflict there is a large gap between how social services are delivered in urban areas compared with remote areas, where public health and education services are of lower quality due to poor infrastructure and the difficulty of attracting staff. The result is low school attendance and low coverage of public health programs.

Table 4.5 Social Indicators

		Indonesia	Aceh	% of Indonesia
Number of schools (primary, junior high and high)	2002/03	175,006	3,610	2.1%
Number of teachers (primary, junior high and high)	2002/03	1,903,052	45,650	2.4%
Number of students (primary, junior high and high)	2002/03	36,509,898	776,601	2.1%
Number of hospitals	2002	1,215	26	2.1%
Number of beds	2002	130,214	2,228	1.7%
Number of public health center (puskesmas)	2002	7,309	230	3.1%
Number of doctors	2001	26.917	567	2.1%

Source. BPS

Social indicators for Aceh (see Table 4.5 above) are not alarmingly low compared to the national average. However, although the province's proportion of doctors and hospital beds exceeds the national average, infant immunization rates and antenatal care still lag behind. Although fewer health facilities than schools have been damaged in the conflict, access to health services, especially at subdistrict and village community level, has declined due to security concerns of staff and patients. Aceh has no lack of health personnel, but health personnel often refuse to work in rural areas. The declining coverage of essential preventive programs, including immunization and maternal care, is in fact threatening the health status of the people in Aceh.

The conflict has also had a powerful impact on schooling. Since 1998 more than 900 schools have been destroyed or seriously damaged. Damage almost always includes loss of equipment and textbooks. Before the imposition of martial law, school enrollment rates in Aceh were similar to national rates, however actual daily participation rates were and continue to be much lower. Teacher attendance is poor and there has been a considerable outflow of teachers over the recent conflict period. In light of the above, there can be little doubt that the overall quality of schooling across the province has declined.

The operations of justice institutions in Aceh have been seriously compromised. Over the course of the last five years, numerous courts and prosecutors offices have been destroyed and many others have closed, mainly as a result of intimidation and attacks on staff and infrastructure. The justice system has by now virtually collapsed due to the ongoing conflict and institutional failure, and corruption is often accompanied by violence because of an added element of impunity caused by the conflict-specific circumstances. Recently the Governor was arrested on suspicion of embezzling Rp. 4.2 billion in state funds. While this signifies the will to fight corruption, it is unlikely this will have a pronounced effect on smaller-scale corruption in the province.

INFRASTRUCTURE

The relatively poor state of Aceh's power, transportation and irrigation networks is a daily reminder of the lack of economic development in the province despite its abundance of natural resources. These deficiencies touch the vast majority of Aceh's population.

Though 94% of Aceh's approximately 5500 villages have been electrified, only about 60% of the province's households have access to electricity and power cuts are common. There is insufficient power generation and transmission capacity in Aceh as its power system was built as an integral part of the North Sumatra power system, where most of the larger power plants that supply Aceh are located. Most power in Aceh is supplied either from North Sumatra or by small diesel-powered generators. The system is fragmented and lacks economies of scale.

During the conflict, bus burning and widespread extortion on Aceh's roads has raised transaction costs for transport in the province. Bus transport is extremely important due to the low level of motorization. Unbalanced road development, poor conditions of kabupaten roads, and an insufficient budget for road maintenance have led to high costs for both passengers and goods, and for both private and public transport.

Assessment of Damage and Losses

ASSESSMENT OF DAMAGE AND LOSSES

Our rice fields have been badly damaged. I don't think we will be able to plant for the next three years. But we do get river floods every year here during the rainy season so maybe this will help to flush out the salt water.

Village head for one of the Lembaruku villages. This location is some four kilometers from the sea but it was evident that the tsunami had reached this far by traveling up the river valley.

There are people here from lots of different villages. Many of the village heads have died, and their offices, the sub-district facilities are all gone. But we have organized spokespersons for each village represented in this camp.

Temporary camp is in the grounds of a mosque, Banda Aceh

INTRODUCTION

The damage and losses assessment that follows is intended to provide a preliminary assessment of the impact caused by the earthquake and tsunami in Aceh and North Sumatra. This assessment was made under the standard internationally accepted methodology developed by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC).[9] Its conceptual basis is a stock/flow analysis that evaluates effects on: (i) physical assets that will have to be repaired, restored or replaced or discounted in the future and (ii) flows that that will not be produced until the asset is repaired or rebuilt. Damage (direct impact) refers to the impact on assets, stock, property, valued at agreed replacement (as opposed to reconstruction) unit prices, considering the level of damage, i.e., whether an asset can be rehabilitated or repaired, or has been completely destroyed. Losses (indirect impact) refer to flows that will be affected, such as revenue, public and private expenditure, etc. over the time period until the assets are recovered. These are quantified as present values.

Damage and losses are estimated on a sector-by-sector basis recording and gathering information in as detailed form as possible ensuring consistency, non duplication and comparability and additionality of sector by sector quantifications. The short time available for this assessment and the fact it was undertaken while the emergency and humanitarian assistance is still taking place implies that more detailed assessments will be necessary, although the present preliminary estimates seem to largely reflect the impact. It is clear that, once the rehabilitation and reconstruction strategies and processes are initiated, the actual reconstruction needs will differ from this damage and loss assessment. Damage and losses have been distinguished between the public and private sector, identifying their national or external components such as reduced exports, increased imports, external transfers, national payments as generated by increased debt if this is required for reconstruction.

The end product presented here is a consolidated summary of damage and losses that provides the extent and breadth of the disaster's impact, in quantitative, sector by sector, and as geographically specific and stratified by affected groups as possible, stemming from information compiled immediately after the event. It should not be considered a definitive assessment, but rather a preliminary undertaking, compiled in a timely manner. This quantification allows two further results: to determine relative size of impacts on relevant economic variables (by use of macroeconomic analysis and scenario modeling under different assumptions for the reconstruction program and needs); and on the resource gap that these reconstruction scenarios pose to the Government and to the affected population.

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[9] See *Handbook for the evaluation of the socioeconomic and environmental impact of disasters* (LC/MEX/G.5, July 2003), available at the www.eclac.cl/mexico, ("desastres")
http://www.worldbank.org/hazards/knowledge/other_res.htm, and
http://www.proventionconsortium.org/toolkit.htm websites

At this stage, the assessment gives decision-makers and stakeholders a quantitative basis to elicit recovery funding assistance, and design a reconstruction strategy. The quantification, given its sector-by-sector nature, allows for concrete, specific proposals for action in sector or geographic terms. It should also assist in determining priorities (importance vs. urgency) and sequencing (timeline for reconstruction process), i.e. restore livelihood conditions while physical reconstruction of housing, production, infrastructure proceed.

The process followed was one of consultation and joint work between the Bank's team and the Government, namely through Bappenas, consulting line ministries and with the support and information also provided by international agencies, donors and other parties involved in the emergency and immediate rehabilitation phase. Teams were established to collect, organize and analyze the necessary sector-by-sector information, from profiling existing baseline to superimposing damage and losses with systematic approach. These teams were both multidisciplinary and inter-institutional, with clearly designated focal points to compile and present the data in a comparable manner –so that they can be summarized and factored into a macroeconomic scenario exercise. Common terms of reference were applied in all sectors. Additionally, the cross-cutting themes of regional governance and environmental impact were also assessed in this fashion. The summary of damage and losses was also provided to the global analysts (e.g. macroeconomist) in order to have a preliminary look at the potential negative impact of the disaster in contrast to the expected non-disaster trend.

SUMMARY

It has been possible to determine the total impact of the disaster on the society, economy and environment of Indonesia and the affected area, based on the individual assessment of the sectors presented here and taking into consideration the limitations of the available information. The results of the assessment are described below.

In addition to the death of some 110,000 people due to the combined action of the earthquake and the tsunami, the analysis reveals that the total impact of the disaster has an estimated monetary value of Rp. 41.4 trillion. This amount includes both the value of the damage to assets (Rp. 27.2 trillion or 63% of the total impact) and the losses in future flows of the economy (Rp. 14.2 trillion or 37% of the total) in the next four years. The first component – the damage – provides both an idea of the destruction of the assets in the country as well as a baseline for defining the program of reconstruction. The amount of losses will directly impinge on the future economic performance of the country and the affected area.[10]

[10] The breakdown of total impact into its damage and loss components for the Indonesia disaster is consistent with the expected structure of damage and losses arising from disasters caused by natural

The magnitude of the disaster can be visualized by pointing out that the total amount of damage and losses is equivalent to 2.2% of the gross domestic product of Indonesia. Such a figure is considered moderately low for an economy the size of Indonesia's and gives assurances that, with the adoption of adequate strategies for reconstruction, the country should be able to overcome the negative impact of the disaster[11]. When the effect of the disaster is compared with Aceh's economy, however, the situation is entirely different. The ratio of total damage and losses to provincial GDP is just about 100%, which would indicate that Aceh will require substantial support, as its own internal resources would not be sufficient to face recovery on its own.

Of special relevance is the fact that, of the total amount of damage and losses, 78% (Rp. 32.4 trillion) were sustained by the private sector, while only 22% (Rp. 9.0 trillion) affects the public sector. While this comparison gives a measure of the relative effort that each sector would be expected to assign, the government may have to increase its proportion in the reconstruction efforts in order to assist the most affected individuals, which in many instances coincide with those of the lower income strata.

Table 5.1. Summary of Estimated Impact of the December 2004 in Indonesia (Billion Rupiah)

	Total Impact			Property	
	Damage	Losses	Total	Private	Public
Social Sectors	**15577**	**612**	**16189**	**13398**	**2791**
Housing	13004	361	13365	13098	94
Education	1030	164	1194	84	1110
Health	767	87	854	216	622
Culture and religion	776		776	0	776
Infrastructure	**5915**	**2239**	**8154**	**3031**	**5122**
Transport	3632	1352	4984	1542	3442
Communications	176	27	203	80	123
Energy	631	1	632	10	622
Water and Sanitation	247	30	277	170	106
Flood control, irrigation works	1229	829	2058	1229	829
Productive Sectors	**3273**	**7721**	**10994**	**10528**	**466**
Agriculture and Livestock	615	1105	1720	1490	230
Fisheries	944	3807	4751	4729	23
Industry and Trade	1549	2604	4153	3988	165
Cross sectoral	**2346**	**3718**	**6064**	**5235**	**829**
Environment	1437	3668	5105	5105	
Governance and administration	779	50	829		829
Bank and Finance	130		130	130	
Total Impact	27161	14240	41401	32192	9208

phenomena of geological origin in other parts of the world: i.e. a high proportion of destruction of assets and a lower amount of losses in economic flows.

[11] The international experience indicates that when the impact/GDP ratio exceeds 8%, the magnitude is considered moderate, and that when it exceeds 40%, the affected economy will likely face significant difficulties to recover.

The most affected sectors – that will deserve higher priority in the reconstruction – can be identified through the analysis of the following information on sectoral damage and losses:

A further breakdown to identify specific individual sectors reveals that housing, both urban and rural, was the single most affected one (Rp. 13 trillion or 32% of the total), followed by agriculture and fishery (about Rp. 6.8 trillion), industry and trade (Rp. 4.1 trillion) and transport (Rp. 5 trillion). This is of special relevance since it reveals the amounts of the special and urgent needs of housing, means of production in agriculture, fishery and micro to medium-size businesses; that the essential social and economic infrastructure requires immediate replacement. Many environmental services will not be available until environmental assets are restored by nature. (see Table 5.1).

While the figures above described are a reflection of the value of lost and damaged assets and changes in economic flows, they provide a measure of the efforts that will be required for the reconstruction. From the analysis, it can be seen that the private sector will have to concentrate considerable resources for restoring its assets and losses – in the housing, agriculture and fisheries, and industry and commerce sectors – and that the Government will have to focus on the reconstruction of the physical and social infrastructure (education, health, water supply and energy utilities, transport, flood control and irrigation works and the facilities for administration). Furthermore, the Government may have to assist the most affected private individuals in the reconstruction of their housing and in the restoration of its means of production and income (see Table 5.1).

The issue of the removal and disposal of the rubble and debris arising from the disaster and from the demolition of buildings deserves special mention, as the amounts involved are of a significant magnitude (in the order of 12% to 15% of the value of total assets destroyed, depending on the sector). The collection and temporary storage of these large volumes of material might be used as means of providing temporary employment to the affected people, but decisions on the ways to finally dispose the material must be adopted after careful study and consideration to avoid further damage to the environment.

With regard to the impact of the disaster on some of the macroeconomic variables, it should be pointed out that replacement of the assets that were destroyed or damaged will require imports of about Rp. 3.8 trillion over the period of reconstruction, which will be reflected in the balance of payments of the country. These increased imports may be offset by the amounts of foreign financing that are likely to be assigned for the reconstruction program. In addition, the emergency and humanitarian assistance provided to the survivors will have an effect on the fiscal budget, albeit of minor significance in view of the size of the relief and emergency assistance received from the international community. Once the strategy for financing reconstruction has been defined, the fiscal implications to the country can be estimated but they are expected to be minor.

SOCIAL SECTORS

The local mosque is helping us, and so is the local police station. But we are carpenters, masons and drivers, and none of us can work now. Even though we still have our house, in a way we are all refugees too.

Middle-aged man on the beach road in Banda Aceh

The damage and loss assessment for the social sectors covers housing, education and health services and the places of worship. The impact of the earthquake and tsunami has impacted the social sectors most extensively through the destruction of housing. Housing damage is the largest item in the damage incurred after the tsunami within the social sectors and the private damage and losses in housing exceeds the costs incurred in all other sectors. The housing damage and losses add up to Rp. 13.4 trillion and this constitutes 32% of all damage and losses brought on by the disaster. This constitutes about 83% of the total damage and loss in the social sectors analyzed here. In the education sector the damage and losses add up to Rp. 1.2 billion and in the health sector to about Rp. 854 million. For the places of worship the damage estimate is around Rp. 776 million. While the education, health and religious services costs are brunt by the public sector, the overwhelming majority of the damage and losses in the social sectors is held by the private sector and directly impacts people's livelihoods.

Implications from the disaster for rehabilitation and reconstruction of the social sectors include:

- Devising housing rehabilitation in the affected areas will be one of the most urgent tasks in the reconstruction process. The affected area has to be cleared of debris before any reconstruction of housing can begin.
- Conflict over property rights may erupt if the strategy is not designed with proper care. This risk is even more increased by the fact that a lot of the documents for possession of houses have been destroyed by the tsunami. Care needs to be taken in getting official records from central or if possible provincial institutions.
- The type of houses varies quite a lot within and between regions and certainly correlates with wealth. Reconstruction strategies will face the dilemma of devising a scheme that provides uniformly similar houses to every one, or providing subsidy/grant so that those who want to rebuild their own house can do so.
- Schools need to be opened quickly, not only for normal academic or social reasons, but also to provide a focal point for children and introduce a degree of normalcy to a traumatized population. Efforts are needed to quickly rehabilitate slightly to moderately damaged facilities to lessen the pressure on emergency services.
- The loss and damage to a very large number of educational facilities necessitates a sector-wide strategy for provision of adequate schooling for the displaced and establishing a sustainable sector infrastructure.
- The loss of health facilities and staff in the worst-affected districts means that a new approach to the organization and delivery of health services will be needed. A part of this change will be providing health services to the large numbers of internally displaced

people in addition to the general population. Private providers will form an important part of this response and may require initial government assistance to reestablish their practices.

- It is well-known that natural disasters cause widespread mental stress and psychosocial trauma to which existing health services are not well-equipped to respond. Consequently, special provision will need to be made to rain staff and provide this service.

Table 5.2: Summary of Damage and Losses to Social Sector (billion Rp.)

	Damages	Losses	TOTAL	Private	Public
Housing	13,004	361	13,365	13,098	267
Education	1,030	164	1,194	84	1,111
Health	767	87	854	219	636
Religion and Culture	776		776	0	776
Total	15,578	612	16,190	13,400	2,790

A. HOUSING SECTOR

A.1 Pre-disaster situation

In Aceh about 90% of houses are classified in the semi-modern category with about 7% of houses being classified as traditional and 3% being classified as modern. Census data shows that about 83% of the residents owned their homes and about 8% have some form of rental agreement, with an additional 3% living in government-provided housing. While the overall rental figure is not very high, there are areas such as Banda Aceh where renters comprise almost 25% of the residents. Along with owners who suffered losses, the shelter needs of these groups would also have to be addressed in the rehabilitation and reconstruction process.

Based upon meetings with various officials, it appears that among those who claim ownership of their homes, before the tsunami, less than 10% were reportedly able to provide valid legal titles to their land. There are reports that this situation may be worse after the disaster since there has been substantial loss of land, many of the existing records have been destroyed, many owners may have perished and the water has washed away many boundary and other reference points. To the degree that land ownership issues are not satisfactorily resolved, this could create delays and higher cost in the reconstruction effort. There may be a need to seek some type of intermediate solution to any drawn-out judicial process. In this regard, the mechanism used under the ongoing Community Driven Development projects in Indonesia (e.g., KDP and UPP) may be one potential tool for getting community groups to come together and try to resolve ownership, boundary and similar disputes.

A.2 Damage assessment

Overall, it is estimated that about 19% of the approximately 820,000 building units (about 151,600 units) in the affected districts suffered an average of about 50% damage while about 14% (about 127,300) were completely destroyed. The damages were centered within a 3.2-6.4 kilometer zone along the coast; Kota Banda Aceh, Aceh Jaya, Aceh Besar, Kota Sabang and Aceh Jaya bearing the brunt of the disaster with damages of over 80% of their housing stocks.

It is estimated that North Sumatra and Aceh suffered damages and losses totaling about 13.4 trillion rupiah. In an effort to show how different income groups were affected, houses were classified as modern, semi-modern and traditional, in line with a similar categorization in the 2000 census. In terms of numbers, semi-modern and modern units appear to have suffered proportionately more than the traditional ones. The reason for this is not very clear; perhaps it could be because of the relatively richer residents living closer to the sea.

Data on insurance coverage are not readily available. However, since most of the units constructed in the country are generally self-financed, there is a low probability that the owners would have sought hazard insurance, a practice required more by banks which finance mortgages.

*Clean-up and debris removal and disposal***.** As part of the process of assisting residents to return to repair and rebuild, the affected area has to be cleared of debris, with services restored. Indications are that if the authorities could work with residents to salvage usable wood and other building material, this would be beneficial in several ways, e.g., in giving residents some income for the task, in helping to reduce the need for new material and in reducing the volume of debris to be collected and disposed of. Even though it appears that there may not be any serious bio-hazard or toxic material in the debris, the authorities would still need assistance in coordinating and managing the debris collection and disposal process.

*Temporary shelter***.** Details on the number of affected families living in temporary shelters are not available partly because of the ongoing relief activities and partly because of difficulty in the record-keeping process. Based upon estimates cited by various officials and the press, it appears that there are about 600,000 people who are currently housed in various formal and informal temporary shelters. The government and the UN Refugee agency (UNHCR) are currently discussing the provision of better temporary shelter facilities while the authorities finalize the rehabilitation and reconstruction plan. Care should be taken in this process and this approach will need to be carefully considered in view of historical evidence showing that such temporary facilities tend to become permanent ones, the possible impact upon future rehabilitation and reconstruction efforts, lost opportunities for revitalizing the local economy and limiting Acehnese involvement in the planning and implementation of the reconstruction program.

Table 5.3: Extent and Valuation of Damage and Losses - Housing Sector

Sub-Sector	Physical Impact			Impact Valuation				
Assets and Services	Base nr.	Damaged nr./%	Destroyed nr./%	Damage & Losses (IDR billion) Total	Damage	Losses	o/w Private	o/w foreign (IDR billion)
Modern Houses				804	793	12	788	161
House units	23,799	4,866	5,051		587			
Tertiary infrastructure		20%	21%		117			
Furniture					88			
Debris removal						1		
Temporary settlement						10		
Semi-modern Houses				12,021	11,694	327	11,781	2,404
House units	740,955	146,787	105,630		8,224			
Tertiary infrastructure		20%	14%		1,538			
Furniture					1,933			
Debris removal						33		
Temporary settlement						294		
Traditional Houses				540	517	22	529	108
House units	67,454	-	16,645		359			
Tertiary infrastructure		0%	25%		72			
Furniture					87			
Debris removal						2		
Temporary settlement						20		
Total	832,208	151,653	127,325	13,365	13,004	361	13,098	2,673

B. EDUCATION

B.1 Pre-disaster situation

Although the education sector has been severely impacted by the years of conflict in Aceh, broad indicators illustrate that overall performance more or less mirrors that of the nation. Illustrations of the impact of the civil conflict on schooling community abound: two days after the imposition of martial law on May 19, 2003, some 248 schools were burned, most of which were totally destroyed. The actions on that day alone seriously disrupted the schooling of over 60,000 students. Before the destruction of May 20, 2003, some 544 schools were torched in 2002. Reconstruction was sluggish and even by the time of the December 26 earthquake and subsequent tsunami many of the damaged schools had not been completely reconstructed and full sets of learning materials supplied. Thirty years of armed conflict across much of the region has of course affected not only students and their teachers: trauma levels are high among Aceh's populations in general.

Reported net enrollment rates (NER) for all levels of schooling, primary, junior secondary and secondary, are higher for the affected areas of Aceh than for Nias (in respect to education, the most effected district in North Sumatra) and are more-or-less reflective of the national average at the primary and junior secondary education and are about 5 percentage points higher for senior secondary. However, it is widely believed that these rates do not accurately reflect participation rates (i.e. the number of kids in actually in each classroom). Roughly 12% of Aceh households received financial support for schooling in the form of scholarship for students. The central government national scholarship

program reaches 6% of Acehnese households the remaining 6% of recipient families gain assistance from local government, foundations and religious institutions.

B.2 Damage assessment

Current estimates of the impact of the earthquake and tsunami are that as many as 45,000 students and 1,870 teachers were lost. Approximately 1,962 schools12 were destroyed or damaged in Aceh and 104 in Nias. This represents 28 of the stock in Aceh province and 20 of the stock in the district of Nias. In economic terms, the Bank currently estimates the value of damage across the sector at Rp. 1041 billion. Costs associated with providing temporary services are estimated at Rp. 166 billion. As the vast majority of schooling is financed by the state, only a small portion of the damages and losses are borne by the private sector. Table 5.4 below illustrates estimated damage by school type and management (Ministry of National Education or Ministry of Religious Affairs). Table 5.5 shows estimated additional inflicted costs. Table 5.6 illustrates estimated losses by sector (Public/Private). Annex II provides tables of estimates of damage by school type and management for both Aceh province and Nias district. In addition to the losses to schooling facilities, much of the local and provincial government infrastructure that supports service delivery has been damaged.

Emergency Services. Although the government has requested that efforts focus on ensuring that all children in Aceh are back in school by 26 January, it is unlikely to happen as some 100,000 children are in need of temporary schooling - for which UNICEF are providing emergency facilities, materials via some 2,000 one-classroom tents and 2,000 sets of school-in-a-box. Various agencies, including government, have begun the task of preparing temporary teachers for those temporary classrooms that can not be staffed by displaced teachers (about 4,800 teachers are among the IDPs).

Table 5.4: Damage by School Type in Education Sector (mil. Rp.)

Education Level	Number of Damaged Faciilities	Estimated costs of Damage (Rp. billion)
Preschools (TK + RA)	239	26,958
Primary Schools (SD + MI)	1,137	306,335
Junior Secondary Schools (SMP + MTs)	263	181,502
General Senior Secondary Schools (SMA + MA)	143	177,975
Vocational Senior Secondary Schools (SMK)	18	25,270
Pesantren	248	291,708
Higher Education Institutions	17	20,700
Total	2,065	1,030,448

[12] With respect to damages, the term 'schools' includes only formal institutions, public and private, state and religious. Some local government documents may confuse the reader in this regard as they refer only to lost madrasah. In Aceh all schools are formally called madrasah, regardless of their management.

Table 5.5: Estimated Losses in Education Sector (mil. Rp.)

Activities	Unit	No	Unit Cost (Rp. m)	Total
Recruiting New Teachers				
- Permanent replacement	Teachers	1,870	5	9,350
- Temporary replacement	Teachers	3,000	9.6	28,800
Training New Teachers				
- Permanent teachers	Teachers	1,870	5	9,350
- Temporary teachers	Teachers	3,000	2	6,000
Counseling for students and teachers	groups	1,300	15	19,500
Clean Up of Facilities	Buildings	2,000	20	40,000
Classrooms and offices	Tents	300	6	1,800
Water supply, sanitation	Units	150	8	1,200
Emergency support				
- Books & stationery	Sets	20,000	0.025	500
- Scholarships	students/yr	150,000	0.25	37,500
Administration Cost				10,000
Total				164,000

Table 5.6: Estimated Damages and Losses by Sector (millions of Rp.)

	Public	Private	Total
Damage	958,317	72,131	1,030,448
Losses	152,520	11,480	164,000
Total	1,110,837	83,611	1,194,448

C. HEALTH

C.1 Pre-disaster situation

Before the tsunami, the health status of people in Aceh was one of the lowest in the country. For example, there were high rates of severe undernutrition and infant mortality; utilization of health services was low compared to other parts of Indonesia and the rates of immunization and use of contraceptives by married women was low. There was limited access to water from improved sources and TB case finding and vector control were limited.

In addition, some health facilities had been destroyed or were in poor condition and the distribution of health staff was heavily skewed in favor of urban areas, as many staff fled from conflict areas to Banda Aceh and Aceh Besar. As a result, utilization of services was often low and many facilities were understaffed. Private health providers accounted for as much as one-third of all health services. Even though the number of hospital beds in Aceh is low relative to the population, their occupancy rate (in both public and private sectors) was less than 50% in most cases. The one exception was the mental hospital which has significantly more inmates than beds as many patients from conflict areas refuse to return home once their treatment is finished.

C.2 Damage assessment

Bank estimates of health sector damages due to the tsunami are summarized in Table 1. The tsunami resulted in the destruction of five hospitals (three public and two private, from a total of 17 public and 10 private hospitals). Nineteen health centers (of a total of 239) were destroyed; a further 11 health centers will require major renovation and two will require minor renovation. The losses were greatest in Kabupaten Aceh Jaya and Banda Aceh city.

The provincial health office will require major renovation. One kabupaten health office was destroyed and one will require major renovation. Two district laboratories were destroyed as was the port health facility. The health training complex in the province will require major renovation. Two drug warehouses will require major renovation and one will require minor renovation. As private medical practices are mostly in houses, damages to private practices in the health sector are assumed to be in proportion to housing losses giving an estimated 1,190 practises either heavily damaged or destroyed. The Bank also estimates that one-third of polindes and polyclinics were destroyed and another third will require major renovation.

These damages, together with their replacement costs are also shown in Table 5.7. The total damage is estimated at Rp. 767,4 billion. Teams from the MOH, WHO, CDC and others are currently carrying out further assessments and further results should be available in the coming weeks.

Estimates of losses include the costs of specific health activities in response to the disaster. These include public health campaigns and trauma mitigation efforts; human capital needs (recruiting and training permanent and temporary doctors and other health staff) in response to the disaster; facility clean up costs; and the costs of health treatment in response to the disaster. The total estimated losses are Rp. 87 billion and are summarized, together with the damage estimates, in the table below:

Table 5.7: Damage and Losses in the Health Sector (mil. Rp)

Item	Damage	Loss	Public	Private	Imported
Public hospitals	425,894	0	425,894	0	100,251
Public health centers	30,362	0	30,362	0	3,124
Public health sub-centers	32,552	0	32,552	0	772
Other public and admin	42,616	0	42,616	0	600
Private hospitals	192,365	0	0	192,365	46,557
Other private facilities	24,928	0	0	24,928	7,970
Public health programs	0	41,000	41,000	0	0
Replacement personnel	0	37,641	37,641	0	0
Facility cleanup	0	3,033	1,492	1,542	0
Additional health	0	5,376	5,376	0	131
Total	767,353	87,050	635,545	218,858	159,380

Source: The World Bank, based on direct observation and information from MoH and MoHA

Clearly, a disaster of this kind has significant immediate effects on the health of the population, particularly in the worst affected areas. Initial concerns center around injuries resulting from the tsunami, prevention of disease outbreaks and the provision of basic health services. Relief efforts are being provided by the government and approximately 50 relief agencies which are providing field hospitals, medical supplies and emergency medical and nursing staff. These relief efforts in the health sector are being coordinated by the World Health Organization office in Banda Aceh.

Attention in the relief efforts has also concentrated on measures to prevent disease outbreaks and their detection when they do occur. WHO and other agencies have established a basic disease surveillance system in the area around Banda Aceh. UNICEF has commenced measles vaccination in the area. There have not been any significant disease outbreaks to date.

Provision of adequate amounts of clean drinking water is critical; a large number of agencies are working on the problem and good progress has been made in some areas. Sanitation and waste disposal are more of a problem. The lack of adequate sanitation and large quantities of debris contributes to the risk of promoting mosquito breeding. There are few resources to date to tackle breeding sites or to set up effective vector control. Efforts are underway to re-establish the medical supply chain, including drug ordering and stock monitoring.

Provision of services for basic health care is also important at this stage of recovery. As many of health personnel were lost and facilities destroyed provision is currently a joint effort between surviving private and public providers, additional Indonesia staff and the staff of relief agencies.

D. RELIGION AND CULTURE

D.1 Pre-disaster situation

Village survey (Podes) data indicated that there were around 2,000 mosques, 5,500 meunasah (small mosques), 2,150 musholla (prayer building), and 91 of other religious buildings previously residing in the affected areas of Aceh. In the affected areas of Nias, there were 70 mosques and 1,350 churches.

In the context of Aceh, mosques and especially meunasah play a very important role beyond just serving as a place for worship. They function as the hub of the community. Village Level Meeting (Musbangdes), civic activities of gotong royong are mostly conducted at meunasah. Meunasah and mosques, besides providing religious learning activities for children, also serve as places for distributing information including announcement on projects and village government activities. Being the center of network, it is crucial that rebuilding these places should be prioritized to foster reviving the lost network and community.

D.2 Damage assessment

Many place of worships were severely affected by the earthquake and tsunamis. A preliminary estimation is done using information gathered from Podes and estimated proportion of damaged occurred in the affected areas provided by Minister of Home Affairs. Overall estimated amount needed for rebuilding places of worship in Aceh and North Sumatra is Rp. 776 million with the following breakdown:

Table 5.8: Estimated Damage in Places of Worship (million Rp.)

	Aceh		Nias	
	Destroyed	Partially Damaged	Destroyed and Partially Damaged	TOTAL
Mosques	144,429	138,198	3,162	285,789
Meunasah	164,238	161,634	372	326,244
Prayer Room	26,970	43,989	0	70,959
Protestant Church	2,325	1,581	63,612	67,518
Catholic Church	1,209	744	17,670	19,623
Confusius Temple	1,209	930	186	2,325
Temple	2,325	1,488	186	3,999
Total	342,705	348,564	85,188	776,457

INFRASTRUCTURE

"Our priority is to rebuild. We will need wood and zinc roofing. These are the most important things. But we also need cement and to be able to cover transport costs. Wood is in very short supply now."

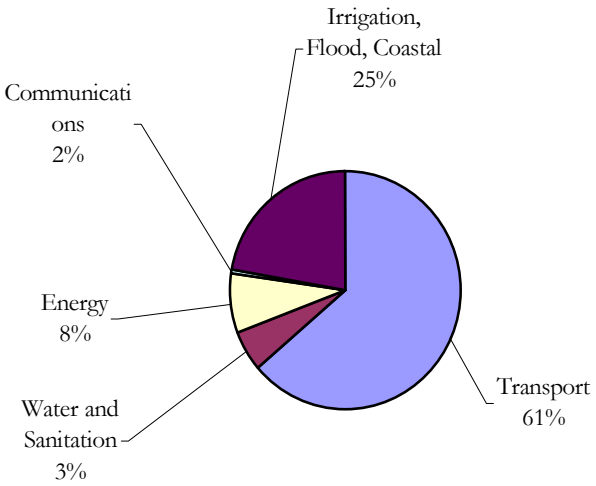
Elderly village head for one of the Lembaruku villages - 4 km from the sea.

Damage and losses to infrastructure totaled Rp. 8.2 trillion and were dominated by the damage to transportation (61% of total impact) and irrigation, flood control and coastal protection (25%), with 7.7% in energy, 3.4% in water and sanitation and 2.5% in communications. An overview of the damages and losses is as follows, and detailed in the infrastructure section of the technical annexes.

Table 5.9: Summary of Damages and Losses to Infrastructure (Rp. billion)

	Total		Impact		Property		External Impact	
			Damages	Losses	Public	Private	Incoming	Outgoing
Transport	4,984	61%	3,632	1352	3,442	1542	1017	
Roads and Land Transport	4,679	94%	3,379	1301	3,137	1,542	919	
Roads	1,735	35%	1,576	159	1,635	100	247	
Land Transport	2,944	59%	1,803	1,142	1,503	1,442	672	
Ports	259	5%	237	22	259	0	98	
Airports	46	1%	17	29	46	0	0	
Water and Sanitation	276	3%	247	29	106	170	19	
Water Supply	267	97%	238	29	97	170	14	
Sanitation	9	3%	9	-	9	0	5	
Energy	632	8%	631	1	622	10	395	
Electric Power	500	79%	500	-	500	0	310	
Petroleum	132	21%	131	1	122	10	84	
Communications	203	2%	176	27	123	80	134	
Telecommunications	194	96%	167	27	114	80	134	
Postal Services	9	4%	9	0	9	0	0	
Flood control Irrigation	2,058	25%	1,230	829	1,229	829	175	
Irrigation	542	26%	543	120	542	0	175	
Flood Control	1,355	74%	687	829	709	829	0	
Total	8,154	100%	5,915	2,239	5,619	1,802	1739	

Damage and Losses - Infrastructure



The damage to transportation infrastructure was dominated by roads and land transport, totaling Rp. 3.4 trillion or 94%. The disaster-impacted facilities in the

affected coastal areas, including about 316 kilometers or 10% of the national and provincial road network, 1,900 kilometers of local roads and over 400 bridges, nearly 30,000 vehicles or 7.2% of the registered vehicle fleet, and nearly all bus and ferry terminals. Public port infrastructure suffered moderate damage totaling Rp. 237 billion (5%) over 14 facilities in Aceh and 5 in North Sumatra, about 70% overall sustaining heavy damage. Airports suffered moderate earthquake-related damages to runways and terminal buildings, estimated to cost Rp. 17 billion (1%). Losses for transport due to increased costs and lost revenues are estimated to be Rp. 1.3 trillion over five years.

The damage to water and sanitation was valued at Rp. 276 billion. There was fairly low coverage and quality of water and sanitation services before the disaster. The urban water association providers suffered damage and losses totaling Rp. 97 billion, mainly to pipelines and lost about 15% of production capacity overall. However, the damage was acute in the most affected urban zones in the north and west. The most substantial damage appears to be to small-scale providers and rural water supply, totaling Rp. 170 billion, where it is estimated that almost all wells in the affected coastal region will have been contaminated. Urban sanitation, comprising entirely on-site facilities, suffered damage to the treatment servicing equipment, valued at Rp. 9 billion.

The energy sector suffered damage totaling Rp. 631 billion, the majority of it to the distribution networks in both electric power and petroleum fuel supply. Electric power supply suffered light damage to generation capacity, no damage to the transmission network but substantial damage to the distribution networks in the affected area. Total damage is estimated at Rp. 500 billion, with negligible operational losses. The state-owned petroleum fuel supply suffered substantial damage to fuel depots, where storage facilities were damaged and some fuel lost, mostly on the west coast, with a total damage of Rp. 131 billion.

In communications, telecommunications suffered severe damage in the affected areas, primarily to fixed connection services where 40% of connections were broken, and to transceiver facilities for cellular phones, with total damage of Rp. 167 billion. Postal services suffered damages of Rp. 8.8 billion to facilities.

Flood control and irrigation infrastructure damage was substantial, totaling Rp. 1,230 billion. About 45% of the damage cost was sustained on the flood control and coastal protection infrastructure (Rp. 624 billion), and 53% on major irrigation facilities of which about a third was earthquake-related.

A. TRANSPORT

Much of the primary transportation infrastructure and transport of Aceh province is in the coastal areas, due to the steep inland terrain and concentration of socioeconomic activity, and was therefore at risk in areas inundated by the tsunami. Earthquake-related damage is evident on port and airport structures and some roads but relatively minor in impact for the transport sector as a whole. However, it is

likely that the severity of the tsunami impact may have been amplified on structures weakened by the earthquake, such as bridge supports.

Total damages and losses for transportation are estimated to be Rp. 5.0 trillion, predominantly in the road subsector which accounts for 94%, with 5% in ports and less than 1% in airports, as shown in Table 5.9.

For road infrastructure, about 19% of the primary roads, 46% of bridges and over 50% of the secondary roads were impacted in the affected area, which accounts for about half of the stock in Aceh Province and less than 1% of the stock in North Sumatra province (only Nias island). That has a replacement cost of Rp. 1.6 trillion, which is equivalent to about 20% of the national annual road management budget. Damages to land transport facilities and vehicles totaled Rp. 1.8 trillion, comprising an estimated 29,800 vehicles or 7.2% of vehicle fleet damaged[13], primarily private costs, and bus and ferry facilities. Damages of Rp. 0.24 trillion were incurred in port infrastructure at 70% of the ports in Aceh and at five ports in North Sumatra. The damages to airport infrastructure were earthquake-related and comparatively minor (Rp. 17 billion) allowing moderate levels of operations to resume, but losses due to increased transport costs may reach about Rp. 36 billion.

TABLE 5.10 Damage and Losses in Transportation Sector

	Damage			Impact Valuation				
	Total	Impacted		Damage & Losses (IDR billion)				
Item	Stock	qty	% total	Total	Damage	Losses	o/w Private	o/w foreign
ROADS				4,679	3,379	1,301	1,542	919
Roads				1,735	1,576	159	100	247
Major roads (National, Provincial)	3,145 km	316	10%		752	52	-	128
Local Roads (Kabupaten, Desa)	9,999 km	1,621	16%		343	48	-	34
Bridges (primary)	1,800 nr.	437	24%		381	59	-	65
Construction Resources					100		100	20
Land Transport				2,944	1,803	1,142	1,442	672
Road Vehicles	414,773	29,746	7.20%		1,592		1,433	637
Bus terminals	8	8	-		14	2	-	1
Road Safety Facilities	8	8	-		27	1		
Ferry terminals	9	8	1		170	4		34
Ferry operation losses						28		
Increased road travel costs						1,098		
Decline in bus revenues						10	9	
PORTS				259	236.5	22.2	0.0	97.5
Public port infrastructure	19	19			222.0	0.8	0.0	88.8

[13] This estimate is based on assumptions relating the vehicle losses to levels of housing damage in the jurisdiction where the vehicles were registered, so should be considered as an order of magnitude estimate.

Navigation facilities	9	9			14.5			8.7
Port revenue losses						21.4		
AIRPORTS				46	17	29	0	0
Airport Infrastructure	7	4	0		17	3		
Aircraft					0			
Airport revenue losses						-10		
Airport operating cost increases						37		
Total				4,984	3,632	1,352	1,542	1,017

Some immediate implications of transport-related damage include:

- Strategically review the transport system to introduce some redundancy, providing alternative routes and access in the event of disruption,
- Incorporate hazard risk assessment into the design and location of transport infrastructure,
- The importance of re-assessing earthquake-damaged structures, e.g. bridge supports, culverts, transport-related buildings, to determine whether there is a need for repair or full replacement,
- the need to carefully assess the full impact of new road construction alternatives to identify least-cost, environmentally-sound solutions, e.g. the proposal to continue with Ladia Galaska versus other options.

A.1 Roads and Road Transport

A.1.1 Pre-disaster situation

Total damages and losses for transportation are estimated to be Rp. 5.0 trillion, predominantly in the road subsector which accounts for 94%, with 5% in ports and less than 1% in airports, as shown in Table 5.10. The impact is dominated by the damages of an estimated Rp. 1.6 trillion incurred in the loss of road vehicles and Rp. 1.3 trillion in road infrastructure. Economic losses estimated at Rp. 1.3 trillion include the emergency repairs and clean-up but are dominated by the costs of diversion and added travel costs required for reaching the western coast areas isolated by damage to the western road.

Roads Infrastructure. The disaster-affected area in Aceh is served by six arterial road routes, amounting to half of the primary road network in the Province and totaling 1,587 kilometers length and 875 bridges. The four National roads, comprising 1,136 kilometers length and nearly 600 bridges, provide the major links along the northeast coast from Bandah Aceh to Lhoksumawe and to Medan in North Sumatra, and along the west coast from the capital to Meulaboh and Tapaktuan, connecting to Sidikalang in the southern part of North Sumatra province. All are asphalt-paved and in good/fair condition. Pre-disaster traffic volumes on these roads averaged 2,000-3,500 veh/day and up to 8,000 veh/day in

the capital's urban area. The two Provincial roads provide cross-island connections from the north-east road from Sigli and from Bireun through Takengon across the mountainous central area to Meulaboh. These two Provincial roads provide alternative access from the lightly damaged north-east to the heavily damaged southwest coast. Each road is over 200 kilometers long and 80% paved, but the slightly longer Takengon road is in generally poor condition and passes through the Genung Leuser National Park. Traffic volumes averaged about 1,000 veh/day. The other half of the network provides a central link and a cross-island link in the south-eastern part of the province.

Responsibility for planning and financing the National roads is handled by the Ministry of Public Works (MPW), managed through the Provincial office (DPUP). The planning, financing and management of the Provincial roads is under the Provincial office, and reported by MPW. Local roads, comprising kabupaten primary roads, and urban and village secondary roads, are under the jurisdiction of local government. Tertiary roads are reported under village infrastructure.

Road traffic and transport infrastructure and services. Responsibility for provision of public bus terminals, vehicle testing stations, vehicle weighbridges and road signing, marking and furniture is vested in provincial and local governments and handled by their respective Transport Departments (Dinas Perhubungan or DisHub). Perum Damri, a state-owned bus corporation, provides city bus services in Banda Aceh and on a number of inter-urban 'pioneer' routes. Important ferry terminals are managed by PT ASDP, a State-owned company which is also the main operator of ferry services.[14] Responsibility for the management of smaller ferry terminals is in process of being transferred from DGLC to local governments.

This apart, land transport activity in the affected region is mostly in the hands of private companies and individuals. Vehicle fleet data are available for registered vehicles through the respective Transport departments (DisHub). The total vehicle fleet registered in the Province was 415,000 vehicles in 2003, comprising 94,500 motorized vehicles (33% trucks, 27% buses, 40% light vehicles) and 320,000 motorcycles – all but 7% of these were registered in the impacted areas.

A.1.2 Damage Assessment

Roads infrastructure. Of the six major roads in the affected area, it is estimated that 316 kilometers or 19% of the road length was damaged and 46% of bridges, including about 120 bridges destroyed. The national road along the north-eastern coast (Banda Aceh to Langsa), sustained only minor damage and was passable after clean-up of surface debris. The north road from Banda Aceh to Krueng Raya lost five bridges. The national coastal road to Meulaboh in the south has been destroyed over 80 kilometers or 30% of its length and 110 or 60% of the bridges. That road was impassable over most of its length, which blocked relief

[14] Ferries are viewed as floating bridges by MOC and accordingly come under the jurisdiction of DGLC.

efforts and made ground surveys impractical - aerial images show whole bridge spans lifted and transported hundreds of meters away. Further south from Meulaboh to Tapaktuan three bridges were destroyed (which were quickly reinstated with temporary bridges). No damage was reported in the south-eastern part of the Province. On Nias island, roads were damaged in two locations at the north and southwest of the island. Current reports have not distinguished damage specific to the earthquake. The initial damage assessment was undertaken by staff of MPW by a driveover of accessible roads seven days after the disaster and reported by satellite telephone. Later, these estimates were corroborated by analysis of satellite images.

For local roads, urban roads in Banda Aceh and Meulaboh were extensively damaged and district and village roads in the affected coastal areas were damaged. As specific surveys had not been made, damage was estimated on portions of the road networks in the affected areas with similar incidence to social infrastructure. It is estimated that about 124 kilometers of urban roads, 1,150 kilometers of kabupaten roads and 340 kilometers of village roads were impacted, with a total damage cost of Rp. 343 billion.

Road traffic and transport infrastructure. The damage due to loss of road vehicles appears to be high as they were vulnerable to the surge of the tsunami funneled through the streets. Based on the vehicles registered in the most affected areas and relating damages to those of housing in the same areas, it is estimated that about 7.2% or 29,800 vehicles were destroyed or seriously damaged with a replacement value in the order of Rp. 1,592 billion, almost all privately owned. The damages include about 6,000 motor vehicles and 23,800 motorcycles and small vehicles. Losses were estimated in terms of the disruption to and increased costs of travel, including the diversion of one half of normal traffic on the west coast road to the longer inland route via Geumpang, and increased road roughness due to road damage, totaling nearly Rp. 1,100 billion.

DGLC reports heavy damage to the bus terminals in Banda Aceh, Meulaboh, and Lhokseumawe, and moderate damage to those in Sigli, Langsa, Bireun, and Gunung Sitoli (North Sumatra). There has also been some damage to road safety infrastructure, including roadside weighbridges, vehicle testing stations, traffic lights, and road signage, etc. Perum Damri reports heavy damage to its Banda Aceh depot and to 52 buses. Banda Aceh's UleUheue ferry terminal has been totally destroyed, while those in Meulaboh and Lamteng have suffered heavy damage. Six others, including Gunung Sitoli, have suffered light damage. No ferry vessels are reported to have been affected.

The damages to bus terminals, road safety infrastructure and ferry terminals are estimated to have a replacement cost of Rp. 41 billion. Losses, including budgets for emergency operations of buses and ferries, are estimated by DGLC at Rp. 7.0 billion.

A.2 Ports and Shipping

A.2.1 Pre-disaster situation

The principal public ports in northern Sumatra are owned and managed by PT Pelindo I, one of Indonesia's four state-owned port corporations. In Aceh, these include the Malahayati (Banda Aceh), Lhokseumawe, Kuala Langsa, and Sabang. Ownership and management of smaller public ports is in process of being transferred to local authorities, but at present these are still managed by MOC's Directorate General of Sea Communications (DGSC). Shipping services are operated primarily by the private sector but PT Pelni, the state-owned passenger and general cargo shipping line, operates 'pioneer' services that provide key links to tsunami-affected islands.

Many large companies, including notably LNG, cement, and fertilizer producers, own and operate special ports for transporting their own raw materials and products. The majority of these are located on the north-east coast, and available reports suggest some have suffered damage.[15]

A.2.2 Damage assessment

DGSC reports heavy damage to nine public ports in Aceh, principally those in Banda Aceh and along the west coast, and light damage to another five ports. There is also heavy damage to five public ports in North Sumatra. Damage is estimated at Rp. 222 billion. DGSC also reports significant damage to maritime navigation facilities in the same areas and estimates replacement costs at Rp. 14.5 billion. There have been no reports of damage to ships, and Pelni ships operating pioneer routes are all available for service. DGSC has estimated a cost of Rp. 21 billion for emergency operation of additional vessels.

A.3 Civil Aviation

A.3.1 Pre-disaster situation

The principal airports in northern Sumatra, including Aceh's largest airport (Sultan Iskandar Muda in Banda Aceh), are operated by PT Angkasa Pura II, one of Indonesia's two state-owned airport corporations. Iskandar Muda has a 2,500 meter runway and can handle B737 and similar aircraft. The province's smaller airports are in principle scheduled to be handed over to regional or local authorities but at present are still being managed by MOC's Directorate General of Air Communications (DGAC).

[15] Cost estimates are included under productive sector where available.

A.3.2 Damage assessment

Preliminary surveys undertaken by DGAC personnel indicate airport damage to be relatively light. Sultan Iskandar Muda is handling traffic more or less normally, with the principal damage being cracking in the air traffic control tower structure. At present, air traffic services are being provided from the old tower. Damage costs are estimated at Rp. 1.4 billion.

The 1,400 meter runway at Meulaboh's Cut Nya Dhien airport has suffered severe cracking and displacement over part of its length but is still able to handle light aircraft movements (Cessna Caravan and similar). There is also cracking of the taxiway and apron area and some damage to equipment. Damage costs are estimated at Rp. 11 billion. The 960 meter runway at Sinabung's Lasikin airport, which serves Pulau Simeuleu, has subsided around 3cm over 300 meters of its length and there is also some damage to flight safety equipment. Runway reconstruction and equipment damage costs are estimated at Rp. 4 billion. Sabang's Maimun Saleh airport, which has a 1,800 meter runway, is operational but has suffered damage to VHF and SSB communications equipment.

There are no reports of damage to aircraft caused directly by the earthquake and tsunami, but two accidents occurred during the first 2 weeks of relief operations, one minor and one major. While aircraft fuelling and handling costs may increase in the short term, it is envisaged that airline and airport profitability will be enhanced as a result of higher revenues from much increased traffic volumes linked to reconstruction and relief activity.

B. ENERGY

The energy sector suffered damage totaling Rp. 630 billion, the majority of it to the distribution networks in both electric power and petroleum fuel supply. Electric power supply suffered light damage to generation capacity, no damage to the transmission network but substantial damage to the distribution networks in the affected area with a total of 90,000 connections lost, mostly in Banda Aceh and Meulaboh. Total damages are estimated at Rp. 500 billion, with negligible operational losses as facilities were back to near full load within one week, with the exception of the two worst hit centers. The state-owned petroleum fuel supply suffered substantial damage to fuel depots, where storage facilities were damaged and some fuel lost, mostly on the west coast. Total damage and losses are estimated to be Rp. 132 billion.

Implications for rehabilitation and reconstruction from damage to the energy sector include:

- A focus on protecting the power distribution network and transformers from vulnerability,
- Identifying opportunities to salvage materials such as transformers, poles and household fittings in order to lower the cost of re-establishing the distribution network,

- Minimizing leakage from the oil depots and potential damage from cleaning out contaminated tanks at retail pump stations,
- Incorporating energy conservation and renewable energy sources as planning considerations in revitalizing the sector.

B.1 Electric Power Supply

B.1.1 Pre-disaster situation

Indonesia's public electricity supply is provided by PT PLN, the state-owned electricity company. Aceh province accounts for a very small share of its total installed capacity, customers, and energy sales. Over 90% of Aceh customers are residential, and over 80% have very small capacity connections (up to 450VA).

Aceh's installed generation capacity comprises the Luengbata diesel plant in Banda Aceh (11 units totaling 50 MW) plus over 215 isolated small units (212 diesel, 3 microhydro) with a nominal installed capacity of 137 MW. Luengbata is managed by PLN's Northern Sumatra Region Grid Office while the small plants are managed by the Aceh Region's five branch offices. Many of the small diesel units are old and their available capacity in 2003 was only around 88 MW. A major part (around 45%) of the energy needed to supply PLN's sales in Aceh is supplied by plants in North Sumatra, principally via the 150KV transmission line which runs south from Banda Aceh along the north-east coast to Medan. Luengbata accounts for a further 22%. Details of the numbers of customers, connected load, and extent of medium and low voltage distribution networks by PLN Aceh branch office are provided in the infrastructure portion of the technical annexes.

The capacity of primary and standby captive generation plant in the private sector is reportedly over 550MW, substantially exceeding PLN's installed power capacity. Most is located in Lhokseumawe, notably at the Arun LNG plant, and in Langsa on the east coast.

B.1.2 Damage assessment

Overall energy sector damages are summarized in Table 5.11. Damage to the public power supply appears to be concentrated in Aceh and in particular in Banda Aceh and southwards along the west coast. PLN has concentrated its damage assessments on regions that were worst hit, including in particular Banda Aceh, Meulaboh, Sigli and Bireun. The main damage is to distribution networks but, because of their extent and geographical dispersion, detailed kilometer-by-kilometer inspection has not yet been possible. Some 90,000 customer connections have been damaged, principally in Banda Aceh (~30,000) and Meulaboh (~50,000).

TABLE 5.11 Summary of Damage and Losses in Energy Sector

	Physical		Valuation (IDR billion)				
			Impact			o/w private	o/w foreign
Item	Nr.	Damage	Total	Damages	Losses		
ELECTRIC POWER			500.0	500.0	0.0	0.0	310.4
Power Generation		Light		42.0		0.0	16.8
Transmission Network		nil		0.0		0.0	
Distribution Networks		Severe		323.0		0.0	226.1
Other facilities		Severe		135.0		0.0	67.5
Operational losses		Negligible					
PETROLEUM FUEL			131.5	130.5	1.0	10.0	84.4
Production Facilities				0.0		0.0	
Petroleum Fuel Storage	5	35%		87.3		0.0	61.1
Petroleum Fuel stock		7,909 L		33.2		0.0	23.2
Retail Distribution	3	Light		10.0		10.0	
Natural Gas Storage		Nil		0.0		0.0	
Spillage & debris clean-up		Minor			1.0	0.0	
Total			632	631	1	10	394.75

Generation. Preliminary inspections indicate damage to generation plant has been relatively light, totaling Rp. 42 billion. The main casualty is a 10MW barge-mounted diesel station, which was carried inland and suffered consequent hull damage. Its mechanical and electrical plant is thought to be sound, although testing has not yet been possible, and the preliminary estimate of damages is Rp. 30 billion. The important Luengbata plant in Banda Aceh has suffered only very minor damage, notably to generation transformers and fencing. The Meulaboh (Lamno) diesel plant has not suffered significant damage. Detailed assessment for the Calang diesel plant and other isolated diesel stations was not available and damage to is estimated to these plants is estimated to be Rp. 9 billion. There are as yet no reports of damage to the private sector plant, although it is likely that some of the many smaller units in Banda Aceh will have been affected.

Transmission. The 150KV transmission line and associated substations have not suffered any damage and are functioning normally.

Distribution. There has been severe damage to PLN's distribution networks in the Banda Aceh and Meulaboh regions, and to a lesser extent in the the Sigli and Bireun regions. PLN estimates damage in these four regions at 1,100 circuit-kilometers of medium voltage line, 1,750 circuit-kilometers of low voltage line, 45 MVA distribution transformer capacity, and 90,000 household connections have been damaged. Total replacement cost is estimated at Rp. 323 billion. In practice, some transformers and other materials (including poles) will likely be salvageable and the actual cost may be lower.

Other facilities/other regions. PLN offices in Banda Aceh, including the Aceh Region Head Office and the Banda Aceh Branch Office, have suffered significant damage. Repair costs are estimated at Rp. 7 billion. There has also been damage to warehouses and contents, for which repair and replacement costs are tentatively estimated at Rp. 20 billion, and to mobile cranes, fault repair trucks and other vehicles, for which replacement costs are estimated at Rp. 7.5 billion. At the time of report preparation, PLN had not surveyed other less severely affected regions such as Sabang and Takengon. However, it estimates damage to diesel plant, distribution networks, buildings and equipment in these other regions could potentially total up to Rp.100 billion.

Operations. With the notable exceptions of the Banda Aceh and Meulaboh regions, PLN Aceh was operating at near pre-disaster levels within 1-2 weeks. In Banda Aceh system load had risen to around 25MW by January 2, still far below the previous level of around 40MW. Some 45,000 of the 75,000 customers who lost supply have been reconnected, but restoring the remainder will take time as buildings and/or distribution networks are totally destroyed or badly damaged. In Meulaboh, where much of the town's buildings and around 85% of its distribution network destroyed, generation was restarted on January 2, 2005 at a load of only 15% of the pre-disaster norm of around 12 MW.

PLN losses due to electricity sales revenues in Aceh are not likely to be significant because the avoidable generating costs of the lost business exceed the associated revenues.

B.2 Public Fuel Supply

B.2.1 Pre-disaster situation

PT Pertamina, the state-owned oil company, is the sole supplier of petroleum fuels throughout Indonesia. In Aceh, it owns most, if not all, of the retail pump stations (SPBUs) in addition to owning and operating all fuel storage and distribution depots. Pertamina is also the sole supplier of bottled LPG.

Aceh has large natural gas resources, which are being extracted by Exxon Mobil as contractor to Government. Gas from these fields is supplied primarily to the Arun LNG plant and also to a number of large industries such as Asean Aceh Fertilizer and Pupuk Iskandar Muda fertilizer plants on Aceh's east coast. Gas supplies do not appear to have been affected by the disaster and the LNG plant is operating normally. Other pipelines in the region, including Asamera-Duri, Asamera-Singapore, and Natuna- Singapore also appear to be operating normally. There is no natural gas distribution in Banda Aceh or other parts of Aceh.

B.2.2 Damage assessment

Pertamina reports heavy damage to its Kreung Raya and Meulaboh depots, and lesser damage to its Lhokseumawe, Gunung Sitoli and Sabang depots. Damage to the Krueng Raya and Meulaboh caused rupture of tanks and resulted in fuel losses. Many SPBUs have been damaged but details are not yet available. Pertamina's branch office in Banda Aceh has also suffered some damage. The replacement cost is estimated at Rp. 130 billion, including for lost fuel stock.

C. COMMUNICATIONS

Telecommunications suffered moderately severe damage, primarily to the fixed connection services and to transceiver facilities for cellular phones. There was a heavy loss of connections in Banda Aceh and Meulaboh, amounting to 28,000 customers of 40% of connections. Total damage and losses are estimated at about Rp. 203 billion, comprising about Rp. 9 billion for postal services, Rp. 5 billion for universal service obligation (USO) connections and Rp. 162 billion for fixed connection services including cellular telephone. Some implications of the disaster for the communications sector are:

- Accelerating the access of remote and isolated villages to telecommunications services
- Reviewing the relative benefits of restoring the fixed line network versus moving to a fully wireless system for urban households.

C.1 Pre-disaster situation

PT Telkom, now 49% privately owned, is the sole provider of fixed line telephone services in Indonesia and is also now rolling out limited mobility CDMA services (TelkomFlexy) in cities including Banda Aceh. Through a majority-owned subsidiary, PT Telkomsel, it is also the largest GSM mobile operator. PT Indosat, which is now 85% privately owned, is developing a limited mobility domestic network (StarOne), and through its subsidiary—Satelindo—has the second largest GSM customer base. Both companies serve Aceh, but customer numbers are small and Telkom has just 15,000 and fixed line customers in Banda Aceh. Both Telkom and Indosat are internationally listed companies, and focus their network extension investments in areas offering commercially attractive returns. Under the national Universal Service Obligation scheme, MOC has recently starting providing limited telecoms access to remote and isolated villages that are not commercially attractive. PT Pos provides postal services throughout the country and has an extensive network of post offices.

C.2 Damage assessment

The tsunami caused significant damage to Telkom's fixed line network, and in particular the last mile of copper wire connection. There was also damage to exchanges, although repairs were made very quickly in many instances. Both Telkomsel and Indosat/Satelindo suffered damage to GSM base transceiver stations and associated facilities, most of which were reinstated quickly. However, MOC reported that all but eight of 111 lines provided to remote villages under the Universal Service Obligation (USO) scheme are damaged. Telkom and other operators were quick to mobilize VSAT and satellite communications equipment to support relief and recovery efforts. PT Pos reported damage to 27 post office buildings.

Table 5.12: Summary of Damages to Communications Sector

	Physical		Impact Valuation (Rp. billion)				
Item	Nr.	Damage	Total	Damages	Losses	o/w Private	o/w foreign
Telecommunications			193.7	166.7	27.0	80.0	134.0
USO connections (MOC)	111	93%		4.7		0.0	4.0
Fixed connections (Telekom)	98,860	40%		162.0		80.0	130.0
Operational losses	28,184				27.0		
Postal Services			8.8	8.8	0.0	0.0	0.0
Postal Facilities				8.8		0.0	0.0
Total			202.5	175.5	27.0	80.0	134.0

PT Pos estimated the costs of rehabilitating or replacing damaged post office buildings at Rp. 8.8 billion, while MOC estimated the cost for repairing damage to DGPT telecommunications equipment and facilities to be about Rp. 4.7 billion. Damage to the Telkom/Telkomsel and Indosat/Satelindo installation, was estimated to be Rp. 40 billion. These costs are summarized in Table 5.12.

D. WATER SUPPLY AND SANITATION DAMAGE

Rural water supply (dug wells and handpumps) was especially hard-hit by the disaster. Significant damage was also experienced by water utilities in Aceh's urban areas. Relatively little damage was done to the urban sanitation system, largely because sanitation is provided by septic tanks with no investment in sewerage. Total damage and losses in the sector are estimated at Rp. 276.4 billion. Some implications of damage in the water supply and sanitation sector include:

- Rapidly recovering the capacity to supply water to both urban and rural consumers in anticipation of the demobilization of mobile water treatment plants that are part of the relief effort,

- Mobilizing a labor intensive approach to cleaning and rehabilitating rural water supply systems, both to repair critical facilities and to generate needed employment,
- Carefully monitoring the availability and quality of renewed water supply and sanitation systems, especially in light of the risk of waterborne disease.

D.1 Pre-disaster situation

Following decentralization, provision of water supply, sanitation, and solid waste management became the responsibility of local governments. Urban water supply in the disaster-affected area is provided by 11 local government owned water enterprises (PDAM). Total water production provided by PDAMs before the disaster, mainly stemming from surface water and well fields, is estimated at about 1,500 l/s. Coverage with piped water supply ranges from about 5% - 50% of the population in their service areas. Only about 9% of the total population in Aceh Province and 24% in North Sumatra Province benefit from piped water supply. Similar to many other areas throughout the country, system efficiency is low with non-revenue water[16] estimated at 30% - 50% on average.

Given the low service coverage provided by PDAMs, the majority of the population, particularly the rural population, has to rely on self-provision, community-based systems, and private small-scale water providers and vendors. Self-provision and community based systems are mainly based on dug wells and pumps (boreholes), which account for about 77% of water sources in Aceh Province, and about 57% in North Sumatra Province respectively. Details of water sources are provided in Table 5.13.

Table 5.13 Water Sources (%)

Province	Pipe	Bottle	Pump	Well	Spring	Other	Total
Aceh	8.8	1.1	2.6	74.8	6.5	6.2	100.0
North Sumatra	24.2	0.4	9.4	47.2	12.8	6.0	100.0

Source: SUSENAS, 2003

Sanitation in urban and rural areas is provided by on-site facilities, mainly septic tanks and pit latrines. The sludge of septic tanks in urban areas is emptied by local government administration and, in some of the affected cities, disposed in septage treatment plants (IPLT). Based on experience in other Indonesian cities, it can be assumed that the IPLTs are only partly operational. Only eight cities in Indonesia have partial sewerage systems; none of these cities is in the disaster-affected area.

[16] Nonrevenue water is composed of (i) physical losses caused by leakages; and (ii) commercial losses resulting from illegal connections, meter under registration, and billing inefficiencies.

D.2 Damage assessment

Damage to water supply and sanitation is summarized in Table 5.14 and has been estimated to total Rp. 276 billion, comprising Rp. 267 billion (96%) for water supply and Rp. 9 billion (4%) for sanitation. For water supply, 63% of the damages were incurred by small-scale and private providers, and the balance by the water supply enterprises.

TABLE 5.14 Damage and Losses in Water Supply and Sanitation

	Quantification		Impact Valuation				
			Damage (IDR billion)				
Item	Unit	Incidence damage	Total	Damages	Losses	0/w Private	o/w foreign
WATER SUPPLY			267.4	237.9	29.5	0.0	13.2
PDAM Water Supply			97.2	72.7	24.5	0	13.2
Water Treatment Plant capacity	1,495 L/s	15%		17.2			3.4
Watertank Trucks	108	5%		49.0			9.8
Pipe network	895 km	26%		6.5			
Lost revenue					16.3		
Additional operating cost					8.2		
Small-scale Providers and Vendors			9.4	4.4	5.0		
Small tankers	70			4.2			
Vendors	570			0.2			
Income losses 6 months					5.0		
Rural Water Supply			160.9	160.9	0.0		
Dug wells	60,000	100%		108.0			
Handpumps	15,000	100%		52.9			
SANITATION			9.0	9.0	0	0	0
Urban Sanitation				9.0	0		
Sludge treatment	6	100%		7.5			
Vacuum truck	20	70%		1.5			
Total			276.4	246.9	29.5	0.0	13.2

Initial reports from Ministry of Public Works (MPW), Perpamsi[17], and aid agencies indicate that PDAMs are operating, although often with reduced capacity, given that they have lost part of their customers and facilities have been damaged. The main damage to PDAM water supply infrastructure occurred at water treatment plants, pipe networks, and connections. It was not possible to assess damage to water supply facilities in detail, and information on damage to office buildings, laboratories, and other equipment was not available. Reports indicated that emergency repair work had started, and PDAMs were getting support from the government, aid agencies, army engineers, Perpamsi, and staff of other PDAMs, which had not been affected by the disaster. Information on human losses of

[17] Association of Indonesian Water Supply Enterprises (Persatuan Perusahaan Air Minum Seluruh Indonesia)

PDAM staff is still limited; it can be assumed that an estimated 10% loss of local government staff also apply to PDAM staff. Besides damage to assets and human losses, PDAMs are likely also to experience reduced revenues and additional operating costs for some time, estimated to be Rp. 24.5 billion.

Information on damage to water supply assets operated by small-scale water providers (SSWP) and vendors is scarce. It can be assumed that alternative providers will resume their activities according to demand not covered by formal providers and aid agencies. Very preliminary estimates of damage and losses to SSWP and vendors are Rp. 4.37 billion.

Reports indicate that damage to rural water supply systems, which are mainly based on self-provision and community-based systems, are significant. Many thousands of wells and boreholes are either fully or partly destroyed or contaminated, and are in need of replacement, cleaning and disinfection. Very preliminary estimates of damage to rural water supply infrastructure and replacement costs are detailed in the infrastructure section of the technical annexes.

Overall it appears that PDAMs have managed to continue providing water at reduced capacity, which is supplemented by water provided by relief agencies and army from mobile treatment plants. Reports from relief agencies indicate, that due to these mobile water treatment plants, water supply poses fewer problems than sanitation issues during the relief phase. However, since it can be expected that mobile water treatment plants will be demobilized within a few months, it will be crucial to accelerate repair to urban and rural water supply systems to avoid a major shortfall in the near future.

Data on damage to urban sanitation, including public toilets, vacuum trucks for emptying septic tanks, and septage treatment plants, is still sparse. Very preliminary estimates of damage to urban sanitation facilities and replacement costs are summarized in Table 3.8 and detailed in the technical annexes.

E. FLOOD CONTROL, COASTAL PROTECTION AND IRRIGATION

Damage to the sector amounted to over Rp. 2 trillion, with Rp. 662 billion in damage and losses in irrigation infrastructure and Rp. 1,396 billion for flood control and coastal protection works. Disaster implications for the rehabilitation and reconstruction of flood control, coastal protection and irrigation works include:

- Using the reconstruction effort as an opportunity to complete irrigation schemes and introduce incentives and systems for sustainable maintenance,
- Integrating earthquake-resilient designs in future investments, given Aceh's significant seismic activity,
- Identify short-term opportunities to use some of the debris for coastal protection,
- Undertake a survey of coastal protection options in light of the coastline's increased vulnerability due to beach, mangrove and coral reef destruction.

E.1 Pre-disaster situation

Flood control, seawall and river structure. Aceh province is mountainous, centering on the Bukit Barisan range which runs the entire length of Sumatra with peaks up to 3,400 meters above sea level. There are 14 principal river systems in Aceh province, and largest basin, Lawe Alas, accounts for 7,557 sq km out of a total land area of 55,852 sq km, including the islands of Pulau Weh, Simeulue, and the Kepulauan Banyak group off the south-west coast. One of the most densely populated basins is in Kab. Aceh, and the city of Banda Aceh is at the river mouth. Generally the rivers are steep and short, especially rivers flowing towards the west coast. The west coast is the wettest with annual rainfall of typically 3,500 mm, rising to 5,000 mm in the nearby mountains. Annual rainfalls decrease towards the north coast to as little as 1,200 mm per year.

Because of this topography and climate, Aceh province has suffered frequent flooding. The flood in November 2000 claimed 20 people and about 300,000 people in the province were affected. The estimated loss was Rp. 301 billion. To minimize flooding damage and losses, floodway, levee and related structures have been constructed to protect Banda Aceh city from the flood water. Similarly, flood control embankment, control gates, and spurs have been constructed on about 40 rivers in Aceh.

Irrigation. Aceh province is rich in natural resources and has a substantial export trade. Rice is the main food crop grown for both internal consumption and export, and most paddy fields are under irrigation. There are about 465 irrigation schemes in Aceh in the form of technical (45%), semi-technical (12%), and simple (43%) schemes, totaling 335,084 ha and an asset value of Rp. 5.1 trillion. The classification indicates the degree of provision of measuring devices to the system. Beside the technical classification, the irrigation system is also categorized by its size: large (>2000 ha), medium (500 ha – 2000 ha), and small schemes (< 500 ha). The small schemes are mostly located in the west coast and in the highland areas, while the large schemes are in the north and east coast.

Only about 70% of the irrigation schemes were in functional condition. The remaining 30% were not functional, either due to incomplete infrastructure such as secondary or tertiary canals, or due to the degraded condition of the structure and canals from lack of maintenance.

E.2 Damage assessment

Flood control, seawall and river structure. Based on the preliminary assessment undertaken by the Ministry of Public Works, the earthquake and tsunami damages were mainly concentrated in the western and northeastern coastal areas. Extensive damage was found and estimated on flood control structures including breakwater systems. For instance, the satellite images show that the newly constructed floodway close to the river mouth in the K. Aceh river was damaged over 2 km length from the sea. Though further assessment with satellite imaginaries and

topological survey will be required to precisely calculate direct damage cost, the preliminary estimates indicate direct damages on flood control and sea wall systems to be Rp. 687 billion.

Given that flood control cannot function without proper rehabilitation for certain years, preliminary estimates indicate yearly indirect losses on public and private assets due to flood water with one-year probability period to be Rp. 709 billion.

Irrigation. The earthquake and the tsunami impacts need to be distinguished. The impact of the earthquake has affected most of the kabupatens in Aceh and partly in northern part of North Sumatra province. This damage is yet to be fully assessed and could be minimal or highly significant. The north western coast of Aceh and its mountainous areas in central part of the province are very close to the epicenter of the earthquake, and thus have been more seriously affected by the earthquake than the other areas of the province. All irrigation schemes which are located in the coastal areas were significantly affected by the tsunami. The total areas affected by the tsunami is estimated at 28,000 ha (technical, semi technical and simple irrigation systems). The degree of damage varies but it appears that the northern and western parts of the province experienced the maximum damage. In addition to the irrigation facilities, the flood protection dikes and other related infrastructure have sustained damage. The preliminary estimates indicate that about 2 kilometers of flood control embankment for the recently constructed floodway in the Aceh river was damaged. In the absence of rehabilitation, this could lead to further agricultural losses during the wet season or a period of heavy rainfall. From a preliminary estimate, the damage caused by the earthquake is close to $24.5 million and the damage from the tsunami is about $37.9 million, giving a total estimated damage of $62.4 million.

Table 5.15: Damage and Loss Assessment – Flood Control and Irrigation

	Physical		Impact Valuation (IDR billion)				
Item	Nr.	Damage	Total	Damages	Losses	o/w Private	o/w foreign
Irrigation			541.8	541.8	0	0	175
Earthquake damage	335,084 ha	3-7%		200.7		0	60
Tsunami damage	28,000 ha	0-80%		341.8	120.0		115
Flood Control & Coastal Protection			687.4	687.4	829	829	0
River Structure	713	38%		402.4			
Seawall	9,898	95%		285.0			
Total			2,058	1,229	829	829	175

PRODUCTIVE SECTORS

We are a mixture here: farmers, civil servants and factory workers. I worked in the cement factory down on the coast. It has been badly damaged.

Young man at a camp on the road from Banda Aceh to Lembaruku

The earthquake and tsunami which had a devastating impact upon the productive sectors of the economy. Thousands of enterprises and livelihoods have been destroyed and, among those that survived the disaster, hundreds of thousands of people have been made unemployed. Thus, after the relief effort, rebuilding the productive sector in the affected areas is one of the most important and difficult challenges facing the country. This section outlines what is known about the damage to the five key productive sectors in Aceh and North Sumatra: agriculture, fisheries, enterprises (large and small), employment and the financial sector. Table 5.16 summarizes the direct and indirect damages sustained by the productive sector as a result of the disaster, amounting to Rp. 13.8 trillion[18].

Table 5.16: Damages and Losses of the Productive Sector

Sector	Total	Damage Direct (Assets) Rp Billions	Indirect (Flows) Rp Billions
Enterprises			
- Largest firms	581	540	41
- Large manufacturing firms	213	44	169
- Small firms/MSMEs	1,046	800	246
- Damage to public markets	165	165	0
- Agro-based industry and commerce	2,394	0	2,394
sub-total	4,399	1,549	2,850
Agriculture			
Infrastructure (Storage, irrigation, etc)[19]	542	542	
Standing Crop Losses	0		
a. Paddy	90	120	
b. Other Second Crop	85	85	
Land (eroded or silted) cleaning, siltation cost	225	225	
Future crop losses	1,105		1105.2
Livestock	126	126	
Farm machinery, Tools and Equipment	41	36	
Government buildings	18	18	
sub-total	2,262	1,157	1,105.2
Fisheries			
Fishing Harbors	103	103	
MMAF's Assets	23	23	
Brackish Water Culture	466	466	
Fishing Boats	190	190	
Fishing Equipment	162	162	
Fishing Production	3,807		3,807
Sub-total	4,752	944	3,807
Grand Total	13,873	6,996	7,762

[18] From this amount several items are deducted in the summary of damage and losses to avoid double accounting.

[19] This amount is not added in the summary of damage and loses to avoid double accounting with infrastructure sectors.

As a result of the disaster the open unemployment rate in the districts affected may reach 30%. Job recovery may be fast in some sectors, particularly as infrastructure rehabilitation re-establishes more normal conditions for daily life and in itself will generate employment opportunities. Nevertheless the mismatch between the demand for labor and the large number of unemployed people may pose a major problem to the recovery process.

Some implications of the disaster for the rehabilitation and reconstruction of the productive sector involve:

- Pursuing labor-intensive solutions in order to provide employment and immediate income for those who have lost their jobs,
- Reviving the thousands of small and informal enterprises through local procurement of goods and services, provision of micro-credit, other appropriate financial services and training,
- Concentrate on re-establishing a functioning marketing system for agricultural products and livestock in order to stimulate demand,
- Consider the trade-offs between restoring the previous shrimp and fish-farming activities and the need for coastal and ecosystem protection provided by mangrove forests.

A. AGRICULTURE

A.1 Pre-disaster situation

Agriculture is a significant driver of the local economy accounting for 32% of the provincial GDP and employing 47.6% of the labor force in the province. Of the 503 coastal villages, about 90% are rural. Within the 98,137 households in the 465 rural coastal villages, about 70% or 67,614 households mainly relied on agriculture for their livelihoods. Within the agriculture sector, food crop production was the predominant activity with minor contributions from horticulture, plantations and animal husbandry related activities. Aceh is also heavily forested with about 2.3 million hectares classified officially as forest land. According to Ministry of Agriculture data, the province had about 359,500 ha of wetland area (sawah) and about 1,228,000 ha of dryland area. The cropping pattern was dominated by paddy, which accounted for 82% or 295,000 ha of the wetland area. Of the dryland area, estate crops comprise about 573,000 ha, 80% of which is smallholder production.[20] There are more than 14 crops produced in this sector of which coconut, coffee, cloves, palm oil and rubber are the most important. The latter two are mainly estate produced.

Livestock. Aceh is one of the few provinces in Indonesia where livestock numbers are still increasing. The highest concentrations of cattle and buffalo are found on the north and east coasts, paralleling the concentrations of human population. Aceh Selatan has one of the highest populations of sheep and goats.

[20] Aceh in Figures 2003, BPS.

Soils and topography. In general, the north-east coastal plains consisting of heavy clay soils are the best soils for rice cultivation along with areas around Medan and the entire east coast of Sumatra. The coast of Aceh becomes progressively less sandy and more muddy southwards and mangrove swamps are quite extensive in Aceh Timur. In contrast to this, the south-west coastal strip has lighter and sandier soils and the prominent beach ridges have contributed to the poor drainage of the plains. Five broadly distinct agricultural regions are distinguished in the province based on altitude, agro-climatology, soils, and geomorphology: the north and east coastal plains and foothills; the narrower south-west coastal strip, the Kr. Aceh basin; the mountains and valleys of the central Barisan range comprising nearly three-quarters of the total land area most of which is forested; and the Kutacane rift valley in the south-west coast.

The north-east coastal plains contain the largest, most productive and most highly developed sawah areas of Aceh. Intensive cropping is limited by the annual rainfall which averages between 1500-2000 mm hence irrigation is essential for a guaranteed single or double rice crop. The south-west coast is very different from the north-east with comparatively wide flood plains and rainfall averaging 3250 mm. North of Meulaboh (Aceh Barat), the coastal plain is much narrower. Irrigation schemes tend to be adjacent to forested foothills which provide areas of ladang cultivation and some estate crops, particularly cloves, rubber and coffee. There is also a relatively productive coastal strip up to 4 kilometer wide where lighter soils encourage the production of palawija crops (groundnuts or soybeans) and patchouli oil in some areas. Thus rice cropping on the west coast is largely associated with cropping alternatives. The Kr. Aceh valley is distinct from both the east and the west coast and forms a transitional region between the two. The central uplands have well-developed coffee particularly in the Takengon area. At the eastern end of the province bordering North Sumatra, is the Kutacane rift valley which is very fertile but because of its extremely fast runoff it is subject to periodic flooding of sawah lands.

Cropping patterns. The nature of the farming systems exhibits significant spatial variation in line with the topographical conditions described above. Food crops predominate with paddy accounting for about 82% of the wetland area. Of the total harvested area of 368,000 ha, Aceh Utara (44,000 ha), Pidie (41,000 ha), Bireun (41,000 ha), Aceh Besar (37,000 ha) and Aceh Timur (31,000 ha) dominate. Estate crops are dominant in the mountainous west with Aceh Selatan (75,000 ha), Aceh Tengah (72,000 ha), Nagan Raya (67,000 ha) and Aceh Tamiang (52,000 ha). For the coastal villages in particular which bore the brunt of the tsunami damage, rice accounted for about 300,000 ha (79% of total cropped area), followed by 52,000 ha of soybeans (14%) and 19,000 ha of maize (5%). Bireun (9000 ha) in the north-east and Aceh Tenggara in the south-west (17,000 ha) are the major soybean and maize producing areas respectively.

Irrigation systems. There are about 465 irrigation schemes in Aceh with an area of about 335,084 ha consisting of schemes that are classified as technical (150,210 ha), semi technical (39,249 ha) and simple (145,625 ha). The irrigation schemes are also categorized by size: large (>2000 ha), medium (500 ha – 2000 ha), small schemes (< 500 ha). The small schemes are mostly in the west coast and in the mountainous areas, while the large schemes are in the north and east coast. Of the 335,084 ha total

irrigation scheme only about 70% were functional before the disaster. The remaining 30% suffered from incomplete infrastructure such as secondary or tertiary canals, or were in a degraded condition because of inadequate maintenance.

A.2 Damage assessment

Based on the preliminary assessment undertaken by the Ministry of Agriculture and Ministry of Public Works, the earthquake and tsunami damages were mainly concentrated in western and north-eastern coastal areas. In some places, the tsunami inundated up to 5 kilometer inland. Field assessment teams reported that on the west coast agricultural areas have been badly affected up to 2 kilometers from the coast line. On the eastern coast it was estimated that about 1 kilometer has been seriously affected. The government survey team as well as those from donors and NGOs are still in the field collecting more information on the damage. Damage coefficients have been used in the case of irrigation that have been determined using factors such as distance from the epicenter, satellite photos/images, available information from the field and secondary data. For agriculture, data on losses/damage are still imprecise but preliminary information has started to come in from the FAO/GOI field missions. This has been used along with province and kabupaten-level data from BPS and PODES to calculate preliminary crop and livestock loss estimates. Based on current available data and assumptions, the total estimated damages and losses in agriculture and irrigation are estimated at Rp. 2.2 trillion.

Large job losses occurred in agriculture, where about one fourth of cash crops areas and rice fields appear to have been damaged. A similar percentage of all farmers and their employees are likely to be unoccupied - an estimated total of around 320,000 people.

Irrigation. Two impacts need to be distinguished in this case – the earthquake and the tsunami. The impact of the earthquake has affected most of the kabupatens in Aceh and part of the northern part of North Sumatra.. This damage is yet to be fully assessed and could be minimal or highly significant. The north-western coast of Aceh and the mountainous areas in the central part of the province are very close to the epicenter of the earthquake, and thus have been more seriously affected by the earthquake than the other areas of the province. All irrigation schemes which were in the coastal areas were significantly affected by the tsunami. The total area affected by the tsunami is estimated at 28,000 ha (technical, semi-technical and simple irrigation systems). The degree of damage varies from kabupaten to kabupaten but it appears that the northern and western parts of the province experienced the maximum damage. In addition to the irrigation facilities, the flood protection dikes and other related infrastructure has sustained damage. The preliminary estimates indicate that about 2 kilometers of flood control embankment for the recently constructed floodway in the Aceh river was damaged. In the absence of rehabilitation, this could lead to further losses during the wet season or a period of heavy rainfall.

Standing crop damages. The damage to fields and to crops due to the earthquake was limited, but that due to the tsunami was quite extensive. Based on the estimates provided by the Ministry of Agriculture, crops on 21,000 ha of sawah and 29,000 ha

of dryland were damaged. The immediate losses are estimated at 80,000 tons of un-husked rice and 160,000 tons of other crops. The damage in monetary terms is estimated at Rp. 204.5 billion.

Land loss and reduced agricultural production. Besides the immediate damage to crops, sand and mud deposits on the agricultural fields plus erosion and salinization may mean that agricultural land is permanently lost or crop yields are reduced for some years. To reclaim the moderately affected areas may require 2 to 5 years before the productivity of the affected land is restored to the pre-disaster period. Based on the initial feedback from the field, 10% to 15% of the affected area or 5000 to 7500 ha may have been permanently lost at a cost of Rp 375 billion. In addition, the future crop losses are estimated at Rp. 1105 billion, consisting of 500,000 tons of un-husked paddy and 280,000 tons of various palawija crops.

Livestock. The Ministry of Agriculture does not have a ready estimate of the loss of livestock; however, based on the BPS data for livestock population and the damage to the farm areas it is estimated that 23,300 large ruminants, 21,000 small ruminants and about 2.5 million poultry birds were lost. The preliminary estimate of damages to animal husbandry are estimated at Rp. 126 billion.

Soil drainage, farm machinery and implements. The soils that have received deposits of salt from the tsunami must be leached and drained at an estimated cost of Rp. 225 million. Replacement of farm machinery and farmers' implements has an estimated cost of Rp. 34.5 billion.

Agricultural marketing and the private sector. The private sector engaged in agricultural marketing and processing has also suffered. In terms of the physical infrastructure, the private sector will need to replace and restore the damaged infrastructure and facilities. More important, however, will be to re-establish a functioning marketing system.

Local government infrastructure. Another major impact of the disaster has been in the implementation capacity of the national, provincial and district agricultural offices. The preliminary estimate indicate that as many as 300 DGWR plus MOA staff either died or are missing. The damage to Government offices, housing and installations in the province has been estimated thus far at Rp. 19 billion.

Table 5.17: Summary Table of Damages and Losses to Agriculture

	Total Rp Billions	Damage Direct (Assets) Rp Billions	Indirect (Flows) Rp Billions
Lands permanently lost	375	375	
Standing Crop Losses	204.5		204.5
Infrastructure, machinery, etc	278.5	278.5	
Future crop losses	1105		1105
Livestock	126	126	
Sub-total	2192	1086	1309.5

It is to be noted here that additional damage to irrigation and drainage, and to flood control structures, are accounted for under the infrastructure sector.

B. FISHERIES

B.1. Pre-disaster situation

Aceh and Nias (North Sumatra) used to have a vibrant fisheries sector with an annual output 158,578 tons in 2003, comprising 133,976 tons of fish from marine capture fishery and 24,602 tons harvested from aquaculture. Total value of the produce was estimated at Rp1.59 trillion. The fisheries sector accounted for 6.5% of Aceh GDP. The province had only one medium size fish-canning facility, and most of the fish caught and harvested in the province were consumed locally or exported unprocessed to overseas or other parts of the country. The fisheries sector also used to play an important role in the economy of the Nias Island.

The fisheries sector provided employment to over 100,000 people in the disaster affected areas of Aceh Province and Northern Sumatra. There were about 58,000 full-time fisher people. Among the 18 regions affected by the tsunami, there are five kabupatens/kotas where coastal population is relatively high: Simeulue (93% of total population), Kota Sabang (87%), Aceh Selatan (35%), Nias (24%) and Aceh Jaya (23%).

Most members of the fishing communities were artisanal fishers fishing inshore waters. This explains the large number of canoes (almost 15,000) as opposed to boats with an inboard motor that can fish further offshore (about 5,600 units). Commercial fleets are on the North and East Coast in Aceh Utara (Lhok Seumawe), Aceh Timur (Langsa) and Bireuen, and on the West Coast in Aceh Barat (Meulaboh) and Aceh Selatan (Tapaktuan). The production of marine fisheries is quite evenly distributed between the Malacca Strait and the Indian Ocean kabupatens/kotas.

The infrastructure and facilities developed to support the fisheries sector in the disaster affected area included two large fish ports in Banda Aceh and Nias, 49 units of small fish ports, and a large number of community-managed fish landing facilities. The Ministry of Marine Affairs and Fisheries (MMAF) manage an aquaculture training center, a demonstration hatchery, fisheries laboratories and a training vessel. Each district has a number of field service offices (Dinas) established by local governments.

There were about 36,600 ha of brackish water shrimp/fish ponds (tambaks) used for less intensive aquaculture, mostly owned and operated by smallholder farmers and fishers. The development of aquaculture is mainly on the Northern and Eastern coast of Aceh (Aceh Utara, Aceh Timur, Biereun and Pidie).

Total value of government and private infrastructure and facilities and assets in the fisheries sector prior to the disaster is estimated at Rp1.9 trillion.

The fisheries sector has been heavily affected by the disaster. A large number of fisher people have been killed (an estimated 15-20% of the fisher people in the 18 kabupatens), most of the infrastructure and facilities have been destroyed or damaged, and most of the community members have lost their houses, fishing

boats and gear. The extent of damage and losses in a kabupaten varies depending on its location. MMAF has initiated a systematic survey of damage and losses in each kabupaten but a comprehensive assessment will take time. In the meantime a preliminary assessment has been made jointly by Bappenas, MMAF and the donor agencies. This is based on the initial findings of the MMAF survey, satellite imageries, reports received from local governments, and estimates of MMAF staff and experts familiar with the physical features of the area and fisheries sector activities in the locality.

Regarding physical infrastructure such as fishing ports and harbors, reports from the regions indicate that the greatest damage was to kabupatens in the northern part of Aceh, both in the western and eastern coasts. In Sabang (which is the northernmost island of Aceh), however, it is reported that all of the ports are undamaged. Overall, it is estimated that 55% of the fishing harbors/ports were damaged (valued at Rp. 103 billion). MMAF lost almost 90% of its assets, which were mostly located in the hardest hit area of the tsunami (around Banda Aceh, except for the hatchery research stations in Simelue and Nias).

The damage to brackish water culture ponds has been widespread. Even in areas where the tsunami did not do significant damage (such as in the southern part of Aceh), floods have partially damaged the infrastructure. In total the damage is valued at Rp. 466 billion which is about 50% of the total damage value to the fisheries sector. It is anticipated that almost two thirds of the fishing boats and gear are fully or partially destroyed. Except in the kabupatens south of Lhok Seumawe, most boats in the affected areas were destroyed or are missing. The replacement cost of these boats is about Rp. 250 billion. The total damage to assets in the sector is estimated at Rp. 944 billion (about half of the total assets).

Although only employing a small number of people (35), Aceh provided a large proportion of the wild caught Penaeus monodon broodstock for hatcheries throughout Indonesia. It is unclear how many of the collectors survived, or what impact the interruption of this broodstock will have on the provision of fry for the shrimp farms throughout Indonesia.

The major economic loss in the fisheries sector arises from the revenue/income lost from fishing and aquaculture. These losses result from the loss of fisher people, the loss of fishing equipment and gear, and the destruction and damage to infrastructure and facilities including fishponds. It is estimated that the output of Aceh's fishing industry will fall 60% as a consequence of the disaster. It has been assumed that the recovery period to pre-tsunami production in aquaculture would be about five years. In marine fisheries, however, recovery may take much longer (estimated at 10 years); the loss of 65% of the boats and equipment and 15-20% of the fisher people will significantly lower the capacity to catch and land fish. Based on the above assumptions, the total loss of income/revenue until full recovery to the pre-disaster production level is estimated to be Rp. 3.8 trillion.

The fishery sector, which accounts for over 100,000 jobs and is vital to the livelihood of the coastal population, was dramatically affected by the disaster. Since very few fishermen have been able to return to their work yet it is assumed that all of these jobs have been lost, at least temporarily.

Table 5.18: Summary Table of Damage and Losses to Fisheries

Description	Assets (IDR million)	Direct Damage		Indirect Loss (IDR million)
		(IDR million)	(%)	
Fishing Ports	189,064	103,148	55%	
MMAF's Assets	25,902	22,841	88%	
Brackish Water Culture	1,134,710	466,063	41%	
Fishing Boats	299,937	190,488	64%	
Fishing Equipment	246,135	161,953	66%	
Fishing Production				3,807,011
Grand Total	1,895,748	944,492	50%	3,807,011

C. ENTERPRISES

C.1. Pre-disaster situation

Large enterprises. There are relatively few large enterprises in Aceh and the affected parts of North Sumatra. The major industries operating in Aceh are: PT. Arun LNG, PT. Aceh Asean Fertilizer, PT. Pupuk Iskandar Muda (fertilizer), PT. Mobil Oil Indonesia, Pertamina and PT. Andalas Cement. In addition, there is Astra Agro Lestari's 4,500 hectares plantation producing crude palm oil.

Medium and large-scale manufacturing. BPS maintains a register of large and medium-scale manufacturing companies (including those above) for its annual Survei Industry. According to the 2002 manufacturing census, Aceh has only 65 establishments, a 0.3% of the nationwide number of medium-large manufacturing establishments. With respect to employment, medium-large manufacturing establishments only make up 0.7% of the total employment in Aceh. However, with respect to regional GDP, the share of manufacturing output to Aceh's RGDP is approximately 18%. Thus manufacturing sector industry in Aceh relies on a relatively small number of capital intensive industries with high output per labor ratio.

The data show that wood product and chemical industries have the highest share of labor and output, respectively. Twenty seven percent of workers in the manufacturing sector are employed in the wood and wood processing industries. Fifty five percent of the manufacturing sector output in Aceh comes from the chemical industries.

With respect to the regional distribution of manufacturing companies, most activities are found in Kabupaten Aceh Timur, Aceh Besar, and Aceh Utara. Aceh Timur has many establishments producing food and beverages, and wood products, Aceh Besar has most of establishments producing wood products, while Aceh Utara has a few establishments producing chemical products. Slightly over half of Aceh's manufacturing establishments were located in four Kabupatens/Kota badly affected by the tsunami (Aceh Selatan, Aceh Barat, Aceh Besar, and Banda Aceh).

North Sumatra has a much larger manufacturing sector than Aceh with more than 940 establishments and 158,000 employees. The majority of these establishments are located far from the affected areas and will therefore not have suffered any direct damage. However, some of them may experience losses associated with trade which was undertaken with Banda Aceh (and conversely some may experience gains due to additional demand from international organizations and the government for relief supplies).

In order to get a better grounding of the reality faced by businesses in the area, an attempt was made to contact these manufacturing firms by phone.[21] Box 5.1 gives some examples of the problems faced by firms on the ground.

Box 5.1: Examples of Problems Faced by Firms – the Reality on the Ground

A motorcycle dealer based in Pidie with branches in Banda Aceh and Meulaboh reported that all stocks in the two cities have been damaged. He had 125 units of motorcycle in each of his shops priced at Rp. 10 million per unit. About 40% were severely damaged in Banda Aceh and 90% in Meulaboh. He estimated that his business in Banda Aceh can resume again after six months because the building still exists, but the Meulaboh operation where the building has been destroyed would take a year or two. He had 42 staff in total in the three offices – including 20 in Banda Aceh and 13 in Meulaboh – he lost two employees and 19 of his staff had lost family numbers.

A small pharmacy owner in Banda Aceh with 2 employees estimates that he is losing up to 80% sales. Some parts of his building were damaged and he would open the store for only two hours everyday because of recurring earthquakes and because he still feels traumatized by the experience. He is also facing constraints on his working capital since his suppliers in Medan, who previously allowed payment in credit, will now only take cash.

While some businesses in safer districts, such as Langkat and Lhokseumawe, were not physically hurt by the tsunami, their losses remain substantial as they have lost a large proportion of their buyers. An ice-block producer said he lost 90% of his customers who were mainly fishermen. A coffee producer said 65% of his 85 customers had died. Financially, such firms also incur an additional loss from having to write-off the debts of customers who purchased on credit.

Fluctuations in market prices are also affecting surviving businesses. For example, it was reported that price of sugar has increased significantly from Rp. 195,000/per 50 kg before the disaster to Rp. 450,000/per 50 kg. Consequently a coffee producer is unable to afford his raw materials. Moreover, damage to road infrastructure is disrupting the transportation of goods to markets. Transportation costs have soared from Rp. 2.5 million to Rp. 4.5 million between Medan and Banda Aceh and have doubled from Rp. 2 million to Rp. 4 million between Medan and Lhokseumawe.

[21] This approach has two significant drawbacks: firstly 31 of the 65 companies have no phone details recorded and are also not listed in Telkom's Business Directory; secondly, where major damage has been sustained by an enterprise it is possible that their phone connection will also have been disrupted, and even if this is not the case, the enterprise may be closed so that there are no staff available to answer a call. Thus a telephone survey may give an unduly small impression of the true damages sustained.

Small-scale and unregistered businesses. The Central Statistical Bureau (BPS) administers the Survei Terintegrasi (SUSI) which explicitly collects data on small-scale unregistered firms. The SUSI survey estimates that there are some 187,996 small-scale or unregistered businesses in Aceh in 2002 employing an average of 1.76 people each. By assuming loss coefficients based upon the location of these enterprises it is estimated that around 80,000 of these enterprises may have been lost, generating job losses in the order of 140,000.

Tourism. Tourism is a very small sector of Aceh's economy. Trade, hotels and restaurants together constitute only 6.3% of regional GDP and much of this is likely to come from trade. Hotels and restaurants in the affected areas are likely to have been devastated in much the same way as for other businesses. The damages to this sector are thus already included in the estimate of damages for the small business sector. The losses to the sector are likely to be small since total guest stays was extremely limited before the disaster - in 2003 a total of 51,678 guest stays were registered.

Public facilities for commerce and trade. In addition to private direct and indirect damages, there has been substantial damage to public facilities for commerce and trade. According to year 2000 records, Aceh had four large department stores, 10 small department stores and 84 traditional markets. The affected areas in North Sumatra had 209 traditional markets.

Employment. Job losses in modern manufacturing activities were relatively minor, a few thousand jobs, given the limited size of those activities. On the other hand, as noted above, there may be around 80,000 unregistered small businesses destroyed employing over 140,000 people in all industries.

C.2 Damage assessment

Overall damages to large firms, medium to large-scale manufacturing enterprises, small and informal businesses and public markets amount to Rp. 2 trillion, as summarized in Table 5.19.

Table 5.19: Summary Table of Damage and Losses to Enterprises

Sector	Total	Cost	
		Damage (Assets)	Losses (Flows)
	Rp Billions	Rp Billions	Rp Billions
Firms & Trading Facilities			
- Largest firms	581	540	41
- Large manufacturing firms	213	44	169
- Small firms/MSMEs	1,046	800	246
- Damage to public markets	165	165	0
- Agro-based industry and commerce	2,394		2,394
Sub-total	4,399	1,549	2,850

Large enterprises. With one notable exception, these facilities have suffered relatively light damage. The exception is PT. Andalas which suffered severe damage. Owned by world's largest French cement producer Lafarge, and one of six foreign investments in Aceh, the plant – situated in Lhonga, 25 kilometers west of Banda Aceh – is missing more than half of its 625 employees. Other major firms suffered brief disruptions but have resumed operations. Overall the damage to these very large facilities amounted to around Rp. 540 billion in damages to assets and about Rp. 41 billion in losses to production.

Large and medium-scale manufacturing. Without systematic visits to these companies it is impossible to obtain an accurate estimate of the damage and losses which they sustained. A rough estimate was obtained by assuming loss coefficients in each area and multiplying these by the asset value of manufacturing firms in each kabupaten. Similarly losses were estimated by assuming recovery times for resumption of full production based upon the level of damage sustained (see Technical Annex for details). Overall for large and medium scale manufacturing the damages are assessed to be around Rp. 44 billion (excluding the big companies discussed above), whilst the losses from reduced production are estimated at Rp. 169 billion.

Small-scale and unregistered businesses. Ideally a damage assessment would incorporate estimates of damage and losses for each of the productive sectors, including not only agriculture, fisheries and manufacturing, but also trade, services, transport, tourism and so forth. Unfortunately very little data exists about the damage to these sectors. However, almost all the activities in these sectors are undertaken by small and medium sized enterprises. Data is available on SMEs which will allow an approximation to be made of the damages and losses to the small business sector as a whole, so the damage assessment for these sectors is grouped together under the general heading of small-scale and unregistered businesses.

The vast majority of businesses affected by the disaster will be micro and small-scale businesses, often household based and informal. Even where the owners of these businesses have survived, many of those in the affected areas will have lost all or most of their business assets and many of their employees. Moreover, businesses not in the affected areas may still be severely impacted by the disaster due to the loss of both customers and suppliers from the disaster areas. Although the monetary value of the losses to each individual small business may be small in comparison with the losses experienced by some large businesses, collectively the losses are much larger. Moreover, the damage and losses experienced by this sector directly impact upon the lives of hundreds of thousands Acehnese households.

Estimating the monetary value of the damages to these small businesses is difficult since SUSI does not contain any measure of asset values. Assuming that each small informal business had around Rp. 10 million in total assets and that all of this was destroyed – this amounts to a total damages figure of Rp. 800 billion.

A rough estimate of economic losses can be obtained by multiplying the estimated number of businesses destroyed by the average number of workers in each business and the average wage – this yields an annual loss of Rp. 246 billion.

Public facilities for commerce and trade. The Ministry of Trade is about to undertake a field assessment to determine how many public markets will need to be rebuilt. However, as a first approximation, the Ministry has assumed that all of these markets have been destroyed. In the interim the Ministry has announced 240 emergency traditional markets will be created at a cost of around Rp. 8 billion. For the restoration phase the Ministry is intending to construct:

- 293 traditional markets in Aceh and North Sumatra as a total cost of approximately Rp. 74 billion (Rp. 250 million per market),
- 18 wholesale markets in 18 regencies/cities in Aceh and North Sumatra. Each would cost Rp. 2 billion,
- 19 warehouses in Aceh and North Sumatra. Each would cost around Rp. 2.5 billion.

The total cost estimate is therefore Rp. 165 billion based on complete replacement of pre-existing facilities. However, this figure should be reduced substantially as additional data on the extent of damage becomes available.

Agro-based Industries and Commerce. In view of the lower agricultural and fishery production that will occur in the following years, as was estimated in the preceding sections, an estimate of the added value that will not be forthcoming from the agro-industry and commerce sectors has been made. The volumes of production from the agriculture and fishery sector that will not be processed and marketed were determined after discounting the amounts used by the primary producers for direct consumption. On the basis of price differentials between retail, wholesale and farmgate and at-dock values, a four-year loss in added value for these sectors was arrived at. This amounts to Rp. 2,394 billion.

CROSS-SECTORAL

Cross-sectoral damage and losses – including regional governance and the environment – have sustained damage and losses that amount to Rp. 7 trillion. Nevertheless, to avoid double accounting in the overall summary of damage and losses, a total of Rp. 5.1 trillion is used.

Table 5.20: Summary of Cross-sectoral Damages and Losses , Rp. Billion

	Damage	Losses
Regional Governance	829	
Finance	2,530	0
Environment	1,437	4,744
Total	4,796	4,744[22]

A. REGIONAL GOVERNANCE

The preliminary assessment of damage to governance and public administration in Aceh Province is $81.2 million, all of which represents damage costs. The immediate implication of this damage is the need to restore basic public administration functions, especially:

- re-establishing public order and security functions,
- resuming minimal government functioning from usable buildings with wide public notification,
- establishing mobile multi-function offices where necessary,
- completing the detailed tally of those killed, injured, missing and displaced,
- providing information through all possible sources on points of contact with kabupaten and kecamatan officials and relief and basic services available.

A.1 Pre-disaster situation

Regional governance in pre-disaster Aceh was confronted with numerous challenges, including conflict, corruption, the lack of institutional capacity, inefficient delivery of public services, conflicting laws, lack of financial resources, lack of popular confidence in the public administration and unclear relationship between the center and regional administrative units.

[22] In order to avoid double accounting, in the overall summary of damages and losses the figure to be used for the item will be Rp. 3,668 billion.

A.2 Damage assessment

The disaster of December 26, aggravated the institutional, infrastructure and governance challenges, and generated numerous additional challenges. In public buildings, 21% of the public buildings and 19% of the equipment were destroyed, 21% of the personnel were severely affected, and 27% of the public records were destroyed. The replacement value of these damage and losses to the regional governance in the Province of Aceh is preliminarily estimated to be over $81 million (Table 5.21).

Table 5.21: Damage and Losses in Regional Governance Sector

Pillar	Category	Damaged	Out of	% Damage	Impact (USD)
Public administration	Building	102	503	20%	23,750,000
	Equipment	-	-	20%	6,115,350
	Personnel	7,343	31,926	23%	1,358,466
	Record	-	-	30%	13,686,498
	Others	-	-		4,203,031
	Oversight	-	-		4,911,335
	Subtotal	-	-		54,024,680
Justice	Building	16	47	34%	5,973,826
	Equipment	16	47	33%	1,048,686
	Personnel	105	N/A		22,631
	Record	N/A	N/A	N/A	N/A
	Others				704,514
	Oversight				774,966
	Subtotal				8,524,623
Parliament	Building	4	22	18%	594,000
	Equipment	158	880	18%	3,247,200
	Personnel	123	880	14%	N/A
	Record	59	220	27%	950,400
	Others	-			479,160
	Oversight	-			527,076
	Subtotal	-			5,797,836
Police	Building	34	171	20%	2,775,625
	Equipment	34	171	20%	1,460,489
	Personnel	2,502	14,763	17%	2,952,600
	Record	686,259	2,541,701	27%	3,431,297
	Others				1,062,001
	Oversight				1,168,201
	Subtotal				12,850,213
Total	Building	156	743	21%	33,093,451
	Equipment	208	1,098	19%	11,871,725
	Personnel	10,073	47,569	21%	4,333,697
	Record			27%	18,068,195
	Others				6,448,707
	Oversight				7,381,577
	GRAND TOTAL				81,197,352

North Sumatra province was also affected, but to a much lesser extent. The total damage is estimated at $800,000 (Table 5.22).

Table 5.22: Damage and Losses in Governance sector in North Sumatra

PROVINCE/ CITY/ DISTRICT		Quantification			Impact (US$)
		Affected	Out of	%	
Nias					
	Building	2	21	10%	475,000
	Equipment	2		10%	148,621
	Personnel	-	2,311	0%	-
	Record	0		14%	35,011
	Others (10% contingency)				68,816
	Oversight				72,449
Total					796,944

The Aceh and North Sumatra public administration, justice and security systems have been paralyzed since December 26. Fourteen of 21 local governments in Aceh, and three of 23 in North Sumatra, have been severely affected and are not yet operational. Currently the institutions and agents through which law and order is upheld are dysfunctional or absent. Police presence is thin on the ground, and the command hierarchy is fragmented or has collapsed. Investigatory, prosecutorial and adjudicatory services have collapsed. There are reports that detention facilities are absent. No standing procedures are reportedly in place to assist the police to maintain law and order. There are reports that judges have fled to other parts of the country.

Affected people continue to suffer from an absence of contact with district or sub-district officials (for assessment for relief needs, damage assessment or information on the status of government actions for recovery and rehabilitation): they are relying on passing NGOs and charities for information, relief materials, food and water. Municipal services such as water supply, drainage, and electricity are non-existent in the core disaster areas. There does not seem to have been any contact by the kabupaten or kecamatan offices with the Internally Displaced Persons (IDPs).

B. FINANCIAL

B.1 Banking

B.1.1 Pre-disaster situation

Given the size of Aceh's economy, its banking sector is relatively small. Bank Indonesia (BI) data for September 2004 show that outstanding loans of commercial banks and rural banks operating in Aceh was only Rp3.7 trillion or 0.7% of total outstanding loans in Indonesia's banking sector. Of this, small-scale loans (each less than Rp. 500 millions) accounted for Rp. 1.9 trillion or 52%, indicating the possibility of a large number of loan accounts.

In the largest city, Banda Aceh, 10 banks had their provincial head offices and branches. In all other regions, Bank Rakyat Indonesia (BRI) and the regional development bank of Aceh – Bank BPD Aceh – had field presence, along with other state-owned or private banks. The banking sector in Aceh is concentrated, with BRI and Bank BPD Aceh accounting for 73% of the credit. Bank BPD alone, on which very little post-disaster data are available at present, had a share of 40% of outstanding credit. Across the province, in terms of type of borrowers, individuals accounted for 41% of the borrowers, followed by state-owned enterprises (20%); private companies (7%). In terms of type of credit, 44.2% of total loans were allocated for investment purposes; 29.7% for consumer financing needs; and 26.1% for working capital needs.

As has been noted elsewhere, the following three areas were the worst affected within the Province of Aceh: Kota Banda Aceh (capital city), Kabupaten Aceh Besar and Kabupaten Aceh Barat (where Meulaboh is located). Loans extended in these three areas accounted for about 50% of the banking system credit. The bulk of the lending appears to have been for retail or consumption purposes, including most likely microenterprise loans. However, the manufacturing sector received close to 80% of credit in Kabupaten Aceh Besar.

B.1.2 Damage assessment

At the outset, BI's early assessments indicate that banks have been able to restore some of the most basic functions of the payment system (with substantial support from regional offices of BI), such as disbursement of cash at branches, and salary payments to civil servants, etc. BI's medium-term assessment points out that agriculture and transportation sectors will be heavily affected by the disaster at a macro level in the province. However, these sectors accounted for less than 10% of total loans in Aceh (see Technical Annex). It is important to note that that many of banks loans to the larger businesses operating in the NAD province are recorded in banks' head office in Jakarta or elsewhere and thus the BI data might not capture domestic banks' total loan exposure to businesses operating in the province. However, a number of large companies that have operations in the province indicated that they do not expect major disruption in their operations. A snapshot-type summary assessment is presented in Table 5.23, based on discussions with BI and BRI thus far. The total estimated losses under the above three categories is just over Rp. 1 trillion.

Table 5.23: Table of Damage and Losses to the Banking Sector (Rp. billion)

Category	Damage	Losses
Loan Losses	Moderate	900.0
Infrastructure	Low	110.0
Reconstructing Records	Low	20.0
Total		1030.0

Loan losses. The disaster will likely reduce the ability of banks' debtors to make repayments, and hence could adversely impact on banks' income and non performing loans. However, because the amount of loans is small, the impact on performance of the banking sector is expected to be minimal. Furthermore, even if all of outstanding loans in the Aceh deteriorate to become loss loans which would require 100% provisioning, the current excess provision that already recorded on banks balance sheet is still much larger than this loan loss. Estimated Damage: Assuming a 50% repayment rate, loan losses in the worst case scenario may result in a damage of Rp0.9 trillion[23].

Banking infrastructure. All national-level banks seem to have had data back-ups in Medan or Jakarta. With the exception of Bank BPD, it appears that there is no major loss of data. BRI had over 120 micro-finance BRI units in Aceh. Initial assessments indicate that branches of several banks in the three worst affected areas have been badly damaged. Branch offices of several other banks, their ATMs, telecommunications and other equipments have been damaged, besides their records. Within one week after the disaster, some large banks have reopened their offices and others are expected to follow shortly. Estimated Damage: Early estimates from the association of state owned banks (Himbara) indicate that the total loss to four state banks (Mandiri, BNI, BRI and BTN) will reach Rp.60 billion[24]. As Bank BPD had a large share of the sector, it is estimated that Bank BPD's losses may amount to about Rp50 billion. Thus, total losses under this category would be Rp110 billion.

Loss of deposits. The public also need to be assured that their savings are safely kept and records are properly restored so as to maintain confidence in the banking sector. In September 2004, public deposits in banks in the province amounted to Rp. 6.9 trillion or 0.7% of total deposits in the banking sector. Stemming from the human death toll of the disaster, BI is discussing with various central ministries/agencies possible legal mechanisms for dealing with the loss of acceptable identification from claimants on bank deposits. Estimated damage: banks are estimated to incur administrative and legal expenses in reconstructing records in the neighborhood of Rp. 20 billion.

More importantly, moving forward, a critical issue is the role of the banking sector in the rehabilitation and restructuring agenda. Banks should extend support in an expeditious and affordable manner to revive economic activity in the affected areas. BI, the government and the banks will have to work on policies that best address the emerging needs without dispensing prudent banking regulations and operations.

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[23] In the summary of damage and loss assessments these losses for the banking sector have not been added, in order to avoid double accounting.
[24] A statement by Himbara's president as quoted in the daily Koran Tempo, 4 January 2005.

B.2. Non-bank financial sector

B.2.1 Pre-disaster situation

Given the nascent state of the overall non-bank financial sector in Indonesia, the depth of insurance and pension products in the Province of Aceh is very small. The assessment below is based on most recent information available.

Insurance. In Indonesia there are 162 insurance companies of which 102 are classified as general insurance, 56 as life insurance and the balance as specialized. The most recent data indicate that fewer than a half dozen insurance companies operated in Aceh, and there were fewer than nine branches in total. Very few policies are underwritten exclusively for Aceh, and current estimates are that 22 risk policies were valued at Rp. 769 billion at year-end 2004, versus 429 policies in North Sumatra with coverage of Rp. 16.1 trillion (Source: Bisnis Indonesia, 12/30/04). The largest policy holders in Aceh include PT Telkom, PT AAF (ASEAN Aceh Fertilizer) and PT. PIM (Pupuk Iskandar Muda). The insured companies believed to have sustained losses include: PT. PIM I in Lhoksumawe which suspended operations and could lose up to Rp. 30 billion; and PT Telkom, which estimates losses from Rp. 20 billion to Rp. 161 billion.

Domestic insurance companies reportedly reserve only 20% of the risk onshore, the balance is re-insured offshore, which will mitigate the impact on the insurance industry and the Indonesian economy. PT. Semen Andalas Indonesia (88% owned by Lafarge), for instance, has reported substantial property losses of up to $40 million, but is insured offshore. Thus, while total claims in Indonesia may rise to $1 billion, AIG and Bumi Putra 1912 Life Insurance Company estimate that the impacts on them and other local insurers will be limited. Consequently, though the earthquake/tsunami caused massive devastation in Aceh, there is no threat to the safety and soundness of the insurance industry, nor does it post any systemic risk to the financial system. In the worst possible scenario, it is estimated that the damage may reach as high as Rp. 1.5 trillion[25] (assuming that about 15% of the insured value is taken on the books of domestic insurers and not reinsured elsewhere).

Cooperatives. The other component of the non-banking financial sector in Aceh are cooperatives. There were 4,752 cooperatives recorded in Aceh in 2003 with a total of over 700,000 members. The total savings of cooperatives members amounted to around Rp. 146 billion whilst total loan capital was Rp. 224 billion. The cooperatives sector will face the same challenge of community based reconstruction of records and assessing and writing off of loans as the general banking sector.

[25] To avoid double accounting, these potential losses of the insurance industry have not been added to the summary of damage and losses.

B.2.2 Damage assessment

Based on the above, in the worst possible scenario, the financial damages are estimated to be in the order of Rp. 2.5 trillion (Rp. 1,030 billion in the banking sector; and Rp. 1,500 billion in the insurance sector).

C. ENVIRONMENT

A preliminary estimate of the total economic cost of the disaster to the environment is Rp. 6,180 billion, of which Rp. 1,437 billion represents direct damage to environmental assets, and Rp. 4,744 billion are losses in environmental services. It is to be noted, however, that in Table 5.24, to avoid duplication with other sectors, a total damage and loss value of Rp. 5.1 trillion is used.

- The need to view the removal of debris as an opportunity for employment generation, resource recovery for reconstruction and fill for coastal protection,
- Heightened vulnerability of the coastline to tides, storm surges and high winds due to the loss of beaches, coral reefs and mangroves,
- Contamination of some rural drinking water resources (shallow wells) from mud, silt, debris, and saltwater,
- Increased vulnerability to flooding in urban areas due to changes in river flow patterns,
- The long-term loss of economic opportunities and environmental services from damaged reefs and forests which will need at least a generation to recuperate.

C.1 Pre-disaster situation

Aceh Province and the affected area of North Sumatra are dominated by a mountain ridge extending west to south-east. The coastal plains are developed with the exception of the western coast. The climatic and soil conditions allow the province to have a diversity of ecosystems. Among the forest types, there are mangroves, peat swamp forests, lowland evergreen forests, lowland semi-evergreen forests as well as forests on lime stone that support a wide range of fauna as well as provide ecosystem services such as water retention, soil retention as well as timber and non-timber forest products.

In the coastal zone, coral reefs, mangroves and seagrass beds are important ecosystems in Aceh. There were about 100,000 ha of coastal reefs in the affected area with roughly 30% live coral. Coral reefs support fish, birds and nesting turtles, trap coastal sediments and provide coastal protection from high waters. The west coast of Aceh is mainly composed of sandy beaches and mangroves are found only in patches. The mangrove areas in and around Banda Aceh have been cleared and converted into fish/shrimp ponds (estimated 36,597 ha of fish/shrimp ponds reported in the Fisheries assessment paper), leaving mangrove areas in shallow lagoons or near river mouths. In 2000, there were an estimated 30,000 ha of mangroves in good condition (around Simeuleu island), 286,000 ha

on fair condition and 25,000 ha in poor condition. Mangroves are particularly important since they function as a nursery and feeding grounds for coastal and riverine fishes and prawns, while providing coastal/delta protection from surges and floods. Peat swamps are found in the west coast of Aceh, particularly 50-250 km away from Banda Aceh. Seagrass beds are considered to be one of the most productive marine ecosystems. Only small patches of seagrass beds have been identified along the coast of Aceh. Two protected areas are of concern: Pulau Weh Marine Reserve (3,900 ha) and Kepulauan Banyak Marine Recreation Area (227,500 ha).

The Province is rich in water resources, distributed in rivers, lakes, wetlands and groundwater systems. Rainfall in Aceh and North Sumatra Provinces is high with annual rainfall in the western and southern coastal plains of 2000-3000 mm/year and 1000-2000 mm/year. Aceh Province has 73 rivers, which are rather short and fast flowing from the mountainous areas to the sea. In rural areas, shallow wells provide water for productive activities and for sustaining human life. The agricultural land extending along the west coast functions as an agricultural production area but also retains runoff water and sediment.

Chemicals toxic to human health and the environment are manufactured, stored and/or used in the production sectors, particularly in Banda Aceh. These include oil and natural gas, fertilizers, pesticides and other chemical wastes. While Aceh is not heavily industrialized, there is localized manufacturing, storage and use of toxic substances.

At the national level, the Ministry of Environment is responsible for environmental standards and policies. At the Provincial level Bapedalda-Aceh is responsible for environmental management, reporting to the Governor. Likewise, Bapedalda-kabupaten (district level) reports to the Bupati (head of district). Bapedaldas submit environmental reports to the Ministry of Environment on a yearly basis. Solid waste management is the responsibility of local governments.

C.2 Damage assessment

The earthquake and tsunami had enormous impacts on the coastal environment, causing damage and loss of animals, plants and habitats, and important ecosystem functions. This assessment covers, in order of priority: critical coastal habitats, water bodies, terrestrial ecosystems, debris and waste, land, environmental management capacity, and chemical contamination.

Table 5.24: Summary of Damage and Losses to the Environment, Rp. billion

	Area Affected	Damage	Loss
Coral reef loss	97,250 ha		3091
Mangrove loss	25,000 ha		1099
Seagrass bed loss	600 ha		21
River mouth rehabilitation	7.5 km	21.4	
Shallow well restoration	1000 wells	9.3	
Forest loss	48,925 ha		204
Debris clearing		31.6	
Coastal area restoration	300 km	1,374.5	
Lost land use	53,795 plots		328
Total		1,436.8	4744

Critical coastal habitats. A valuation of the ecosystems under the pre-disaster condition was carried out based on the value of ecosystem goods and services (both direct and indirect costs). Although the extent of the damages to these ecosystems is not confirmed at the time of this assessment, the following assumptions and results were obtained: (a) mangroves – full damage to the 25,000 ha of mangroves in poor condition at a conservative unit value of $737 per ha, yielding a net loss of $118.2 million; (b) coral reefs – 30% damage to 97,250 ha at a conservative value of $1599 per ha as there was pre-existing damage to the coral ecosystem, yielding a net loss of $332.4 million; and (c) seagrass beds – 20% of 600 ha damaged at a value of $2684 per ha, yielding a net loss of $2.3 million.

Water bodies (rivers, lakes, wetlands, and groundwater systems). It is expected that the freshwater resources in rivers will recover quickly, probably in a matter of days, from any impact. It is therefore unlikely that the quantity and quality of river water in the upper reaches have been impacted. In the lower parts, i.e. 2 to 4 kilometers from the coastal region, most rivers in the north and west coast to Meulaboh have wider river beds that have received both saline water and sediment from marine areas, sludge from lower river parts and topsoil. The replacement cost has been calculated in terms of necessary dredging of lower river stretches. The priority target area for such rehabilitation is 5-10 kilometers of lower river stretches and canals may also need some rehabilitation. An estimated price per kilometer of river stretch is $300,000, making the total cost for river rehabilitation $2.3 million (assuming an average of 7.5 kilometers in need of rehabilitation).

Replacement cost has been calculated for the rehabilitation of shallow wells by removing sand and sediments and pumping out saline water, followed by disinfection. Some repair work on wells and pumping equipment may be required. No data on the number and condition of the shallow wells are available except for some rapid assessments made by NGOs like Oxfam. A rough estimate based on rural population, service level and the areas that have been flooded is that 1,000 shallow wells may have been affected. Rehabilitation of each of these, undertaken by local people with technical assistance from NGOs, is estimated to cost an average $1,000 per well. This yields a total cost of $1 million for shallow well rehabilitation in the rural coastal areas.

Agricultural, forest and other terrestrial ecosystems. Forest areas are included in the coastal strips, but actual coverage of forests in the coastal strip is not clarified. Damages to the patch forest areas were not evaluated in detail, but an attempt has been made to evaluate the damages to forests. The total agricultural land affected by tsunami has been calculated as 69,000 ha. The GIS-based study in the impacted area (wider areas than the actual affected areas) indicates forest cover of 52.46% and agricultural land cover 17.56% of the total area. However, forest coverage in the affected area is thought to be much lower, amounting to between 41,230 ha and 82,460 ha, respectively. A mid-point value of 48,925 ha of pre-disaster forest in the affected area has been used with the assumption that 30% of this area has been lost. The forest ecosystem services were estimated at $209.43/ha/year (Primary forest in 2002; IPP, 1999 and others calculated by Tim Brown). This yields an annual lost value of $3.1 million, or a net present value loss of $21.9 million, assuming that the forest full recovers it productive value over a 25-year period.

Debris and waste. The earthquake and tsunami generated a huge amount of building rubble and other debris as well as redistributed municipal and industrial wastes. All these require collection, processing and disposal. If not properly managed, wastes may pose a risk to human health as well as ecological functions. Appropriate waste management is a key to the environmental rehabilitation of the affected areas. Storage and recycling of building rubbles should be given a top priority not only to clear the transport network and to improve living environment, but also to provide an opportunity to reduce recovery cost through recycling of debris, as well as avoiding impacts on the environmental conditions. According to the Housing sector report, the recovery cost is calculated at $3.4 million, but this may be reduced through proper planning of waste collection and disposal as well as effective recycling.

Foregone land use opportunities due to lost or degraded land. The tsunami modified not only land surface, but also the coastal lines and channel morphology in the lower stretches of the rivers. Consequently some land around river mouths and coastal lagoons lost critical functions such as shoreline protection and support for coastal habitats. Experience from similar disasters indicates that such damages likely happened and the cost in terms of necessary coastal rehabilitation is calculated at between $84.4-211 million. For purposes of this report, we use an average figure of $147.8 million for coastal rehabilitation.

Further, the modified coastal and riverine land has simply disappeared along with associated land uses. Information on the extent of the lost land is not available at the time of the current assessment. However, an attempt is made to estimate, using the total housing unit destroyed, the magnitude of the land loss. The cost for the lost land is estimated to range from $23.5 - 47.1 million[26]; for damage calculation purposes, the average value is $35.3 million for lost land use.

[26] The total housing units destroyed is 53,795. The average value of house and land US$5,000, while the land value constitutes approximately 35%. The value of the lost land is calculated at US$94.1M, but this estimate is taken as an upper side. Assuming 20% and 50% scenarios, the range of value is US$23.5 – US$47.1.

Local environmental management capacity. Local environmental and solid waste management institutions (buildings, equipment, staff, records) have been significantly affected. The recovery cost for these authorities in local governments is included in the Civil Service report. However, it is noted that early re-establishment of solid waste management services and local environmental management capacity is essential for the rehabilitation and reconstruction program, including data collection, EIA, licensing and environmental monitoring. Protected area management, particularly for the Pulau Weh Marine Reserve, may have been affected by the disaster but this is not considered to be significant.

Possible contamination caused by damaged industrial installations. Three major industrial sites are confirmed to be damaged: Pertamina (oil depot in Krueng/Banda Aceh). Pertamina (oil depot in Meulaboh), and Semen Andalas Indonesia (cement factory in Banda Aceh). Concerning Pertamina, it is confirmed that 40,000 kl oil in eight tanks in Banda Aceh and 5,000 kl of oil in one tank in Meulaboh, were respectively stored prior to the disaster; a total of 8,000 kl has been reported to have leaked from the Banda Aceh facility but the amount of released oil from the Meulaboh depot is unknown, leading to difficulties in evaluating how much oil can be recovered. Semen Andalas Indonesia has been heavily damaged, and there is a potential of leakage of copper slag and used lubricating oils, but information on leaked wastes is not available. The status of other industrial installations that may release toxic substances to the environment has yet to be confirmed. Risks include: the transformers and capacitors in power generation and transmission facilities and large buildings may contain PCBs that could have been released into the environment during the disaster. Pesticides and fertilizers may be leaking into the environment from damaged storage facilities, but both baseline and damage information are not available.

Livelihoods Lost

LIVELIHOODS LOST

We are farmers. All of our rice fields are gone, and our vegetable and fruit gardens as well. We only managed to save one of the buffaloes. I have four grandchildren with me here, the oldest is six. But we have lost people.

Woman in Lembaya Camp on the main road between Banda Aceh and Meulabo

INTRODUCTION

The damage and loss assessment demonstrates that it is the private livelihoods of people and communities that have been most hard hit by the earthquake and tsunami disaster. While the rest of the damage assessment captures the quantity of the damage, this chapter tries to capture the reality of the struggle involved in starting from scratch for many of these communities. Addressing the impact of the disaster on the livelihoods of the survivors should constitute the crucial part of the reconstruction effort. Despite the trauma sustained by the Acehnese population, the desire to start working and rebuilding is certainly apparent from early qualitative reports from the region. In order to match the aid efforts with the needs of these communities, the local communities need to be informed of their options as they re-establish livelihoods and the reconstruction process should take direction from them.

Based on the conclusions from the damage and loss assessment, this section outlines the areas of particular importance for the livelihoods of communities in the region including: (i) housing and shelter; (ii) rural livelihoods in the agricultural and fisheries sectors; (iii) small businesses and private enterprise; and (iv) public service delivery. These are priority areas to resuscitate livelihoods. The section then discusses some cross-cutting issues that require special attention in the aftermath of the disaster such as the psychological and social impact of the disaster on communities as well as security and land ownership issues. Finally, the vulnerable populations of women and orphans are discussed and their numbers are analyzed in order to focus aid and rehabilitation efforts for these exposed populations.

HOUSING AND SHELTER

The disaster has hit the livelihoods of communities mostly through its overwhelming destruction of homes, communities and, in some cases, whole villages. The damage and loss assessment indicates that about 48% of the total damage due to the disaster is in the housing sector, and that total damage and losses in the housing sector make up about 42% of total private damage and losses. Rehabilitating livelihoods will only be possible with the first step of reconstructing homes and starting new communities. Repairing and constructing homes will be less costly when carried out at the community level and will also generate income at the local level which is very important at this stage for resuscitating livelihoods in the region. Local housing programs need to be based on public and participatory planning. Past experience in other countries show that temporary shelter facilities can become permanent ones in the absence of further reconstruction efforts. Care should be taken to avoid such

short-cuts on the part of the reconstruction effort as this would undercut the opportunities for revitalizing communities and the local economy.

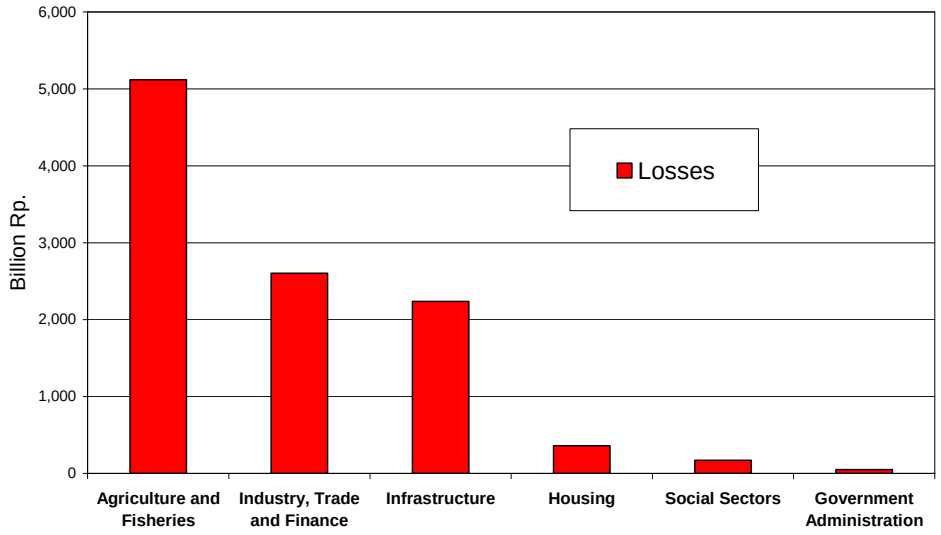
REVITALIZING INCOME GENERATING ACTIVITIES

While short-term relief needs involve shelter, water and food, the longer term return to income generating activities will be the major challenge in the region. In this context, the dual rural and urban economies with significantly different characteristics should be taken into account in designing productive sector reconstruction strategies. The needs of agriculture, fisheries and informal self-employment jobs in rural areas will be different from the more formal wage work in trade and services in the urban areas.

RURAL LIVELIHOODS

The livelihoods of people in the agricultural sector and fisheries have been hardest hit. The human toll is highest for workers in the agricultural sector, with 30% of the deceased estimated to have been involved in agriculture. The damage and losses in the agricultural sector and fisheries add up to almost one-fifth of the total cost of the disaster. It is important to realize that the loss of income in agriculture and fisheries make up more than one-third of total losses due to the disaster. In order to minimize these expected losses, it is important to resuscitate the livelihoods in these sectors as quickly as possible. In some areas, the tsunami wave reached farther than five kilometers inland, destroying crops and killing livestock as well as sweeping through houses. While reconstruction is a priority for everyone affected, farmers face a particular challenge in that it may take years for their land to become fertile again, if it has not been altered permanently by loss of top soil. Employment opportunities created by the cleaning and reconstruction processes may not match the amount of time that the land needs to recover. In addition, with family members injured or dead, it may be impossible to return to farming at pre-tsunami levels. For subsistence farmers, these changes may spell the difference between success or failure.

Figure 6.1: Losses in the income generating sectors



It is estimated that about 10% of the casualties in the disaster were fishermen. Prior to the tsunami, many of them were already in a tenuous position. Over-fishing was rife and a large number were in debt to local moneylenders. Indeed, many did not own their own boats, but were working for others. With fewer fish coming in, it was becoming harder to repay loans. Reef and fish stock recovery times are far in the future and it will be difficult for these fisher folk to start again. Currently, the desire to return to the sea is tempered with fear and a need for information about possible livelihood options. Questions remain for those who do not want to return to coastal areas and who must seek new land and build lives and communities far from what they know. However, there may be some opportunities. With a recovery process that is sensitive to both the needs of the fishers and the environment, it is possible that a more sustainable livelihood in fishing can be developed, and the former exploitative nature of employment for many fishermen be avoided.

I lived near the Darusalam University Campus, quite near the Governor's office. Our home is gone, and I don't think we will be able to return to our kampong. It can't be used again, and we are afraid that more waves will come. I was employed as a fisherman, along with some of my friends here. We would prefer to continue fishing in the future, but I guess we could change professions if necessary. The important thing is to obtain a living – anything really, as long as it is well planned.

Man at refugee camp on the outskirts of Banda Aceh

Can we stay here? This is the question that those of us who survived are asking just now. Many do not want to stay; they do not want to be near the sea again. Our hopes are that we will be able to choose a new area to live. Maybe we should be in the mountains.

Man from Alu Naga village

SMALL BUSINESSES AND PRIVATE ENTERPRISE

Trade and industry were primarily located in urban areas. Many individuals up and down the coast were involved in these sectors across a broad socio-economic spectrum. In Aceh and North Sumatra, the informal economy provides a large number of women and men of all ages, but especially those entering the labor market, with opportunities to earn a living. According to the damage assessment, after the housing sector, the largest damage and losses of the disaster are in the trade and industry sector. The analysis shows as many as 80,000 small enterprises have been destroyed, providing income to some 140,000 people in the affected areas. Especially in terms of minimizing future losses, it is important to mobilize resources in order to bring businesses back to life.

On the positive side, there are already reports in Banda Aceh that individuals are keen to have access to their bank accounts, some with the goal of restarting business operations. Markets reopened quickly and, while still not as extensive as prior to the tsunami, economic activity is picking up. However, there are a number of challenges to be faced. Several sources in Banda Aceh pointed to a particular feeling of hopelessness in the city, since the extent of the damage and debris is so great. The clearing of rubble has commenced on a large scale and market and mosque re-openings are critical steps to regaining a sense of normalcy. This is an important psychological as well as physical issue in that traumatized people do not feel confident to return to work in areas where the devastation is so obvious.

While there are businesspeople who are very interested in staying and rebuilding, there are others who are not ready to weather the process. In particular, these individuals may be those who possess enough capital to leave and reopen elsewhere, or who have the ability to leave for an extended period of time while the area is cleared. Their willingness or not to reopen business in Aceh impinges on the livelihoods of many thousands of their employees. This applies equally to the commercial and manufacturing sectors.

Some workers might face trauma causing reluctance to come back to work, for example fishermen. The number of micro-, home-based enterprises that would have contributed to the livelihoods of a larger group, and that have been destroyed will not be known for quite a while. Those who remain will, in the short term, be looking for subsistence-type income generating opportunities. Training might be needed to help them explore other types of job. Extended micro-credit programs could play a major part in their recovery.

PUBLIC SERVICE DELIVERY

The damage assessment shows that infrastructure, social services (excluding housing) and government administration were also hard-hit by the disaster. Although the brunt of the cost is on the public side for these sectors, the lack of these services in the region will have a bearing on the rehabilitation process for private communities. It is expected that the worst-affected levels of government are the village, *kelurahan* and sub-district levels where, in many cases, government officers have been lost, and facilities, assets and records have been completely eradicated. This has major implications for the re-establishment of people's livelihoods. Re-engagement with government by community members will be impossible in these places for the foreseeable future until these important levels of administration are re-established. This is clearly a priority, as people in local neighborhoods have always relied heavily on these local administrations for a wide range of permits and services related to their lives and livelihoods.

OTHER CROSS CUTTING ISSUES

LOSS OF SOCIAL CAPITAL

In addition to the loss of housing, few refugees are with people of their own communities. They have lost very large numbers of friends and family members, and in many cases have lost entire neighborhoods and communities. The social and economic interactions they took for granted are now gone. This further impacts on livelihoods, and certainly means a very poor quality of life for many if not most for the foreseeable future.

The sense of community and mutual self-help built up over generations has thus ceased to exist for many, at least for the time being. This can only add to the loss of confidence that many people are experiencing now. However, there is a sense of mutual purpose and solidarity building amongst people from different areas who are working and living together. Reports also suggest that people are choosing representatives to meet the needs of the moment, even if their traditional or administrative leaders have died or are missing.

THE EXPERIENCE OF TRAUMA

It is difficult for many individuals to think about the future, as they are still battling with day-to-day demands and trying to comprehend how their lives have changed. There are many stories of trauma: 3000 teachers, for example, are currently unable to return to work. On an individual level, people are still terrified when there are aftershocks, and extremely afraid of the sea.

There are many effects of trauma. At the worst, individuals are incapacitated and need medical treatment. For many, lives and livelihoods continue, but will be affected in numerous ways. These people need counseling and public support. In addition, they need information about what actually happened to them. Reports from field visits indicate that people are still very confused, providing many opportunities for rumors and additional fear and panic.

Trained mental health professionals are needed to assist the most traumatized victims, and programming going forward needs to include broad counseling; through schools, community organizations and existing village structures. In addition to being sensitive to different effects of trauma, it is also important to realize that different social roles and support networks are available to women, men and children. These create different reactions to traumatic events and generate various coping mechanisms.

ONGOING SECURITY ISSUES

It is critical to remember that Aceh is still a conflict area, and security for both survivors and relief/reconstruction personnel must be ensured. While possibly less a factor in Banda Aceh, existing and changing security situations must be taken into account. For instance, even before the tsunami, there were displaced populations in Aceh. At one IDP camp visited by a local NGO, many of the individuals had evacuated before the disaster due to increased hostilities around their village. Now, their homes have been destroyed and their belongings swept away. Reconstruction plans will need to take into account that some communities were already at risk in their original locations or may now be at risk due to a changing security landscape.

POSSIBLE LAND AND HOME OWNERSHIP PROBLEMS

Land and livelihoods, in many cases, are inextricably linked. In an area where the geography changed in a matter of minutes, and population is still shifting, land control and ownership will become a critical issue. This will be an issue not only in agricultural areas, as individuals try to return to land or settle elsewhere, but also in urban areas, as individuals try to rebuild on smaller plots. In Aceh, most of the households lived in self-owned houses and less than 10% of houses were rented. The percentage of households that have some form of documentation for their house is around 88% in Aceh while only 9% of households hold land certificates. However, today many of the documents they might turn to have been destroyed and the issue of ownership claims may soon become a source of tension in the area.

VULNERABLE POPULATIONS

There are certain parts of the affected communities that are in a particularly vulnerable position today after the disaster. [27] These vulnerable populations especially include (i) the widows that need to single-handedly take care of children with no prior experience in the labor force and in an environment where communal networks have been lost, and (ii) the children that are orphaned and are in need of care by other adults.

WOMEN AS SURVIVING MOTHERS

While the physical destruction will take years to mend, the damage done to families will take generations. Both men and women have the emotional trauma of having lost spouses and children, and single-headed households will struggle to simultaneously re-enter the market and raise children. For women, the challenges are particularly great. Since Aceh is a conflict area, the number of female-headed households is already high, at 19%. Many of these women were already marginalized and the tsunami brings an additional burden that may prove quite difficult to bear. For example, one woman had recently established a warung with a micro-loan. She had enough capital to start raising a few chickens as well. The tsunami has destroyed her shop and killed her chickens, but she still needs to repay the loan that allowed her start up in the first place.

Of children who still have a surviving mother, 75% of them do not live with extended families and the children and mother of these households mostly have to rely on themselves in coping with the tragedies. Of the newly-widowed women, it is estimated that only 27% have experience with work outside the home. For many of these women, new skills will be necessary to survive. When asked the main reason of not working, most cited household duties (96%) while only 3% were discouraged worker and 1% claimed that they already had financial means. When we examined the sectoral classification of their previous jobs, we found that they were involved only in three sectors: agriculture, trade and services. The small proportion of urban single mothers who previously had jobs worked primarily in formal social services, while the rural counterpart worked primarily in agriculture sector.

There is a clear need for reconstruction efforts to maintain a focus on women to be sure that women get the support that they need. In some areas, this is already happening as women's organizations, prayer groups, etc. are already assisting. In some areas, women are still waiting. As one woman in an IDP camp noted:

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[27] In this section, the impact on the specially affected sections of the population: women, children, and elderly is analyzed. The casualties and destruction is simulated in order to get better estimates of the profile of the dead and the survivors in these vulnerable populations. The assumptions and methodology of the simulation and analysis is provided in Annex I.

The women here do not have much say in what is going on. There is no specific assistance for women here. We have not yet been contacted by any women's organizations.

The subordinate position of women in society also makes them targets for physical attacks and abuse, blocks avenues for acquiring necessary skills, and limits their access to resources and power structures. Given the current security situation, these challenges may be amplified. In many camps, women have little say in the allocation of resources. As reconstruction efforts begin, this lack of voice may translate into poor representation in resettlement planning and an inability to express retraining and financing needs.

CHILDREN AS ORPHANS

Children are the most vulnerable victims of this kind of catastrophes. Our estimation indicates that 37% of the casualties were children below 18 years old. As many as 12,160 or 13% of those who died were infants. Striking as these figure are, they do not capture the fact that in some villages nearly all of the children are gone. In one village, Alu Naga, it was reported that all the children had died. Drawn to flopping fish on the beach as the sea receded, many were then killed by the wave that followed. This is not just a loss now, but it is also an inestimable generational loss for the foreseeable future. The family lives of these children are forever altered. These figures do not take into account the number of children who have lost siblings or extended family members, nor can it capture the trauma of experiencing the catastrophe and living through the death and devastation that followed.

In order to guide aid and rehabilitation efforts relating to orphans in the area, a separate analysis has been run on the number of children that are likely to have lost parents. The analysis reveals that as many as 32,735 children have lost either one or both parents. The number of children who have lost both parents is estimated as high as 7,722 children.

Table 6.1: Orphans in the Impacted Area

Surviving Children	Without Father and Mother	With Surviving Mother only	With Surviving Father only	Total
0-5 years old	2,435	3,448	4,509	10,392
6-12 years old	3,078	4,183	5,453	12,714
13-18 years old	2,209	3,503	3,917	9,629
Total	7,722	11,134	13,879	32,735

For those children that have mothers and /or extended families that can take care of them, putting them in an orphanage might not be an optimal choice. Out of the 7,722 children who have lost their parents, only 20% used to live in extended households. These children might have a choice of living with their extended families, older siblings, grandparents or other relatives. For the remaining 80% who used to live in a nuclear household, the choice might be more limited. This huge number of

orphans indicates the need to carefully establish mechanisms to provide shelter for families or institutions for them. Attempts at reunification with relatives who lived separately before, orphanage or special children care center, living in pesantren, or in some cases adoption are among the choices that can be explored. Options for them need to be developed carefully with the Acehnese being the main actors in deciding the best option to choose. This is a very sensitive issue among Acehnese with a lot of coverage in recent newspapers showing that the top- down approach of allocating these children will cause offense and the sensitive issue of religion should not be ignored. Proper registration of these children is a crucial need. If indeed the choice is allocating them outside Aceh, either in institutions or with foster parents, care needs to be taken to ensure that they indeed were allocated in an institution or with foster parents of the same religious affiliation.

The psychological damage stemming from the tsunami impacts more than the family lives of children. As many teachers have been killed or are seriously traumatized themselves, recovery and reconstruction efforts need to be sure to address educational needs. In many areas, this needs to include support of undamaged schools that have taken on extra students. Many students are already attending temporary schools, and some have also been absorbed into existing schools, dramatically increasing class sizes and stretching existing resources.

Macroeconomic Impacts

ECONOMIC IMPACTS

I was employed as a fisherman, along with some of my friends here. We would prefer to continue fishing in the future, but I guess we could change professions if necessary. The important thing is to obtain a living – anything really, as long as it is well planned.

Fisherman in temporary camp Banda Aceh

MACROECONOMIC IMPACTS

ECONOMIC SITUATION OF ACEH

As a proportion of the Indonesian economy, Aceh's share is small in some key respects. The province's regional GDP accounted for 2.3% of total GDP in 2003. Oil and gas dominate the economic production of Aceh, accounting for 43% of the region's GDP in 2003. In 2003, Aceh's nominal GDP was Rp.38.6 trillion (about $4.5 billion), 2.3% of national GDP. According to the latest information, oil and gas fields were not damaged including Exxon Mobil's large Arun natural gas operation in Lhokseumawe. However, when considering the livelihoods of the survivors, other economic sectors are important in terms of employment. In the non-oil and gas economy, most people in Aceh work (32%), while livestock (10%) and food crops (10%) also have large workforces. As such, the lack of damage to the oil and gas fields while important for Indonesia as a whole, does not much mitigate the impact on Aceh itself[28].

On an expenditure basis, the investment to GDP ratio was 7.5% in 2003, less than half of national ratio (19.7%). Aceh's investment to GDP ratio was low at 11-13% even before the crisis. In contrast, net exports (exports minus imports) were high at 42% of GDP in 2003, much higher than the national figure of 5.5%, and mainly due to exports of natural gas.

Aside from natural gas and fertilizer, Aceh represents a small share in Indonesia's exports. In 2003, Aceh's total non-oil and gas exports were $84 million, 0.2% of national non-oil and gas exports. Among Aceh's non-oil and gas exports items, fertilizer is the main product. In 2003, fertilizer exports were $55 million, 65% of total non-oil and gas exports and Aceh's fertilizer exports accounted for 29% of total fertilizer exports. Aceh's LNG exports from Arun have a substantive share. In 2003, it accounted for 24% of total volume.

POTENTIAL ECONOMIC IMPACT

Some of Aceh's main economic drivers – particularly its people and their ability to generate outputs – have clearly been devastated and with it, the immediate economic prospects. Two-thirds (67%) of nominal GDP in the non-oil and gas sector (2002 accounts) are in the affected areas.

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[28] Central government revenues from gas are, however, an important source of income to the Aceh government.

IMPACT OF THE EARTHQUAKE AND TSUNAMI ON ACEH AND INDONESIA'S ECONOMY

Growth. The impact on the 2005 GDP growth rate of Aceh and Indonesia is analyzed according to three scenarios, with varying assumptions about the potential impact on Aceh's non-oil and gas GDP and assuming that oil and gas is unaffected. As indicated, a starting point is the 67% share of non-oil and gas GDP in these kabupatens. The scenarios assume 10%, 20% and 40% of non-oil and gas GDP in Aceh will be lost.

The results are presented in Table 7.1. Aceh's GDP could be 7% to 28% lower in 2005 than in 2004 with these assumptions. These would result in a reduction in the growth rate in Indonesia's GDP to between 4.9% and 5.3%, 0.1 to 0.4 percentage points below the original growth projection of 5.4%. For example, Scenario 2 (moderate) assumes that Aceh's non-oil and gas GDP declines 20%, the 2005 growth rate would drop 13.9%, lowering the national growth rate by 0.2 percentage points from the baseline.

Table 7.1: Impact of Sumatra Earthquake on Aceh and Indonesia's GDP and GDP growth

	Scenario 1 (Minor)	Scenario 2 (Moderate)	Scenario 3 (Worst)
Aceh's Non-oil and Gas GDP Declines by 1/	10 percent	20 percent	40 percent
Aceh's growth rate	-7.0 percent	-13.9 percent	-27.8 percent
Impact on National GDP Growth	-0.1 percent	-0.2 percent	-0.4 percent
Revised GDP Growth Forecast	**5.3 percent**	**5.2 percent**	**5.0 percent**

1/ Compared with estimated 2004 GDP
Source. CEIC, World Bank Staff Estimate

Possible Positive Impact from International Assistance and Reconstruction. International assistance and forthcoming reconstruction activities are likely to have a positive impact. As the situation clarifies this impact will be added to the analysis.

Per Capita Income. The GDP from the oil and gas sector does not directly flow to the people of Aceh. Instead, much is returned as revenue sharing and other central government transfers. To assess the impact of the tsunami on income, revenue sharing from the oil and gas sector (in 2004) is added to per capita GDP depending on the scenario from above. In addition, Aceh's population is assumed to have grown 1.5% in 2004 minus the estimated casualties (110,000 at this point). If there had been no tsunami, per capita income would be Rp. 1.9 trillion whereas if we assume a decline of 40% in non-oil and gas GDP, per capita income declines by 32% (see Table 7.2).

Table 7.2: Per Capita Income

Decline in Non-oil and gas GDP by	Non-oil and gas GDP (Rp.bln, 93 constant)	Revenue Sharing (oil and gas)	Total (Rp.billion)	Aceh Population	Per capita (Rp.million)
0%	6,993	1,622	8,615	4,483	1,922
10%	6,294	1,622	7,915	4,440	1,783
20%	5,594	1,622	7,216	4,440	1,625
30%	4,895	1,622	6,517	4,440	1,468
40%	4,196	1,622	5,817	4,440	1,310

Source. World Bank Staff Calculation

Sector Impact.

Tourism. Aceh and North Sumatra are not major tourism destinations and as a result, the direct impact on tourism is not likely to be large. In 2003, Indonesia had 3.8 million visitors, of which only 76,000 (2% of the total) went through Medan (capital of North Sumatra) and even fewer to Aceh due to the conflict. There are concerns about a spillover impact on tourism due to residual fears but this may be offset by tourism shifting to Indonesia from other locations not impacted by the tsunami.

Investment. Investment, as measured by investment approvals, was relatively limited in Aceh except for foreign investment approvals in 2003[29].

Financial Sector. Aceh's financial sector is relatively small. For example, in terms of commercial bank loans, Aceh accounts for 0.7% of Indonesia's commercial loans as of September 2004. Banking activity is undoubtedly larger as many bank loans to larger business operations in Aceh are recorded in Jakarta or other places.

Balance of Payments. The main impact of the earthquake and tsunami on Indonesia's balance of payments is likely to come from the international assistance package rather than exports and imports, given that Aceh's non-oil and gas trade is small and there will be no impact on oil and gas exports.

Employment. The total death toll in Indonesia is currently estimated at some 110,000, more than 2% of Aceh's population. To estimate the impact on labor markets, it is assumed that the number of casualties does not affect the open unemployment rate. In other words, both employed and unemployed are assumed to be equally impacted. The three scenarios used for GDP are applied with the results in Table 7.3 showing that if 20% of total employment generating opportunities are lost, Aceh's unemployment rate would increase from 11.2% (2003 actual figure) to 29%. As a result, the national unemployment rate would increase from 9.5% to 10%. This

[29] These statistics do not include oil and gas or finance.

impact would be reduced by employment generated by rehabilitation and reconstruction activities.

Table 7.3: Impact on Employment

	2003	Direct impact	After Impact		
			10%	20%	40%
Total Employment	**90,785**	**90,729**	**90,509**	**90,014**	**89,078**
o/w Aceh	2,254	2,198	1,978	1,759	1,319
Unemployment	**9,531**	**9,524**	**9,744**	**9,964**	**10,403**
o/w Aceh	284	277	497	717	1,156
Total Labor force	**100,316**	**100,253**	**100,253**	**99,977**	**99,482**
o/w Aceh	2,538	2,475	2,475	2,475	2,475
Unemployment Rate	**9.5%**	**9.5%**	**9.7%**	**10.0%**	**10.5%**
o/w Aceh	11.2%	11.2%	20.1%	29.0%	46.7%

Source. CEIC, World Bank staff

Poverty. The impact on poverty is analyzed using the same three scenarios (Table 7.4) mentioned above. For example, scenario 2 assumes that non-oil and gas GDP declines 20% across non-oil and gas sectors. The simulation result shows that the number of poor would increase 0.6 million and the national poverty headcount index would increase 0.3 percentage points. Again, these simulations do not take into account the possible positive impacts on growth and employment of the eventual reconstruction effort.

Table 7.4: Impact of the Earthquake and Tsunami on Poverty Headcount Index

	Scenario 1 (Minor)	Scenario 2 (Moderate)	Scenario 3 (Severe)
Aceh non-oil and gas GDP decline by 1/	10%	20%	40%
Impact on national poverty headcount index	0.1%	0.3%	0.5%
Increase in the number of the poor (million)	0.2	0.6	1.1

1/ Compared with estimated 2004 constant GDP
Source. World Bank staff calculation

Disaster Preparedness and Mitigation

Photo by: USAID / Michael L Bak

DISASTER PREPAREDNESS AND MITIGATION

….there, a fearful sight met my eyes: a schooner and twenty-five or thirty prahus were being varied up and down between the drawbridge and the ordinary bridge as the water rose and fell, and nothing remained unbroken, including the telegraph wires which had been snapped by the schooner's mast.

Notes on the Krakatao explosion 27 August 1883 (by Shruit the telegraph master located in Anjer West Java, taken from **Krakatoa: The Day the World Exploded** by Simon Winchester pg. 225)

Actually we know about tsunamis here, and this helped us to know what to do. I looked again and could see a huge black wave coming. I ran to my house just along the beach here and alerted my family. We ran up that path there to the officer and then over the road and on further up the hill.

Employee at National Government's fisheries research and extension unit at Air Payo, Ujung Bate

CURRENT INSTITUTIONAL SET UP

Indonesia regularly experiences a wide range of disasters, such as earthquakes, floods, storms, wild fires, volcanic eruptions and tsunamis. The National Coordinating Board for Disaster Management and Internally Displaced People Affairs (Bakornas PBP) coordinates disaster prevention, mitigation, response and recovery nationally.

Bakornas is chaired by the Vice-President of Indonesia and is placed under the Coordinating Minister of People's Welfare. It has a core staff of about 40 people and relies on the line ministries for the implementation of disaster relief. The ministries of Home Affairs, Social Affairs, Health, Settlement and Regional Infrastructure, Communications and the Chief Commander of the Armed Forces and the Police are members of Bakornas. Coordinating units are established in provincial levels (Satkorlak PBP), with subsidiary structures at district or municipal levels (Satlak PBP). Bakornas has evolved over its almost 40 years of existence as warranted by changing national needs and the emergence of different types of disaster risks.

Bakornas controls a limited budget to execute its coordination task. A contingency budget is placed with each member line ministry that can be released by the Ministry of Finance in case of emergency. While Bakornas has a coordinating role, it has little authority over how spending decisions are made in the event of an emergency.

INSTITUTIONAL PERFORMANCE

Bakornas reacted swiftly to the disaster despite the fact that many of its Aceh staff died, were injured or displaced, and its local facilities and equipment were severely damaged. In events of this magnitude, some initial confusion should be anticipated as the staff of local authorities are as likely to be victims as the rest of the community. To fill this immediate vacuum, senior Bakornas staff arrived in Banda Aceh two days after the disaster and have played an important role in coordinating the relief effort since then. This coordination has been undertaken in liaison with the remaining local authorities and the international relief effort led by the UN with the participation of many bilateral and international donors, official relief agencies and national as well as international NGOs.

As a consequence of this displacement of senior staff, initially there was insufficient capacity for coordination at the central level. This need was met when a new secretariat was formed in the Vice President's office that absorbed the existing Bakornas staff. This secretariat is now the Jakarta-based counterpart of the Bakornas office in Banda Aceh. President Susilo Bambang Yudhoyono has recently ordered the reorganization of Bakornas in order to improve coordination and speed up humanitarian operations.

RECOMMENDATIONS ON HOW TO MOVE FORWARD

The magnitude of the earthquake and tsunami disaster in terms of human toll and need for emergency response highlight the importance of upgrading essential coordination capacities in a country exposed to frequent disasters, as well as ensuring that the risk of any future disasters be minimized as much as possible. The availability of likely additional resources and the current focus on disaster preparedness, early warning, response and prevention and mitigation provide an opportunity to upgrade essential capacities identified previously[30], but which have yet to be significantly realized.

Three lessons from the disaster experience stand out. First, current warning systems for tsunamis do not function adequately. The country has an existing tide gauge network with 54 permanent stations operated by Bakosurtanal and 10 permanent stations operated by PT Pelindo (see map). Undoubtedly, the event corroborates the need to improve these technological capacities. Most importantly however, the technology-based warning system is to transcend the predictive service to reach and serve those at risk by strengthening and better integrating existing capacities and networks and have, as an end product, contingency plans, actions and procedures to be followed on the ground in the event of an alert.

Existing National Permanent Tide Gauge Network

- 54 permanent stations operated by BAKOSURTANAL
- 10 statiun permanent stations operated by PT PELINDO I-IV

Source: National Seismological Center, Indonesia Meteorological and Geophysical Agency, Department of Communication.

[30] Prior to the disaster the Indonesian Government made an appropriate and candid diagnosis of its needs in respect of BAKORNAS, as reflected in the submission made by the institution to the World Conference on Disaster Reduction (Kobe, January 2005). See *Indonesia, National Information prepared for the WCDR 2005,* National Coordinating Board for Disaster Management and Internally Displaced People Affairs (BAKORNAS PBP), October 2004.

Second, the route between identification of the disaster and inducement of appropriate action by the community needs to be shortened. To begin, there is a need for integration of the existing technological monitoring system with a regional or worldwide system. But even with a highly advanced technical system, the short time between the occurrence of earthquake and the subsequent tsunami may make it impossible to warn people in time. Ann effective approach will require information on community-based warning systems, an awareness of how to act in the event of a disaster, integration of physical vulnerability reduction tehniques in the teaching curricula, civil servant training programs and community-based projects, etc.

Third, legal reform is needed to allow for the swift mobilization of decentralized functions of line ministries represented in Bakornas in the event of a disaster. Central line ministries represented in Bakornas have contingency funding available in the event of a disaster, but not control over implementation capacity. That is under control of local government which, as in the case of Aceh, may be severely affected by a disaster. Legislation should focus on improving the coordination of the response between central and local governments in the event of a disaster.

Moving Towards a Reconstruction Strategy

Photo by: USAID / Michael L Bak

MOVING TOWARD A RECONSTRUCTION STRATEGY

You know we don't have a tent yet. You can see I am weaving these leaves into a temporary roof to keep the rain away. I do want to return. Actually I will return if the majority decides that this is the best thing to do.

Woman In Lembaya Camp between Banda Aceh and Meulaboh

For the next year we need a house. That's the first thing. Then we can work. Several of us women here are planning to do laundry for other people. But we have no community left. All of my neighbors died. Please help us all with houses, but please don't make us pay for them.

Woman in police station building Djanto

A COMPREHENSIVE AND CREDIBLE RECOVERY STRATEGY

The human cost of this tragedy is vast and will weigh upon Aceh, North Sumatra and the rest of Indonesia for many years. After the shock and grief, after the immediate crisis is confronted, after the bodies are recovered and the rubble is cleared, there will be rebuilding. This damages assessment is simply a part of rebuilding lives and communities. One thing is clear from the rush of goodwill and, importantly, donations to help the process – Indonesia will not be alone in rehabilitating and reconstructing the shattered parts of its country.

Aceh and North Sumatra need a comprehensive strategy to rebuild the lives of their population. The challenge ahead is broad with action required in many areas, demanding a comprehensive approach – lives must be rebuilt, communities protected, local economies revived, the massive inflow of relief, rehabilitation and reconstruction funds must be managed with transparency and accountability, civil administration and infrastructure modernized.

In devising a strategy to guide the reconstruction process, decision makers will need to incorporate the following key components: (a) a comprehensive damage and needs assessment; (b) rapid mobilization of reconstruction funds and activities; (c) focus on the needs of the local population; (d) establish highest fiduciary standards and efficient system managing the funds, and (e) to update and monitor needs and results. This document attempts to provide the damage assessment. However, the factor which underpins every stage of the strategy must be the needs of the local population. Global experience teaches us that those communities must be among central decision makers of the reconstruction process.

Indonesia's leaders have already expressed their vision for a National Recovery and Reconstruction Strategy. The six key principles outlined by the Government – which could underpin the National Reconstruction and Recovery Strategy – include:

- A people-centered and participative process, where the administration listens to and understands the feelings and aspirations of the people;
- A holistic approach – rebuilding based on a comprehensive strategy;
- Effective coordination for consistency and effectiveness among sectoral and regional programs at national and local levels;
- Drawing a distinction between rehabilitation – achieving minimum standards – and reconstruction, with a clear strategy for each;
- Focus on services and institutions, rather than projects;
- Incorporating fiscal transparency and effective monitoring into the rehabilitation and reconstruction programs.

A successful reconstruction strategy will result in five primary outcomes. First, it will restore people's lives – clean water to drink, health clinics and the roads to get there, roofs over heads and a source of income to support families. Second, it will restore the economy – jobs for people, markets for people to sell and buy daily necessities,

banks that lend to small-scale enterprises, shops for families to buy materials to rebuild their homes. Third, it will restore the system of local governance – local governments that represent people's aspirations and ensure provision of basic services, like roads, water, markets, education and health services. Fourth, it will rebuild local governance and government. Fifth, the strategy will implement a province-wide regional development plan.

The common thread in all those is people and returning their lives and livelihoods. The means to achieving that outcome fall into six categories – housing and shelter; reinvigorated businesses, trade and industry; support for agriculture, fishery and rural livelihoods; public services; support for the vulnerable; and specific support for social structures.

HOUSING AND SHELTER

Rebuilding houses – Repairing or reconstructing their houses always ranks at the top of victims' concerns. Community-built housing is preferable as it costs less but delivers higher rates of satisfaction and a cornerstone for successful community reconstruction. It also injects cash into local economies. Given the nature of the disaster and anticipated reconstruction, local housing programs must be planned and coordinated. First, basic design standards are needed for construction quality, sanitation and so on, particularly in urban areas. Second, if large numbers of houses are rebuilt simultaneously, significant shortages of materials and house-building specialists may arise, so advance procurement planning will be needed. Third, highly vulnerable households will not be able to reconstruct their houses without additional help.

REINVIGORATING BUSINESS, TRADE AND INDUSTRY

Employment-intensive investment in infrastructure - The rehabilitation phase would aim to bring basic infrastructure back to an adequate level of service. This will particularly involve the rehabilitation of infrastructure that is fundamental to the process of improving access and local markets which provide the potential for cash crop production and access to basic living necessities. In this phase, the key concept of people-centered infrastructure development needs to be prioritized. This implies that solutions are not imposed but developed through understanding the needs of the people. Labor-intensive methods should be used to the extent that is economically and technically feasible. The infrastructure should therefore be both asset-creating and employment-creating.

Labor intensive public works – Cleanup and preliminary reconstruction should begin with a simple system of paid, labor-intensive public works. Wages need to be set at or below local agricultural minimums to avoid drawing people out of other jobs. All villagers would be eligible. This system should be used only for simple clean-up and very minor repairs since it will usually not have sufficient technical oversight or tools to take on more difficult public works, which can be tackled during the reconstruction phase.

Encouraging entrepreneurship - A local economic revival strategy should also focus on local entrepreneurship and the promotion of micro/small enterprises, enhancing their capacity to respond to emerging market opportunities and encouraging new initiatives. During the rehabilitation phase many people will turn to micro-enterprise activities to generate an income. These re-emerging entrepreneurs will need to access to ideas, micro-finance, and know-how. Strategies that reach large numbers of people using mass-media and community-based approaches are often effective in disseminating this type of information. Special attention must be given to women entrepreneurs as they commonly constitute the largest number of micro-entrepreneurs yet are the most disadvantaged in terms of access to productive resources.

SUPPORT FOR AGRICULTURE, FISHERIES AND RURAL LIVELIHOODS

Recapitalizing household micro enterprises with grants – Reconstruction will bring with it many opportunities to re-start small businesses that were ruined by the crisis. The farming and fishing sectors are foremost among these. Resuscitating these businesses might mean choosing between providing communities with micro-credit versus providing them with grants. Experience in rural areas elsewhere suggests that start-up grants, even for private goods such as small businesses, are a better instrument than micro-credit would be. The reason is that initial repayment rates are likely to be low (too many competing uses, local risk, no institutional backup, etc).

PROVIDING PUBLIC SERVICES

Rebuilding local administrations – In many areas, local administrations no longer function. They should be re-launched as quickly as possible, through standard procedures for village elections. Village councils (BPDs) should be elected early, in order to aid in local reconstruction and to help prevent local capture of development aid. Getting them started in the rehabilitation phase will in many areas involve a trade-off between the need for action and the need for broad-based representation from populations that may still be dispersed elsewhere.

Re-establishing public safety functions – An urgent need for Aceh and North Sumatra is to re-establish a functioning administration that supports the relief, rehabilitation and reconstruction efforts in the affected areas. A collapse of law and order would complicate the recovery and rehabilitation process, and dramatically weaken foreign assistance. Currently it appears that the institutions and agents through which law and order is upheld are dysfunctional or absent. The structure of the police force and its command hierarchy are fragmented. Investigatory, prosecutorial and adjudicatory services have collapsed. Specific challenges include ensuring the protection and security of civilians (especially children, women, senior citizens, displaced persons, and aid workers); helping refine initial estimates of loss and damage to human and physical assets; restoring minimally required public services (cleaning up and disinfecting affected areas, extending health and education services; restoring communications; etc).

Restoring the decentralized representative institutions of governance – One immediate and continuing challenge is to ensure the local population participates in assessing local needs and priorities as part of the rehabilitation activities. For this to

be done effectively, it is essential to re-build representative institutions of governance such as DPRDs and KPUDs. However, given the magnitude of the devastation, the central government will need to play a significant role in relief and rehabilitation. At the same time, Aceh is an autonomous province which has experienced a long-lasting conflict. Hence, the management of the relationship between the national government agencies, sub-national entities of governance and civil society assumes great significance.

ASSISTING THE VULNERABLE

Supporting host communities that have taken in displaced people – It is already clear that across Aceh and Nias, neighboring communities have taken in large numbers of displaced people. They will require support. This should be provided through open community discussions so that villagers are all aware that their contribution to the reconstruction effort is acknowledged. It should also distinguish between short-term shelter, and permanent relocation since the latter will require entering new numbers into district service provision plans.

Poverty mapping – A recurrent problem in local development projects is that the very poor and vulnerable are hidden from view. In a crisis such as this, where their normal protection systems may have vanished entirely, not bringing these people into view can quickly turn into tragedy. Female-headed households will face a particularly severe challenge in this context because many have lost their support networks and inherited assets. A large repertoire of participatory mapping tools already exists and has previously been used with success in Aceh and northern Sumatra. Local level poverty mapping will not only provide external service providers with information about how to help the most vulnerable, but it nearly always triggers charitable responses by communities.

COMMUNITY-DRIVEN DEVELOPMENT

Rebuilding communities through Pesantren – The reconstruction not only of houses and markets but also of social structures and communities provides an opportunity for Acehnese to participate in their own governance and society building. Revival of the social fabric after the disaster requires empowering *pesantren* leaders to take an active part in rebuilding communities. Religious leaders, especially *pesantren* heads, are natural leaders in this regard, but often have little experience in engaging in policy-making. Building on successful programs in other areas of Indonesia, and the training of a group of *pesantren* leaders on human rights and Islam, Indonesian NGOs will provide training for these leaders, giving them skills such as budget analysis and policy advocacy. In this way, *pesantren* and religious leaders will be able to ensure that the cultural values of the local Acehnese are fairly represented within the new social, governance, and economic systems that will emerge through reconstruction.

Build institutions, not just infrastructure – The key to developing viable service delivery in the affected urban areas of Aceh will not be found in the construction of new infrastructure and facilities alone. While new or rehabilitated facilities are indeed required, the reconstruction of the water sector is both physical and institutional. The service will only be provided when the human resources are also restored and new

and revitalized institutions established. This means new management teams with systems, structures and procedures that facilitate efficiency and financial viability. Efforts to build capacity for sanitation service delivery in local government are essential if the levels of coverage are to change to any significant degree.

MAINSTREAMING AND RESTORING THE ENVIRONMENT

Mainstreaming the environment - Environmental issues should be considered in all sectoral reconstruction planning and actions. EIAs are to be conducted in a swift manner so that the planned reconstruction projects would not experience delay in their implementation. Overall spatial planning principles and strategy should be established prior to any sectoral reconstruction projects. Once the reconstruction projects are established, it is hard to change established land use. During spatial planning, issues such as environmental implications and disaster resilience will need to be taken into consideration. Temporary housing and resettlement camps in the affected areas may stay for a longer time depending on the reconstruction process. Selection of locations for temporary housing should be done in considering potential longer time environmental implications.

Restoring the environment - The damaged environment can be restored. As much as possible, the restoration should take place utilizing ecosystem recovery potential and in such a manner that the ecosystem goods and services are used for local livelihood. A comprehensive environmental assessment of damages caused by the disaster should be conducted as follow-up to the current preliminary assessment. Such assessment efforts could be done in the manner that national and local capacity is developed through the assessment. Further, environmental monitoring capacity should be established to monitor the environmental factors contributing to the disaster mitigation and preparedness. In rebuilding an institutional structure for environmental management, an effective accountability structure and clear responsibility should be defined at national, provincial and district levels.

IMPLEMENTATION

Among the most important lessons from international experience for managing recovery and reconstruction in disaster-affected areas is the need for effective coordination. In Indonesia, the scale and scope of the December 26 disaster means recovery and reconstruction efforts will involve nearly all of the key ministries and state agencies, working across all levels of government – central, provincial, kabupaten, kecamatan and desa. In addition, the outpouring of domestic and international support for the reconstruction phase has resulted in many local and international NGOs, private sector actors, official donor agencies, and multilateral institutions seeking to provide assistance, often on the basis of their own internal standards and guidelines. Coordinating all these organizations within the overall

recovery and reconstruction process, while promoting the interests of the local communities, is a major task.

Setting a common framework for the implementation and administration of assistance operations is critical to prevent inconsistencies in the standards and guidelines across projects. Providing common rules for fiduciary management and performance reporting is similarly important to ensure the effectiveness, efficiency and integrity of the use of assistance funds and, hence, the ability to continue attracting the necessary funds once the initial fervor of support subsides. A management structure of the recovery and reconstructions funds, therefore, needs to be designed to provide this overarching coordination, while not at the same time over-centralizing decision-making in a manner that alienates people in the affected communities or creates unnecessary bureaucratic bottlenecks at a time when fast-disbursement of assistance is paramount.

As the main Government agency responsible for strategy and planning, Bappenas has a central role to play in coordinating the recovery and reconstruction activities following a smooth transition from the humanitarian relief efforts coordinated by Bakornas. In addition, it is recommended that a dedicated Reconstruction Management Agency (RMA) be created quickly under the leadership of Bappenas to administer the coordination responsibilities listed above.

Maps, Satellite Imagery, Photos

Indonesia - Banda Aceh Subset 2

1 : 10.000

IKONOS - January 10, 2003 - PRE-DISASTER IMAGE

IKONOS - December 29, 2004 - POST-DISASTER IMAGE

Center for Satellite based Crisis Information
- Emergency Mapping & Disaster Monitoring -

German Remote Sensing Data Center
German Aerospace Center

DLR

Ikonos - Subsets

Damaged Area

Legend

Coastline before Tsunami

Interpretation

The map shows an area north of the village of Lhoeng on the northwestern coast of Sumatra (Indonesia) before and after the devastating Tsunami flood wave, which struck many countries in the Indian Ocean on December 26, 2004. The IKONOS images were taken on January 10, 2003 and December 29, 2004, respectively.

The region of Banda Aceh is one of most severely damaged areas. The Tsunami swashed up to two kilometers inland and destroyed major parts of the coastal plains, including settlements, forests and farmland.

Scale

1 : 10.000

Projection: UTM Zone 46 N
Spheroid: WGS84
Datum: WGS 84

Data Source

IKONOS imagery provided through

CRISP
National University of Singapore

SPACE IMAGING

Map created December 30, 2004 by ZKI@DLR/DC
updated January 4, 2004 (Version 02)

Estimated Collapsed Structures–Banda Aceh

Primary Impact Zone (PIZ)
6,466 ha
36,016 structures digitized (before tsunami)
5.6 structures per ha (before tsunami)
29,545 structures collapsed
82% structures collapsed in PIZ

Notes:

- **The number of collapsed buildings does not include number of structures severely damaged or destroyed** in the Primary Impact Zone that cannot be directly observed from satellite imagery.
- The boundary for the Primary Impact Zone does not include Lho Nga.
- See attached methodology.

29,545
structures collapsed, est

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Source:
QuickBird (60cm), Landsat 7, ETM+, and SRTM (90m DEM)

Imagery and Mapping by:

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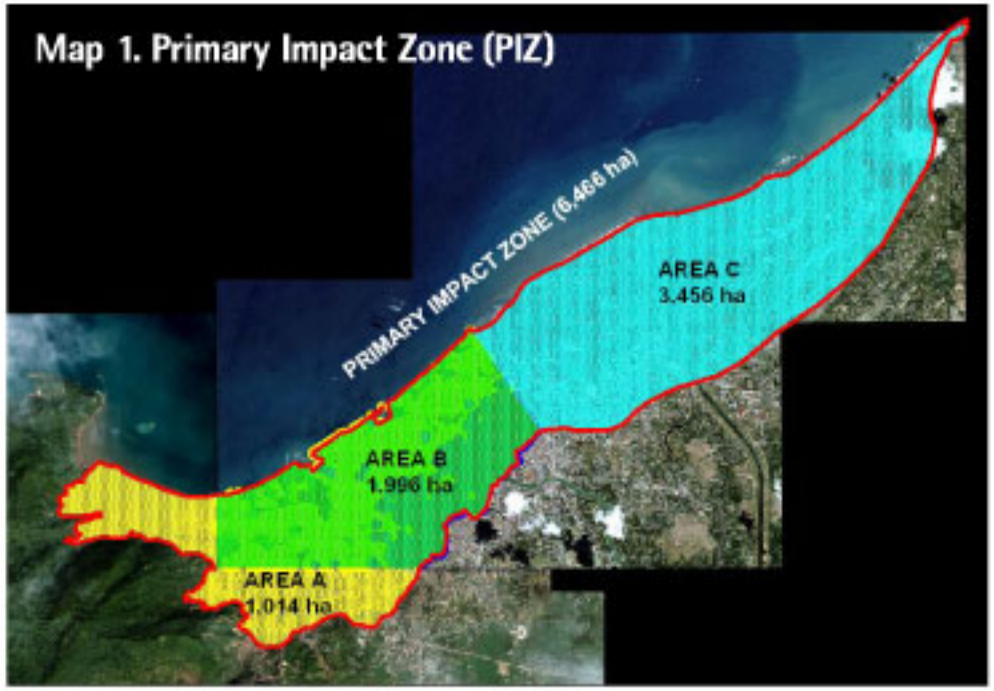

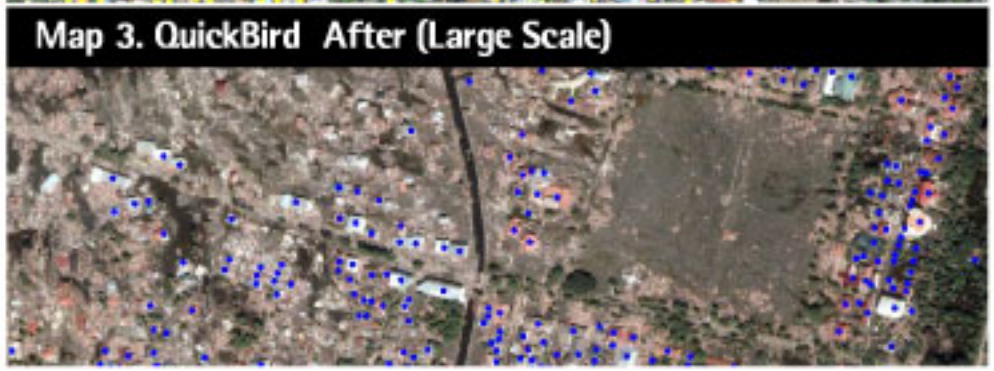

Methodology

Estimated Collapsed Structures

Methodology

The Primary Impact Zone (PIZ) was determined by observations based on QuickBird (60cm), LandSat 7, ETM+, and SRTM (90m DEM). The range of heavily damaged structures was estimated and digitized using QuickBird imagery viewed at large scale (maps 2 & 3). For the areas beyond available post-tsunami QuickBird coverage (map 1, area C), the PIZ was estimated based on interpretation of post-tsunami LandSat 7 and low elevation (<25m) areas defined by DEM.

All observable existing structures pre-event were digitized (map 2) using QuickBird at large-scale, covering areas B&C on map 1.

For areas within the PIZ, not covered by pre-event QuickBird (map 1, area A), an estimated density of 4 structures per ha. was applied

Available pre and post-event QuickBird images (map 1, area B) were analyzed, and remaining structures post tsunami (map 2 & 3) were digitized and counted. A ratio of pre and post-event structures collapsed in the PIZ was calculated (82%), and applied to the remaining area (map 1, area A & C) of the PIZ not yet covered by pre *and* post-event QuickBird.

Summary

Primary Impact Zone (PIZ)

6,466	ha
36,016	structures digitized (before tsunami)
5.6	structures per ha (before tsunami)
29,545	**structures collapsed**
82%	**structures collapsed in PIZ**

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Source:
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Critical Infrastructure Destroyed

Coastal Communities Devistated

Homes and Shops Turned to Rubble

Earth Quake Damage, Leveling Shops