



**ATTACHMENT 3
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CONCERNING

**MASTER PLAN FOR THE REHABILITATION AND RECONSTRUCTION FOR THE
REGION AND PEOPLE OF THE PROVINCES OF NANGGROE ACEH DARUSSALAM AND
NIAS ISLANDS, NORTH SUMATRA**

**DETAIL BOOK
ENVIRONMENT AND MINERAL RESOURCES SECTOR**

REPUBLIC OF INDONESIA

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CHAPTER I FOREWORD

1.1. Background

The occurrence of earthquakes and the tsunami that swept a major part of the coastal regions of the Nanggroe Aceh Darussalam Province (NAD) and part of the North Sumatra Province (Sumut) requires close attention specifically in the phase of reconstruction of regions hit by the impact of the disaster. Earthquake and tsunami natural disasters have opened the awareness of the people to re-evaluate and reformulate the concept of spatial layout that is integrated with considerations of environment feasibility and the support of natural resources, at both national level as well at the sub-levels. Approaches towards sustained development by considering economic, social and environment feasibility which takes into consideration the potential of disasters and the potential of support within a region are the main pillars in the formulation of a master plan or any other spatial plans in the context of rehabilitation and reconstruction of areas hit by the disaster in NAD and part of North Sumatra.

Changes in the ecosystem due to the tsunami have resulted in requirements for new space for the people inflicted by the disaster. Various new living settlements and public facilities have to be reconstruction. Additional, the debris, mud and various types of waste need to be managed and disposed of from the present sites. The selection of new space or location could give rise to a new set of problems regarding the environment short term as well as long term. Therefore in the compilation of a new spatial layout plan for the Provinces of NAD and North Sumatra as well as Spatial Layout Plans for *Kabupaten/Kota* in both abovementioned provinces, consideration should be given to various aspects of economy, social and the environment in accordance with the principles of sustained development. Approaches through the consideration of environment support could become the basis of determination of a certain space, which could possibly exceed the limitation of regional administration. Such approach does not mean only emphasizing of flora and fauna in the compilation of spatial limits, but also includes consideration for the interests of mankind (Anthropocentris). Such pattern of planning focuses on interaction among various elements of nature and man. However several obstacles faced in the compilation of this document mainly the brief time available for the preparation of various evaluations on the condition of the environment before and post tsunami, has resulted in work on in-depth material still required to be done at local level and specifically with the people therefore the accuracy of the plan could be even better.

1.2. Objectives, Goals and Benefits

The objectives of the writing of this document is to provide direction concerning considerations of the environment for the compilation of a regional spatial layout plan and to provide direction concerning the work plan of the related sectors through management of natural resources as well as of the environment in the rehabilitation and reconstruction phase of NAD and Sumut post tsunami disaster.

The goals to be achieved are as follows:

1. The compilation of the blue-print documents on rehabilitation and reconstruction of NAD and Sumut which wholly consider the support of the environment and natural resources;
2. The compilation of guidelines and criteria of the environment directed towards the compilation of a regional spatial layout plan as well as a detailed plan on spatial layout for the regions of urban areas and coastal areas in NAD and Sumut;
3. The compilation and integration of programs and sectoral activity plans as well as donor institutions in the context of rehabilitation and reconstruction of urban areas and coastal areas in NAD and Sumut.

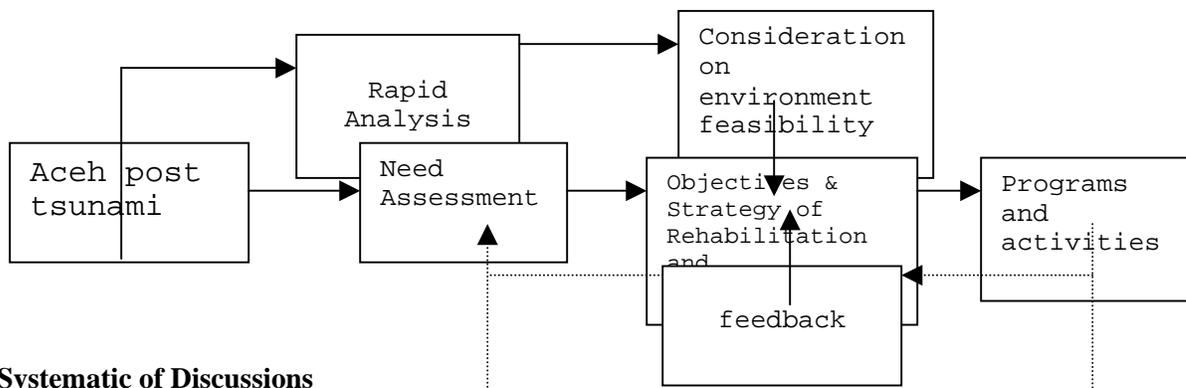
The benefit of this document is to provide information concerning damages, environment gradation, needs assessment, environment feasibility considerations and work plan/action plan of activities to be undertaken in the rehabilitation and reconstruction phase specifically in the sectors related to natural resources and the environment. It is expected that all institutions both government at central as well as regional level, and international donors, bilateral countries, the business world as well as other community groups can make use of this document as a main reference in assisting the people of NAD and Sumut who were inflicted by the impact of the tsunami.

1.3. Method of Approach

The compilation of this document basically is a cooperation among various government sectoral institutions, the Regional Work Groups (Pokja) of Natural Resources and the Environment, including the regional authorities of NAD, Universities, NGOs, and donor institutions, as well as the people in general who have paid great attention towards the issue of Aceh post tsunami specifically concerning issues of natural resources and the environment. In the compilation of this document Bappenas acted as facilitator and coordinator of all undertaken activities including the determination of vision, objectives and goals as well as strategies for the preparation of documents. On the basis of uniformity and the relationship with other Pokja documents, the format of this document was then decided upon. Coordination with various government and non-government institutions was conducted through various official and unofficial meetings, which in essence were held for information sharing, aligning of programs and their activities, in order to prevent over-lapping among institutions.

The compilation of this document commenced with quick field surveillances and studies concerning the latest condition post tsunami in NAD by various sectoral institutions, donor institutions and research institutions including universities. Thereafter through such quick studies, the value and level of loss and damages could be indicated, which in the end produced a needs assessment. Based on the existing needs that exist, therefore each sectoral institution submitted a program and activities plan as well as an estimated budget needed. For 2 full months the process of re-compilation was conducted as feed-back to evaluate the feasibility of the action plan related to the latest situation in NAD and Sumut.

Picture 1.1.: Method of Approach in compilation of the report



1.4. Systematic of Discussions

Chapter 1: Foreword

This chapter covers explanation concerning the background of the compilation of documents and justification on the importance of environment and natural resources considerations in the rehabilitation and reconstruction phase of NAD and Sumut. This chapter also explains the objectives, targets and benefits of natural resources and environment documents, including the methods of compilation and the challenges faced.

Chapter 2: Inventory on Damages and Losses of Natural Resources and the Environment.

This contains illustration concerning the vast damages and losses of several aspects of natural resources and the environment, the results of studies of several sectoral institutions, research institutions, donor agencies both domestic and international.

Chapter 3: Environment Gradation

This chapter illustrates the gradation of the environment post tsunami, seen from several aspects such as geology, condition of land covering and changes in the coastal line in several locations, the natural ecosystem, and vegetation presently existing post tsunami. This chapter also presents a picture on the protected area regions in the Provinces of NAD and Nias Island.

Chapter 4: Policies and Strategies for the Rehabilitation and Reconstruction in the Natural Resources and Environment Sectors

This chapter explains about the general policy as well as strategies for implementation of rehabilitation and reconstruction in the natural resources and environment sector. Main activities of each strategy are explained briefly as the basis for compilation of Chapter 5.

Chapter 5: Activity/Action Plan and Program for Rehabilitation and Reconstruction of the Natural Resources and Environment Sectors

This chapter presents proposals of programs and activities in the rehabilitation and reconstruction phase with reference to policies, strategies and main activities in the form of action plans.

Attachment:

This covers interpretation concerning basic principles in the management of the environment mainly in their relationship with the plan for rehabilitation and reconstruction of NAD and Sumut. Several proposals for the development of the coastal region functioning as buffer zones came from various sectoral institutions and universities. The structuring of buffer zones and the coastal region contains recommendations on the expanse and types of vegetation suitable for planting. Recommendations and methodology proposals concerning waste management, handling of polluted ground water, processing of liquid waste and clean water management. The last part contains wood requirements for construction of housing in NAD and recommendations.

CHAPTER 2

INVENTORY ON DAMAGES AND LOSSES OF MINERAL RESOURCES AND THE ENVIRONMENT

Natural resources and environmental damage and loss inventory affected by the *earthquake* and tsunami can be classified into 3 parts:

- Loss of human resources
- Damage of facility and infrastructure
- Damage of natural resources & the environment

2.1 Loss of Human Resources

Based on the report received from the institution related to the natural resources and environment management sector, at least 223 civil employees were killed within the Forestry, Agriculture, Maritime & Fisheries, Environmental and Mining Sectors. From the 5 above mentioned sectors, the whereabouts of 250 forestry & agriculture civil employees are up to now still unknown. However, details on numbers of victim are as shown below.

2.1.1 Forestry Sector

Based on the Forestry Department's data dated 17 January 2005, the number of their employees at the kabupaten and city level including its officials at NAD Province totals 301 people. Consisting of 173 Natural Conservation Center (BKSDA)NAD employees, 43 Kabupaten Management Institution for River Current (BP DAS) Krueng Aceh employees, 26 from the Certification Center for Forestry Product Examination (BSPHH) Kabupaten I employees, 1 employee from Certification Center for Forestry Product Examination (BSPHH) Kabupaten II, 20 National Park Leuser Mountain Center (BTNGL)employees and 38 people at the Forestry Office. After the earthquake and tsunami 115 people were registered as safe, 26 died and the survival of 160 people are still unknown. Details on the above data are shown in table 2.1.

2.1.2 Agriculture Sector

Several Agriculture Sector government apparatus of the province and kabupaten were killed and the existence of which is still unknown while others went into a deep trauma. Table 2.2 below describes that out of 1,083 employees within the Agriculture Sector, 98 people died, 63 injured, 97 missing and 213 people lost their homes. The Department of Agriculture and Department of Animal Husbandry are suffering the most for the deaths and loss of employees, respectively 35 and 34 employees. Whilst the biggest number of victims who lost their homes are those from the Department of Plantation and Agriculture, respectively 100 and 51 employees. Some of them have also lost their families. For instance the Aceh Besar *kabupaten* Department of Agriculture lost 30 people, and employees of the Food and Horticulture Observation Center (BTPPH) lost 45 members of families.

Table 2.1: Recapitulation of NAD and North Sumatra Forestry Sector employees – victims of the Natural Disaster.

No.	Institution	Total Employees	Status			Remarks
		(People)	Survive	Death	Uniden- tified	

A	Central UPT					
1.	BKSDA NAD	173	18	10	145	
2.	BP DAS Krueng Aceh	43	29	10	4	
3.	BSPHH Wilayah I	26	21	2	3	
4.	BTNGL	20	13	1	6	At the time of tragedy they were in the location of disaster
5.	BSPHH Riau	1	1	0	0	At the time of tragedy was in Banda Aceh
	TOTAL (A)	263	82	23	158	
B	DISHUTNAD	38	33	3	2	Total employees based on names received from Command Post
	TOTAL (B)	38	33	3	2	
C	DISHUTKAB NIAS	-	-	-	-	No data available
	TOTAL (C)	0	0	0	0	
	TOTAL (A+B+C)	301	115	26	160	

Source: Department of Forestry. 17th January 2005

Table 2.2: Recapitulation of NAD and North Sumatera Agriculture Sector employees - victim of the Natural disaster.

No.	Institution	Total Employees	Employee	Condition	(people)	
		(people)	Death	Injured	Unidentified	Lost Home
1	Plantation Sector	320	2	10	66	106
2	Agriculture Sector	173	25	8	10	51
3	Animal Husbandry Sector	160	34	-	-	26
4	BPTP	80	5	-	-	12
5	Quarantine	22	1	-	-	4
6	Food Protection Center	83	15	-	-	10
7	BPTPH	136	19	20	14	29
8	BPSB	109	12	25	-	27
	TOTAL	1.083	113	63	97	265

Source: Animal Husbandry Dept.'s National Disaster Prevention Team, 2005

2.1.3 Maritime and Fisheries Sector

The temporary data received from both the Maritime & Fisheries Sectors of NAD and the Department of Maritime & Fisheries indicated that a total number 13.000 – 14.000 fishermen have become the victims of the tsunami. At the same time 920 fish-ponders also became victims. Picture 2.1 describes estimated fishermen and fish-ponders, scattered victims of the tsunami disaster from the Maritime and Fisheries Sector – NAD. Apart from the above 49 civil employees from the Maritime and Fisheries

sector including their family members were also killed. Recapitulation of total victims registered by the Department of Maritime and Fisheries is as described in Table 2.3 below.

Picture 2.1.: Estimate on Total and Spread of Lost Lives of Fishermen and Fish Ponders

ESTIMATED VICTIMS OF FISHERMEN AND FISH PONDERS DUE TO THE EARTHQUAKE AND TSUNAMI NANGGROE ACEH DARUSSALAM

Table 2.8: NAD Environmental Management Institution Damages

No.	Institution	Effect	
		Damages	Remarks
1.	City of Banda Aceh	Office Building and its equipment experienced total damage	
2.	Banda Aceh's Environmental Laboratory	Building and its laboratorium equipments were totally smashed 1 lab. Car 2 ops. Cars	Still owned by KLH as it has never been handed over to Province Bapedalda yet
3.	Tertiary education & Observatory Institutions	Unsyiah Environmental Study Center building experienced minor damage due to flood	
4.	Environmental LSM	Office equipment totally smashed. 1 operation vehicle smashed/lost	WALHI Aceh Director was killed

Table 2.3:Recapitulation of Employees of the Agriculture, Fishermen and Fish Ponders Victims Died and Missing Due to the Natural Disaster in NAD and Sumut

Losses due to the Natural Disaster.

No.	Detail	Civil Employee	Wife	Children	Total (spirit)
1	Maritime and Fisheries Department NAD Province	36	32	66	134
2	UPT Cultivating Shop Ujung Batee	9	6	16	31
3	UPT SUPM Ladong	3	3	9	15
4	UPT Fish Quarantine Station Sultan Iskandar Muda	1	-	-	1
5	Fishermen NAD SUMUT	-	-	-	14.396 14.461 235
6	Fish-Ponders NAD SUMUT	-	-	-	920 920 -
	TOTAL				15.497

Source: Department of Maritime and Fisheries, 2005

2.1.4 Environment Sector

The Environment Ministry (2005) has up to date reported 12 people as the number of human resources lost at the level of government environment management. This consisted of 7 Bapedalda employees - NAD Province and another 5 Bapedalda Banda Aceh employees who were killed. Syiah Kuala University lost 110 tutors, 5 of which were environmental sector tutors. No comprehensive data was collected yet for the whole *kabupaten/kota* crushed by the earthquake and tsunami. There is concern that the number of victims may increase should data collection along the *kabupaten's* coastal area be performed in a more intensive way. Meanwhile 2 people from the non-government organization (LSM) Walhi died in the disaster (KLH, 2005).

2.1.5 Mineral Resources and Energy Sector

As a consequence to the tsunami disaster, many Aceh Mining Department employees become victims. The number of deaths totaling 23 persons consisted of 9 echelon IV, 4 staffs (S1), 8 younger staff (SMU), and another 2 honorary employees (SLTA). Death of wives or family member reached a total of 23 people. 23 employees evacuated.

2.2 Loss of Infrastructure and Supporting Facilities

2.2.1 Forestry Sector

In reference to the Dept. of Forestry data (2005), infrastructure and its supporting facility damage includes the facilities available at BKSDA NAD and BP-DAS Krueng Aceh institute. BKSDA represents the Technical Implementation Unit (UPT) carried out under the Directorate General of Forestry Protection and Nature Conservation (PHKA), whilst BP DAS Krueng Aceh acts as the Technical Implementor Unit for the Directorate General of Land Rehabilitation and Social Forestry (RLPS), Department of Forestry. Details are as described in table 2.4.

Table 2.4.: Damages on Infrastructure and Supporting Facilities in the environment of BKSDA and BP-DAS

No.	Kind of Construction	Total	Remarks
1	Resort office KSDA Banda Aceh (Ex Sub Office KSDA DI Aceh Public Hall) Land Area 1.000m ² , Construction 350m ²	1 unit	Totally damaged, new construction required
2	Working Cabin Banda Aceh, Type 70	1 unit	Totally damaged, new construction required
3	BKSDA Meulaboh office, West Aceh. Land area 600m ² , Construction 120m ²	1 unit	Needs rehabilitation
4	Guard post at Alue Pili and Lami, West Aceh	2 units	Totally damaged, requires new construction
5	Information Center at Sabang	1 unit	Needs rehabilitation
6	KSDA Resort office, Iboih	1 unit	Needs rehabilitation
7	Entrance gate TWA Weh island, Sabang	1 unit	Totally damaged, require new construction
8	MCK at TWA, Weh island, Sabang	1 unit	Totally damaged, requires new construction
9	Shelter at TWA, Weh island, Sabang	1 unit	Totally damaged, requires new construction

10	BKSDA Province NAD employee housing	42 units	
11	4 wheel operations vehicle	6 units	Totally damaged
12	2 wheel operations vehicle	9 units	Lost
13	Office equipments		Totally damaged/lost
14	BP-DAS office, 480m2	1 unit	50% Damaged
15	Government office, 3.000m2	1 unit	50% Damaged
16	Official house	2 units	50% Damaged
17	Parking area, 1.206m2	1 unit	50% Damaged

Source: Department of Forestry, 2005

No report on the damaged facilities has been submitted on behalf of the Forestry office neither at the *kabupaten* nor *kota* level.

2.2.2 Agriculture Sector

Evaluation by the Department of Agriculture (2005) indicated that the Agriculture Institute at Banda Aceh buildings/offices and working facilities have experienced heavy damages requiring total rehabilitation or reconstruction of 5 buildings, comprising: (i) Kimbun Plantation Sector, (ii) Animal Husbandry office, (iii) Plantation and animal sea port quarantine, (iv) Food Drive Institution office, and (v) Food Plantation and Horticulture Prevention office. Not only were building constructions wrecked, but most important facilities supporting the office to function such as furniture, data management, lab equipment and telecommunications were also destroyed. Minor damages also occurred at the office of province Department of Agriculture, office hall for Quality Surveillance & Food Seed Plantation and Horticulture Certification (BPSBTPH) as well as their housing. It is strongly suspected that the Agriculture Department office at Meulaboh *Kabupaten*, West Aceh was totally demolished. Detailed conditions are shown in table 2.5.

Table 2.5 Condition of Buildings and Working Facilities for Agriculture Department Work Institutions in the Province of NAD

No.	Institution	Bld. Construction Condition	Working Facility Condition			
			Furniture	Data Processing	Lab Eqpt	Telecom
1.	Plantation Sector	Govt. Office - Intact	Intact	Partially damaged	-	Intact
		Kirabun Office Totally damaged	Totally damaged	Totally damaged	-	Totally damaged
		UPTD Kabupaten Office	Intact	Intact	Intact	Intact
2.	Agriculture sector	Office : Intact	Partially intact	Damaged	-	Intact
3.	Animal Husbandry Sector	Office:total damage	Totally damaged	Totally damaged	Totally damaged	Totally damaged
		Guest house:intact	Intact	-	-	-
4.	BPTP	Office: intact	Partially intact	Partially intact	Partially damaged	Intact
		Guest house: Intact	Intact	-	-	-

5.	Quarantine	SeaPort quarantine:totally Damaged	Totally damaged	Totally damaged	-	Totally damaged
		AirPort Quarantine:intact	Intact	Intact	-	Intact
6.	Food Preserving Sector	Office: Totally damaged	Totally damaged	Totally Damaged	-	Totally damaged
7.	Food & Horticulture Protection Center	Office: Totally damaged	Totally damaged	Totally damaged	-	Totally Damaged
8.	Insemination Certification & Examination Center (BPSI)	Office : intact	Partial intact	Partial intact	Partially damaged	Intact

Source : Agriculture Dept. National Disaster Prevention Team. 2005

No report on the Agriculture Office facilities damages was received neither at the *kabupaten* nor *kota* level.

2.2.3 Maritime & Fisheries Sector

The number of fishing fleets where *kabupaten/kota* were exposed by tsunami in NAD province totaled 9.563 units comprising of 3.969 unit (41,5%) boats, 2.369 units (24,8%) motor boats and 3.225 unit (33.7%) 5Gt to 50Gt motor boats. In Nias, North Sumatra itself 5,386 unit fishing *fleets*, comprising of 4,514 unit boats, 575 motor boats, 296 unit of 5 – 10Gt motor boats. Meanwhile, 39 Fishing disembarkation bases (PPI) comprising of 38 PPI at NAD province and 1 at Nias island (PPI Pasar Sirombu) North Sumatra were exposed to the tsunami. Detailed damaged facilities at each *kabupaten* and *kota* in NAD and province are seen in table 2.6. Fish pond cultivation exposed to the tsunami reaches +/- 14.523ha or 39.68% against the total spread in over 11 *kabupaten/kota* as described in table 2.6.

Table 2.6: Total Armada of Fishing Boats in the *kabupaten/kota* hit by the impact of the tsunami

No.	Kabupaten/ Kota	Boat	Outboard Motor Boat	Motor Boat	# of Motor Boats	Total PPI
	Nanggroe Aceh Darussalam	3.969	2.369	5.225	9.563	38
1	West Aceh	645	198	871	1.714	3
2	Simeulu	640	67	7	734	1
3	Aceh Besar	218	475	202	895	8
4	Aceh Jaya				-	5
5	S.W.Aceh	568	163	140	871	3
6	Banda Aceh	35	80	114	229	2
7	Sabang	465	80	146	361	-
8	Pidi	647	280	355	1.282	2
9	Bireuen	845	614	574	2.035	4
10	Lhokseumawe	-	-	-	3	3
11	North Aceh	236	392	816	1.444	3

12	Singkil	-	-	-	-	1
13	South Aceh	-	-	-	-	1
14	East Aceh	-	-	-	-	4
North Sumatra		4.514	575	296	5.386	1
1	Nias Kabupaten	4.514	575	296	5.386	1
TOTAL		8.484	2.944	3.621	14.949	39

Table 2.7: Area of Fish Ponds in *kabupaten/kota* hit by the impact of the tsunami.

No.	Kabupaten/Kota	Vast (ha)	Vast of ruined ponds (ha)
1	South Aceh	25	10
2	West Aceh	289	289
3	Aceh Besar	1.006	1.006
4	Banda Aceh	724	724
5	Sabang	28	28
6	Pidi	5.056	2.528
7	Bireun	5.147	2.573
8	North Aceh	10.520	4.208
9	East Aceh	7.822	2.347
10	Langsa	2.122	424
11	Aceh Tamiang	3.838	386
	TOTAL	36.597	14.523

Source: Dept.of Maritime & Fisheries, 2005

2.2.4 Environment Sector

Data on damages relating to environmental infrastructure facilities generally covers the building construction and 1 environmental laboratory still under the control of the Central Government, since its status as a project founder was by GTZ-Germany (KLH, 2005). Details are described in table 2.8.

Table 2.8: Damages of Environment Management Institutions in NAD

No.	Institution	Effect	
		Damages	Remarks
1.	City of Banda Aceh	Office Building and its equipment experienced total damage	
2.	Banda Aceh's Environmental Laboratory	Building and its laboratory equipments were totally smashed 1 lab. Car 2 ops. Cars	Still owned by KLH as it has never been handed over to Province Bapedalda yet
3.	Tertiary education & Observatory Institutions	Unsyiah Environmental Study Center building experienced minor damage due to flood	

4.	Environmental NGO	Office equipment totally destroyed 1 operation vehicle destroyed/lost	WALHI Aceh Director was killed
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Source: Ministry of Environmental, 2005

Until now there is no report yet explaining the environmental facility condition of other *kabupaten* and *kota* except for Banda Aceh.

2.2.5 Mineral Resources and Energy Sector

Aceh's Mining Sector experienced the following damages:

- Head of Dept. room & meeting room (120m²) collapsed
- Damages in the main building & working area of 2000m²
- Damages at the 200m² musholla
- Damages of vehicles & office equipment
- Damages at the lab room & its materials
- Damages of 79 units of employee housing

2.3 Damages to Natural Resources and the Environment

2.3.1 Damages to Mangrove Forest Ecosystem

Considering that a large portion of the mangrove ecosystem condition prior to tsunami was already in a deteriorated condition, it thus became difficult to place damage estimation along the NAD and Nias Island coastal areas. In reference to the Department of Forestry data (2004), the NAD Province mangrove forest covers an area of 346,838ha (Table 2.9)

Table 2.9.: Position and Area of Mangrove in NAD

Coast Position	Coast line length (km)	Mangrove total area (m ²)
North Eastern Coast	761	296,978
South West Coast	706	49,760
Simeleu islands	1,000	1,000

Source: Department of Forestry Press Release #S.32/II/PIK-1/2004 & Department of Forestry data 2001 & WI-IP

According to Wetlands International - Indonesia Program, up to the year 2000, there were only +/- 30.000 Ha mangrove forests left in good condition that included mangrove forests along the shore of Simeleu Island. Heavily damaged mangrove forest reached 25,000 ha and 286,000 ha semi-ruined.

Therefore, there is no fixed quantitative information on the mangrove ecosystem damages caused by the tsunami except for some reports received from the inhabitants and humanity volunteers whom by some chance happened to witness the field's condition. Based on direct observation in Banda Aceh, it is reported that the mangrove condition remained as described in table 2.10.

Table 2.10: Condition of Mangrove in Banda Aceh Post Tsunami

No	Location	Area	Type	Remarks
1	Uee Lhee	Banda Aceh	Rhizopora mucranata	Only the root of Rhizopora

				mucranata remains
2	Kampong Java		<ul style="list-style-type: none"> - Rhizopora mucranata (mangrove) - Avicernia Alba (lampe, api-api) - Mypa fruticaris (nipah) - Acrosticum cureum (paku laut) - Thesphesia populnea (waru laut) 	Sub-dominant (Rhizopora mucranata)
3	Syah Kuala		<ul style="list-style-type: none"> - Rhizopora mucranata (mangrove) - Avicernia Alba (lampe, api-api) - Thesphesia populnea (waru laut) - Casuorina equisetifolia (cemara laut) 	Dominated by Rhizopora mucranata (-/+ 100 individuals)
4	Lingke, Ue Naga, Lambada		<ul style="list-style-type: none"> - Rhizopora mucranata (mangrove) - Cacus nucifera, Casuorina equisetifolia 	Ex embankment
5	Neuheun		<ul style="list-style-type: none"> - Avicernia Alba - Rhizopora mucranata (mangrove) - Sanneratia Alba (pedada) - Nypa fruticaris (nipah) - Thesphesia populnea (waru laut) - Hibiscus Tiliaceus (waru laut) - Cacus nucifera (coconut) - Colothropis gigantean (biduri) 	
6	Field – Malahayati		<ul style="list-style-type: none"> - Rhizopora mucranata (mangrove) 	Dominating
7	Lhok Nga		<ul style="list-style-type: none"> - Casuorina equisetifolia (cemara laut) - Cacus nucifera (coconut) 	Unable to find the real type of mangrove
8	Meunasah papan imasin		<ul style="list-style-type: none"> - Rhizopora mucranata (mangrove) - Exoecaria agallocha (buta-but) - Avicarnia lanata (lampe) - Nypa fruticaris (nipah) 	Dominated by Rhizopora mucranata

Source: Ministry of the Environment, 2005

2.3.2 Damages to Coral Reef Ecosystem

Coral reef damage as a direct impact of tsunami is not accurately acknowledged yet. Similar to the mangrove forest condition, coral reef damage was already found prior to the disaster. Referring to the Forestry Minister's Decree #928/Kpts/Um/1982 dated 22 December 1982 the coral reef ecosystem is found at Weh Island around Weh Island's sea park comprising a spot of +/- 2.600Ha concentrated around Robiah Island. Whilst at Singkil Aceh Kabupaten, coral reef is found at Banyak Island Preservative Park covering an area of nearly 227.500Ha. The damaged ratio of coral reef ecosystem at the above kabupaten reaches between 50-70% and 38-44,25% around Robiah Island, Sabang, as shown in table 2.11.

More coral reef area is found spread at West Coast NAD and not found on the coast, as seen in picture 2.1. Data captured from the satellite explains that the coral reef coast at a depth of 15 meters from Lhoknga-Banda Aceh-Sabang is more or less 2,900 Ha, 23,776 Ha at Simeleu, Aceh Singkil 22,400 Ha, and +/- 16,800 Ha along the West Coast starting from Lamno-Calang to Meulaboh. Meanwhile, the total coral reef at West Coast of Aceh (including that of Simeleu Island) is +/- 89,602 Ha as seen in picture 2.1 below. UNEP-WCMC & KLII estimated the coral reef covers an area of +/- 92,500 Ha – 102,000 Ha (with no depth explanation). It is believed that the entire West Coast coral reef was demolished by the tsunami. A public report says that the coral reef condition post tsunami, especially at Weh, North Aceh remains unchanged. However, around Banda Aceh where many tsunami dead victims were found, huge numbers of deep sea fishes were cast ashore.

Table 2.11: Location & Level of Damages to Coral Reefs

No.	Location	Total vast of Coral Reef (Ha)	Damage % prior to Tsunami	Coral Reef condition post Tsunami
1	Weh Islands (Robiah island)	2.600	?	No significant changes
2	Banyak Island	227.000	50-75%	No data available
3	NAD West Coast	65.876	No data	Assumed destroyed
	- Lhoknga-Banda Aceh	2.900	No data	Assumed destroyed
	- Aceh Singkil	22.400	No data	Assumed destroyed
	- Lamno-Calang-Meulaboh	16.800	No data	Assumed destroyed
4	Simeleu	23.776	No data	Assumed destroyed

Source: NAD Maritime & Fisheries Sector

Pulo Aceh and Simeleu Island clusters are the worst hit clusters by the tsunami. Public reports identified that even coconut trees along the shore were totally yanked off the ground by the tsunami. This condition strengthens the assumption that the coral reef ecosystem, hatchery beaches, and fields have been totally destroyed. Coral reefs at Weh Island at 30 – 40 meters depth unharmed, while at 3 – 6 meters depth the coral reefs were covered by sand deposit.

Picture 2.2.: Map of Spread Coral Reefs in NAD

Source: Bappenas analysis 2005 with WCMC Map

Explanation: Coral reef (violet color) is spread along the Aceh West Coast, around Sabang Island, and a little on the shore. Mangrove (green color) is spread evenly along the East Coast. Citra satellite exposed a vast area of 89,652 Ha of coral reef and 150.000 Ha mangroves.

2.3.3 Damages to Lands of Agriculture, Plantation, and Animal Livestock

Based on the temporary evaluation by the Department of Agriculture, the rice fields belonging to the people that suffered heavy damages (*puso*) are estimated to reach 20.101 Ha, while the damages in the fields reach 31.345 Ha. The fields that suffered *puso* where a largest part is used to cultivate *palawija* crops (crops planted as secondary crops during the dry season) and horticulture plants and a few coconut plantations. It is recorded that there are 9 *kabupaten/kota* hit by the tsunami disaster, out of which the agriculture land suffered the most damages, which are Aceh Besar, South West Aceh, Aceh Jaya, West Aceh, North Aceh, East Aceh, Simeulue, Pidie, and Bireun as mentioned in table 2.12. Meanwhile, the number of dead/missing livestock is estimated to reach 1.9 million, out of which the majority is birds, and the remaining is *ruminansia* livestock such as cows, buffaloes, goat/sheep.

Table 2.12.: Condition of Land for Agriculture, Plantation and Animal Livestock in the Province of NAD

No	Kabupaten and City	Damages in Agriculture Land			Missing Livestock*
		Rice field (Ha)	Plantation/ Garden (Ha)	Field (Ha)	
1	Sabang	-	-	-	32.061
2	Banda Aceh	180	-	115	332.505
3	Aceh Besar	5.611	4.316	13.400	500.000
4	Pidie	1.859	4.704	5.256	238.301
5	Bireun	2.118	2.750	597	153.961
6	North Aceh	1.224	-	1.037	74.460
7	Lhokseumawe	-	-	-	27.292
8	East Aceh	2.119	-	60	-
14	West Aceh	880	4.167	1.174	251.962
15	Nagan Raya	800	3.122	1.600	137.765
16	Aceh Jaya	1.755	6.480	3.128	156.280
17	Simeuleu	3.410	7.904	110	-
18	South Aceh	-	2.750	-	-
19	South West Aceh	250	1.365	4.788	-
20	Aceh Singkil	-	-	-	-
	Total	20.101	36.803	31.345	1.904.587

Notes: * the majority is birds

Source: Team for Overcoming National Disaster of Department of Agriculture (16 February 2005)

Other than the damages in the above mentioned agriculture land, damages also occurred in the irrigation networks, irrigation buildings, canal network at the level of agribusiness, roads of agribusiness, bund (rice field), irrigation (dry land), and buildings on the surface of the agriculture land. The plantation/garden land that experienced damages are estimated to reach 36.803 Ha (Department of Agriculture), which consists of rubber, coconut, oil palm, coffee, clove, nutmeg, areca nut, chocolate, patchouli, and ginger plantation land. The largest part of plantation land that experienced damages is the coconut plantations, growing on the shore. Meanwhile, based on area, the plantation land that suffered the most damages is located in West Aceh, Simeulue, Nagan Raya, and Aceh Jaya Kabupaten. There is

no data yet concerning the percentage of the damages of the plantation land of the total plantation land in NAD.

The land damages due to the earthquake and tsunami caused the sea water to enter the land (salinity) thus thick sedimentation occurred. Based on the survey by the Food and Agricultural Organization (FAO) conducted during 11 – 14 January 2005, in the heavily damaged areas in the western part of Aceh, the salinity level of the land reaches more than 1.000 ppm or approximately 40 times the level that can be tolerated by vegetation/plants. The effect of the sea water swept into the land until a height of 20 meters above sea level. Analysis results of the laboratory of the Department of Agriculture on a variety of mud samples indicated that the average of Electricity Power (DHL) is 30,7 dS/m, ranging from 11,5 until 48,9 dS/m, the DHL for the land surface is an average of 4,8 dS/m, ranging from 0,3 until 8,4 dS/m. Generally, the growth of similar season plants such as corn, peanuts, and paddy are beginning to be affected by the DHL of 4 dS/m. The salt content in the mud and land samples is also quite high, which is 20000 – 26900 ppm for mud and 140 – 6000 ppm for land. The tolerance level of the same season plants towards the mineral contents in the land is generally approximately 2000 ppm. In general, the damages suffered by the agriculture land in the west coastal area are heavier than those suffered by the east coastal area. On the west coast, the sedimentation covering the land is thicker, generally >20 cm, compared to that on the east coast which generally is <20 cm. The thick mud (>10 cm) can normally be seen from a distance of 3 – 4 km from the shore, the nearer it is to the coast the less thick the mud is and its texture is rougher.

2.3.4 Pollution to Surface Water and Ground Water

After the tsunami, it is estimated that the pollution of surface and ground water can occur due to issues as follows:

- The release of waste material from the pile tank of hazardous waste.
- Contamination of the human and animal corpses in the water bodies, and the rain water flow contaminated by human and animal corpses.
- Contamination of sea water in ground water.
- Puddles of the remains of tsunami water.
- Pathogenic and infectious microorganism contamination in the ground and the well water.

The Ministry of Environment, in the second week after the disaster, conducted quality monitoring of the environment in Banda Aceh by taking samples of well water, ground water, river water, sea water (on the shore), air, and sedimentation/mud, along with the mapping data of the location of the mentioned samples. The samples are taken from areas damaged by the tsunami disaster and the areas that were not hit by the tsunami disaster (as a control).

The parameters monitored consist of:

Water sample: pH, temperature, salinity, dissolved oxygen (DO), DHL, colour, BOD, COD, TSS, NH₃, PO₄, NO₃, NO₂, As, Hg, sulfide, Fenol, Cu, Cd, Total coliform, E.coli.

Air sample: particles (TSP), odor (NH₃, H₂S).

Sedimentation/mud sample: pH, characteristic and heavy metal test (Pb, Cu, Cd, Mn, Zn, As, Hg).

Laboratory analysis results of the water samples show that the ammoniac concentrate (NH₃) of the majority of the samples is between 8 – 19 mg/l, which means that it exceeds the quality level of 1,5 mg/l. Mapping of the spread of E.coli is shown in picture 2.3. High concentration of Total Coliform is seen in the samples of the damaged areas hit by the tsunami disaster and the undamaged areas. The high concentration in both parameters is presumed to be connected to the pollution of organic waste which suffered decomposition or decay. Meanwhile, the laboratory results show that the Phosphate (PO₄-P),

Sulfide, Ammonia (NH₃-N), Fenol, COD, and DO parameters on the majority of the well water samples have exceeded the quality level (picture 2.4).

[picture 2.3.]

Picture 2.3.: Map of Dissemination of Ammoniac in Banda Aceh

Source: State Ministry of the Environment

[picture 2.4.]

Picture 2.4.: Map of Dissemination of Ecoli in Banda Aceh

Source: State Ministry of the Environment

[picture 2.5.]

Picture 2.5.: Condition of Well Water Quality Based on a Number of Chemical Parameters

[picture 2.6.]

Picture 2.6.: Picture of Dissemination of Heavy Metal in Ground Water

2.3.5 Pollution of Solid Waste

Based on direct assessments in the field, the mud pollution caused by the tsunami occurred mostly in the northern area, especially in Banda Aceh and its surroundings. However, in the west coast of NAD, tsunami mud is not significantly detected. The Ministry of the Environment has also conducted environment quality monitoring on pollution of solid waste in Banda Aceh by taking samples of sedimentation/mud, along with mapping data of the location of the mentioned samples. Samples were taken from areas damaged by the tsunami, and from the areas that were not hit by the tsunami (as a control). Parameters monitored consist of: sample of sedimentation/mud, pH, characteristics and heavy metal test (Pb, Cu, Cd, Mn, Zn, As, Hg).

[picture 2.7.]

Picture 2.7.: Results of Analysis of Heavy Metal in Mud and Sedimentation

From the results of observation of a number of heavy metal parameters, such as Cadmium (Cd), Copper (Cu), and Lead (Pb), the quality of the heavy metal content in the tsunami mud has exceeded the determined limit. Even so, the sources and causes of the mentioned heavy metal pollution have not yet been determined, thus further research shall be required.

Solid waste pollution occurred as an effect of building debris waste, waste of stuff and materials belonging to the people, sea materials, animal corpses, and tsunami mud.

Massive cleaning of garbage has been conducted in Banda Aceh and its surroundings. Piled garbage spread everywhere consisting of various types of garbage, such as building debris, plastics, iron, logs and tree roots, trees and bushes, vehicles, home furniture, and corpses. The cleaning was conducted rapidly, therefore the garbage was placed on the sides of the roads, city borders, and in the open space until 5 – 10 km of entering the kota of Banda Aceh.

[picture 2.8.]

Picture 2.8: Disposal and Piling of Tsunami Waste

Source: Document of the Directorate of PSDA and LH, Bappenas (2005)

Picture 2.7. above shows the process of disposal and piling of garbage due to tsunami disaster in the damaged coastal areas or the residential areas. The cleaning and piling shall continue and are priority

programs in this early phase, which certainly has potential to pollute the environment surrounding the location and losing the border of ownership of the land. Without the right environmental impact management, there is concern that such a condition shall cause further impact on human health, especially workers, volunteers, refugees, and the community as a whole. As such the rehabilitation plan of the coastal area, which shall face obstacles due to the piling of garbage.

Generally, the harm of disposing and piling of garbage in inappropriate places shall cover:

- Water flow, drainage system, and dysfunctional septic tanks, thus water sources shall be polluted by sea water, mud, E.Coli and hazardous waste.
- The large number of water puddles could become lairs of mosquitoes and disease germs.
- Building debris can still be seen left on the beaches, thus shall impede the rehabilitation phase in the mentioned areas.
- Hazardous waste, such as those from hospitals were disposed in public places, thus can contaminate and spread a number of diseases.
- Garbage burning in certain places can harm the health of the people. Up until now, there has not been a fixed garbage disposal area, thus threats of infectious diseases (epidemic) shall surface, and spreading of pollution, especially during the wet season.

2.3.6. Air Pollution

The pre-tsunami condition shows that the parameters of the ambient air quality in Banda Aceh is still below the air quality standard. However, post-tsunami, the air quality condition, especially in the kota of Banda Aceh, now shows a quite high level of pollution, especially for particles (dust) originating from dried mud. It is estimated that the particle contents in the air shall decrease along with rehabilitation and cleaning of the kota of Banda Aceh, especially from mud and debris.

Monitoring of the quality of the environment, especially with regards the air pollution aspect, has been conducted in Banda Aceh in the second week after the disaster, by taking air samples, along with mapping data of the locations where the mentioned samples were taken. Samples were taken from areas damaged by the tsunami and from areas that were not hit by the tsunami (as a control). Monitored parameters consist of air samples in the form of particles (TSP) and odor (HN_3 , H_2S). The analysis results of the air samples show that the particles dust level ($615 \mu\text{g}/\text{m}^3$) in a number of locations has exceeded the quality standard ($230 \mu\text{g}/\text{m}^3$).

CHAPTER 3 ENVIRONMENT GRADATION

3.1 Geological Condition

3.1.1 Tectonic Pattern

The tectonic pattern in Aceh and North Sumatra Regions are controlled by the tectonic pattern in the Indian Ocean, as seen in picture 3.1. The Indian Ocean is located above the Indian-Australian Plate which moves to the North with a velocity between 6-8 centimeters per year. The movement causes the Indian-Australian Plate to collide with the Eurasian Plate. In the West this collision produces the Himalayan Mountains. Meanwhile in the East, it produces subduction which is marked by the Ocean Trough called Java Trench, which stretches from Benggala Gulf, Andaman Sea, in Southern Island of Sumatra, Java, and Nusa Tenggara, all the way to Banda Sea in Maluku. The tectonic pattern in Indian Ocean is seen in picture 3-2.

Picture 3.1.: Map of Tectonic Pattern in Indonesia

Picture 3.2.: Tectonic Pattern in the Indian Ocean

In Sumatra, such subduction also produces a series of non-volcanic Forearch Islands (Simeulue Island, Banyak Island, Nias Island, Batu Island, Siberut Island, Enggano Island), the series of Bukit Barisan Mountains with the volcanic lane in the center, can be seen in picture 3.2, and The Great Sumatra Fault separating the Island of Sumatera, starting from Semangko Gulf to Banda Aceh. The Great Sumatra Fault continues until Andaman Sea to Burma.

Picture 3.3 shows the spread of earthquake locations. This shows that Indonesia is within the tectonic active zone. Thus, the Aceh region is in the area which is always under threat of tectonic earthquakes and tsunami which is why the overall planning aspect must be anticipative towards such threat.

Picture 3.3.: Spread of Troughs and Volcanoes in Indonesia

Picture 3.4: Spread of Locations of Earthquakes in Indonesia

The subduction of Indian-Australian Plate also affects the geomorphology of Island of Sumatra. Due to the subduction, the Western part of Sumatra Island becomes elevated, meanwhile the East becomes the relatively lower part. This causes the Western part to have a narrow and sometimes steep coastal area. The coral is generally more developed compared to the varieties of mangrove. The Eastern part which is relatively lower will receive the soil as the result of erosion from the Western part (which moves upward), thus the Eastern part has a vast and level coastal area. In the East, the turf and mangrove are more developed compared to the coral reefs.

With such description above, not only in the Aceh region, but also in other regions on the Western Coast of Sumatra, Southern Coast of Java and Nusa Tenggara, also need to be alert to the possibility of similar disasters.

3.1.2. Physical characteristics of Rocks and Soil

Rocks in NAD and North Sumatra may be classified in coagulated rock and metamorphic rock, sediment rock and old volcanoes, limestone, young volcano rock and alluvial sediment. Specified they are as follows:

1. Coagulated and metamorphic rock consists of granite, diorite, gabbroid, and slate. These can be found in the central part of the Bukit Barisan. Rock with a character of being solid, in which water standard is low, generally has a good structure foundation supporting power, and is able

to support high-rise buildings, and seldom become aquifer. Granite, diorite and gabbroid may be used as building materials, although they are not as good as andesite. Generally their corrosion soil has the texture of clay up to sand. Their potential fertility is classified as average, as their silicon contents are high.

2. The group of sediment and volcanoes, consists of braxy, conglomerate and lava, these can be found at the edge of the Bukit Barisan and the low mountainous area, which bridges over from Sigli up to Pangkalanbrandan. In general the character of the rock has the character of being solid, its water passing is low, able to support high-rise buildings, and may become aquifer with a small up to average productivity. Generally their corrosion has the texture from clay to sand. Their potential fertility is around low until average.
3. Limestone rocks, can be found along side the Lhoknga area, at the southern part of Banda Aceh and in Lampeunerut. Having the character of being solid or forming hollow spaces, their passing varies depending on the number of the cavities. At the part of the solid limestone rock the supporting strength of its foundation is considered good. The limestone rock can be used as building material and cement raw material. Its corrosive soil has the texture of clay and generally has a high potential of fertility
4. The group of the young volcano rocks consists of turf, agglomerate, volcanic braxy and lava. These can be found at the mountainous area south of Lhoksemauwe and Medan. The rocks general are somewhat solid, the water passing is average up to high, and the foundation supporting strength is good. Its corrosive soil has the texture of clay, silt and sand, its potential fertility is generally high.
5. The alluvial sediment group consists of clay and sand. These can be found alongside the coast and alongside DAS Krueng Aceh, including the Banda Aceh Kota. The sediment still has the character of being loose up to somewhat solid, its water passing is low up to average, its foundation supporting strength is low up to average, and the potential fertility of the soil is low up to high.

Drawing 3.5 below shows a map of the types of sand and its swampy forests at all regions/mayoralities at the Province of NAD.

Picture 3.5. Map on Types of Land in NAD Province

In order to implement rehabilitation and reconstruction of the Province of NAD, after the Tsunami disaster many mineral sources shall be needed for building materials. The mineral sources needed should if possible originate from the areas, being hit by the disaster themselves, in order that they would be cheap and easy to get. Subsequently, the building materials to rehabilitate and reconstruct the province of NAD and Sumatra, post disaster may be fulfilled from the local areas. The building materials, which may be made available by the Province NAD are: stone, sand, sand for fill, split stone, limestone, decoration stone, and cement raw materials.

Drawing 3.6. beneath shows a map of the availability of building materials from the mineral natural resources of the Province NAD together with its swampy forests.

Drawing 3.6.:Map of spread of Construction material in the NAD Province

Source: ESDM Department

3.2. Coastal Condition

The condition of the coastal areas especially at the Northern and Eastern Part of NAD experienced a change, i.e. its coastal line moved back to the direction of the mainland because of the Tsunami wave. However, said phenomena was accompanied by sedimentation, causing the increase in shallow waters around the coastal areas as a result of heaps of material being returned to the direction of the sea.

3.2.1. Change in Coast Line.

Drawing 3.7. below shows a change in the coastal line around Banda Aceh pre and post the occurrence of the tsunami disaster. The green color in the drawing at the right side shows the area of water back-up, the result of the tsunami disaster, where the coastal line has moved to the direction of the land.

Drawing 3.7.: Change in Coastal Line around Banda Aceh.

(2 drawings)

Source: Bappenas analysis 2004

The change in the coastal line occurred at almost all coastal areas hit by the tsunami disaster. At several places the change in the coastal line was up to 40 m into the land. Prior to this writing has been made there was no accurate information regarding how large and big the erosion was. Drawing 3.8. below shows the change of the coastal line at the Banda Aceh coastal area, especially in the Uleu uleu area.

Drawing 3.8.: Change in Coastal Line in the Uleu uleu Region

Source: KLH 2005.

3.2.2. Sedimentation of Waters

Drawing 3.9. below shows the change in the coastal areas prior and post the tsunami disaster. The red color shows the shallow sedimentary waters, while the yellow color shows sediment in the deep waters. From the image interpretation can be seen that post the tsunami disaster at the drawing at the right side, the basic closures of the shallow waters is all the time increasing, this is caused due to the process of dislocation and the piling up of the sediment.

Drawing 3.9 : The change in Closure of Water lands

Two drawings.

Source: Bappenas Analysis, 2004

3.3. Condition of Land and Preserved Areas

The tsunami disaster did not have its impact on the mainland with a height exceeding 30m from the sea surface, so that its impact towards the woods of the low mainland was not too large. However, at the mainland with a height below 30 m, the tsunami disaster could reach 3 – 5 km into the mainland. A large part of the forest closures in Aceh are above 30m or far from the coast. This is based on the field report from the NGO Flora, Fauna Indonesia (FFI).

In general the vegetation, which could maintain the impact of the tsunami disaster at a height at the coastal areas below 30 m were coconut, sea casuarinas, tamarind trees, banyan trees and others, except in certain areas such as Pulau Simeulue.

According to the report of partner Wetlands International Indonesia in the area of Bakongan, South Aceh, the areas having mangrove with the formation of Rhizopora, Casuarinas, and Sea Pandan and coconut close to each other, they experienced little damage compared to the area, which did not have such vegetation.

3.3.1. NAD Preserved Regions

This preserved area was arranged in a space pattern with educational, research and recreation functions. Structures may also be built, which may maintain and increase the benefit of this preservation function, such as structures which will break the waves in the sea and a retaining wall in the mountains. Management of this preserved area needs to be arranged with a regional regulation in order to control the quality of the preserved area such that the negative impact, which might impact arise, may be minimized.

This preserved area in NAD comprises a large part of the area starting from the north up to the south as well as the areas from east to west. Picture 3.10 shows the map of the preserved area of the NAD province. This preserved area is in the form of a nature preserve, preserved forests, production forests, fauna, natural tourist parks, hunting parks, the people's forest park, and areas for other uses.

The Leuser Ecosystem area including the preservation areas in the NAD Province constitutes one of the richest tropical forests all over the world. The size of the area is two million and a half hectares and consists of a luxurious low mainland forest area, alpine plants, fresh-water swamps, valleys and volcanoes. In addition to its unique biodiversity of a high value, this area plays also the role of life's support system for the sake of four million people living in the neighborhood of this area. The function constituting services of this ecology, has according a study a value of more than Rp. 1,9 trillion a year. (Beukering and Caesar, 2000).

At present there is an idea to build a road connecting North and South Aceh and East and West Aceh, going through the Leuser Ecosystem Area. The plan for the development of this road is known as Ladia Galaska (Indian Ocean – Gayo Alas – Malacca Street), which is still a controversy between the central government and the region, including also the public, environmental organizations, and the international world.

Drawing 3.10: Map of Preserved Regions in NAD Province

The map on the preservation Area in the Nanggroe Aceh Darussalam Province

3.3.2. Preserved Regions in Nias Kabupaten (District)

The Preservation Area in the North Sumatra Nias Kabupaten covers a large part of the Nias Island. Drawing 3.11 shows the preservation areas' map in the Nias Kabupaten. This preservation area consists of preservation forests, production forests, conversion production forests and limited production forests.

Drawing 3.11.: Map of Preserved Regions in Nias Kabupaten

The map on the Preservation Areas in the Nias Kabupaten (District) of the North Sumatra Province.

Drawing 3.12 shows an analysis of the change of the ground coverage prior and post the Tsunami disaster in part of Banda Aceh and Lhoknga.

Drawing 3.12.: Analysis on Change in Closure of Land Before and After Tsunami

3.4. The hydrology condition

3.4.1. Rainfall

The rainfall in the NAD province area for the largest part exceeds 13,6 mm/hr/year , it even reached above 34,8 mm/hr/year. The area, which rainfall, is above 34,8 mm/hr/year covers Pidie, West Aceh, Ragan Raya, South West Aceh, and Simeulue Island. While the areas having a rainfall of less than 13,6

mm/hr/year comprise West Aceh, part of North Aceh, part of East Aceh and part of South East Aceh. Drawing 3.13 below shows a map on the annual rainfall in the NAD province.

Drawing 3.13.: Map of intensity of annual rainfall in NAD Province.

Source: Jakarta BMG

3.4.2. Ground Water Resources

In general all water bodies and water sources in the coastal areas hit by the tsunami disaster experienced damages by material and pollution brought by tsunami, so that they did not function at all during some time post the disaster, both as water sources, water flow and city drainage as well as septic tanks. There are no data or information yet on the final hydrological condition in the disaster areas. New stream flows from upstream may be able to decrease the high salinity in the rivers and estuary areas at the coast however, for the flat areas river dredging shall be needed. For the desalinization process shallow water sources technological intervention shall be needed.

The Aceh coastal area is classified as an area with adequate ground water sources, both at the shallow ground water as well as at its deep ground water, such as can be seen at drawing 3.14 below. Its potential is around high (pump debit > 10 liter per second), average (5 -10 liter per second) up to small (<5 liter per second). The deep and shallow ground waters have the characteristics of fresh water. Banda Aceh is classified to have the potential of having high ground water up to average. While Lhok Semaue, Sigli, Lhoknga, Teumon , Meulaboh and Tapaktuan are classified to have an average ground water potential. Said ground water potential may be benefited through shallow wells and deep wells. Except in Banda Aceh, the shallow ground water potential is estimated to be larger than the deep ground water potential.

Groundwater quality of the NAD Province.

Drawing

Drawing 3.14. The Map on the Quality of Ground Water in the NAD Province.

The *kota* of Banda Aceh has waste gutters (drains), however, their condition is damaged, and also the available septic tanks are inundated. Added with the existence of chemical materials and fuel from damaged motor cars and fuel tanks, all these have the potential to pollute the ground water. Especially in the area near the ports, where there are fuel depots. In general the water wells/ shallow water wells (with a depth of 5 m) in the main lain area are all polluted, contaminated with mud and sea water. Besides the water quality, the quantity of water shall become a problem. Reports from the sites show that at a number of settlement areas there is a shortage of clean water.

A number of industrial installations (fuel depots, pesticide, chemical materials for agriculture) got the direct impact of the tsunami disaster, because generally they are situated in the coastal areas. The Banda Aceh Port, Semen Andalas with its port at Lhoknga and the fuel depot of Pertamina at Krueng Raya Bay about 40 km from Banda Aceh, are industrial installations, which are heavily damaged. Additionally also the unfortunate tank trucks being in the way in the disaster areas, are estimated to be in a full position when hit by the tsunami wave. However, there is no report of areas that are heavily polluted, and it is assumed that they have been swept away together with the low tide of the tsunami wave. Except in several fishponds around Banda Aceh and around the Pertamina facilities pollution concentrations of the ground water were found. The environment threat came also from the damaged and broken gas pipes, as well as from a large hospital.

3.4.3. Surface Water Resources

The Nanggroe Aceh Darussalam province situated between 2 degrees – 6 degrees North latitude and 95°27' (Six) degrees up to 98 degrees with a area of 57,365,57 km² is divided into 15 River Stream Areas (DAS) consisting of : Pase DAS, Jambu Aye DAS, Kluet DAS, Krueng Aceh DAS, Krueng Baro DAS, Merbau DAS, P.Weih DAS, Peureulak DAS, Peusangan DAS, Sabe Geupe DAS, Simeulue DAS, Singkil DAS, Teunomwoyla DAS, Tripee Batee DAS. The DAS swampy areas can be seen at following drawing 3.2.

Drawing 3.15. Map on Units of Regions on DAS Management in NAD

Source: Forestry Department.

Based on the Decree of the Ministry of Forestry and Plantations No.: 284/Kpts-II/1999 in respect of determining the priority in the order of Water Streams from the 15 DAS existing in the NAD Province, 2 DAS shall be included in the DAS Priority I, 3 DAS shall be included in the DAS Priority II, and 10 DAS shall be included in the DAS Priority III. Table 3.1. shows the grouping of the DAS priorities.

Table 3.1. Priorities in the Province of NAD

No.	Name of DAS	Priority Handling.
DAS priority I		
1.	Krueng Aceh	Critical land extensive, erosion, high sedimentation Pressure of the people large
2.	Prueng Peusangan	Critical land extensive, high erosion Pressure of the people large
DAS Priority II		
3.	Krueng Pase	Critical land extensive, high erosion Pressure of the people large.
4.	Krueng Baro	Critical land extensive, high erosion Pressure of the people large.
5.	Krueng Meureude	Critical land extensive, high erosion
DAS Priority III		
6.	Krueng Jambu Aye	High erosion Pressure of the people large.
7.	Krueng Sabee Geupu	Critical land extensive, high erosion.
8.	Krueng Tenom-Woyla	Erosion high. Pressure of the people large.
9.	Krueng Singkil	Erosion high. Pressure of the people large.
10.	Krueng Tripee Batee	Erosion high. Pressure of the people large.
11.	Krueng Kluet	Erosion high.
12.	Krueng Peureulak	Erosion high.
13.	Krueng Merbau	Erosion high.
14.	Pulau Simeulua	Sedimentation high.
15.	Pulau Weih	Sedimentation high.

Source: Forestry Department.

3.4.4. Condition of gambut/turf land in NAD

In the west coast of NAD especially starting in the neighborhood of Keudetenom (40 km north of Meulaboh) up to around Singkil in the South there are sufficient extensive turf lands. In several places, said turf land reaches up to a depth of 4 m, while in other areas only about 1 m. In the neighborhood of Keudetenom said turf land has the form of a dome with the center more deeper. Based on the analysis conducted by Wetland Indonesia towards the impact of the tsunami in areas dominated by turf, the tsunami wave did not enter too far, among others due to the type of topography of the respective turf land.

The turf land situated at the coast has an important function in coast hydrology because 90% of the turf consists of water, such that it functions as fresh water reservoir in the coast areas. The turf land also protects the surface of stream flow and ground water to stream into the mainland. As the largest part of the turf land in the west coast is not damaged by the tsunami, its function as reservoir and water provision for the settlements around them is still workable.

Picture 3.16. Spread of Gambut (Turf) Land in the NAD Province.

Picture

Another matter to pay attention to regarding the turf land is that the land is no longer appropriate for agribusiness in general paddy and as such that such the turf land should not be used for agriculture food plants as well as settlements. The analysis against the use of turf land for such requirements (for example development of 1 million ha of turf land in Middle Kalimantan) concludes, that said matter has caused forest fires' disasters difficult to overcome. Therefore one of the matters to be done is to protect the turf ground area to remain as forest area and not to be opened for other purposes, both as plantation as well as settlement. On the other hand the public may benefit from the turf land as a sustainable forest management area, i.e. to benefit from the forestry products, such as rattan, ramin wood, jelutung and others.

CHAPTER 4

THE POLICY AND STRATEGY FOR REHABILITATION AND RECONSTRUCTION OF THE NATURAL RESOURCES AND *ENVIRONMENT* SECTORS.

The rehabilitation and reconstruction on the Natural Resources and *Environment* Sectors, covering the aspects of forestry, agriculture, maritime and fishery, mineral resources and mining and *environment* will use the sustainable development principle prioritizing the balance between aspects and economic, social and *environment* considerations, social and environment with the development between and inter generation. The implementation of several development aspects in the sustainable natural resources and *environment* sectors also considers the other supporting aspects, such as the use of the latest, effective and friendly-environment technology and also considers the possible aspects of future disasters.

The principle of sustainable development will be applied in the Natural Resources and *Environment* sectors by complying with following considerations:

1. The Rehabilitation and Reconstruction Plan of the Natural Resources and *Environment* reaches a long term perspective exceeding one-two years, such that the development activities need to calculate the long-term aspects.
2. The Rehabilitation and Reconstruction Plan of the Natural Resources and *Environment* sectors will consider the interdependency relationship between natural agents, social and man's make.
3. The Rehabilitation and Reconstruction Plan of the Natural Resources and *Environment* sectors shall be conducted in the endeavor to fulfill the requirements of man and public of today without prejudice to the ability of the future generation to comply with their requirements. This requirement covers the need for environment, social-cultural-political requirements and economic requirements, which need to be simultaneously adhered to in human and public life.

The implementation of the rehabilitation and reconstruction on the Natural Resources and *Environment* sectors shall be implemented by making use of the principle:

1. Benefiting of the newest natural resources, which may be used again (resource recovery) and recycled with a high efficiency pattern;
2. Benefiting of the not newest natural resources, which pays attention to the newest threshold of its own modernization (environmental supporting strength).
3. Conducting activities resulting in the lowest possible level of pollution under the health threshold of the living creatures.
4. Minimizing the space allocation, especially economizing on land, which is increasingly getting limited;
5. Benefiting of the newest energy as optimal as possible as well as not the newest energy with the method of use as minimal and clean as possible with considering the supporting power and the environmental balance.

Carrying out the process as optimal as possible, which shall result in an environmental, social-cultural and political and economic benefit, by involving all related interested functionaries, including local public officials (sea commanders, religious scholars and etc.)

Said principles mentioned above will be applied in the development policies of the natural resources and *environment* sectors comprising: policy on the recovery of the environmental supporting power and the

anticipation of the threat of a natural disaster; (2) the policy on the recovery of the public's economic activities based on the natural resources; (3) the policy on involving the public and the use of social and local cultural regulations in facing disasters and development activities; and (4) the policy on the recovery of the governance institutional system in the natural resources and *environment* sector.

4.1. Recovery support for the environment and anticipation of natural disaster threats

The tsunami disaster and the earthquakes have resulted in environmental damage, which had a direct impact towards the life of the people at present and for the future.

4.1.1. To inform and inform regions under threat of pollution and earthquake danger

The main activities cover: Regular Surveys on the pollution parameter. Determining the status of the environmental security of a region, socialization on the environmental quality and the threat of danger for earthquakes.

4.1.2. Cleaning up of disaster areas

The main activities comprise: Disposing of the tsunami solid waste. The restructuring of the city waste system, and restoring the urban drainage system. To build a liquid waste management system.

4.1.3. Land rehabilitation

The main activities cover: Careful investigation on the quality of the land, including survey activities, classifying the status of the land, evaluation and recommendation on handling and rehabilitating the land.

4.1.4. Rehabilitation of coral reef

The main activities cover: Recovery of the coral reefs, replanting of the coral reefs and composition of the institutional mechanism.

4.1.5. Rehabilitation and development of coastal regions specifically in the green belt area and the fish breeding ponds area and forestry in accordance with the plan for spatial layout and character coastal areas

The main activities cover: Rehabilitation of Mangrove and Rehabilitation of Vegetation, protection of other coast areas; rehabilitation of the embankment areas; and development of urban forestry

4.1.6. Security of the existing preserved region functions

The main activities cover: To secure the Lueser National Park from the building of "R3WANs" and to secure the function of other preservation areas, existing in NAD and Nias as well as in the other neighboring provinces.

4.1.7. Rehabilitation of River Flow Areas (DAS).

The main activities cover: Management of the land through forest and land Rehabilitation and (KHL), protecting and developing water sources, management of the vegetation for the land and water lay-out protection and the development of the awareness and ability of human resources.

4.2. Recovery of natural resources-based community economic activities

With several public economic activities being smashed especially in the agricultural and fishery sector, which was the main livelihood of the local people, reactivation shall be needed and recovery of the public economic situation, which were hit by the impact of the tsunami. In order to support economic and development activities during the rehabilitation and reconstruction time a strategy is needed to comply with the requirements on materials, building materials particularly originating from the natural resources.

4.2.1. Recovery and improvement of agricultural activities

The main activities comprise: Rehabilitation/building of water gutters and tertiary and quarterly irrigation (according to scheme and type); rehabilitation of production/farmer's roads; development of seedlings/culture medium units; development of facilities to market agricultural products; building of animal health posts; careful investigation and development of effective technology: Agricultural facilities' assistance in the framework of re-initiation food planting production, horticulture, plantation and animal husbandry; integrated agricultural development, arrangement of work capital for agricultural businesses; assistance for management facilities and the marketing of the outcome of agriculture and assistance for production facilities' kiosks and the increase of the public economic business in the conservation area supporting regions (Tour Park, nature preserve and fauna and wildlife reserve).

4.2.2. Recovery and improvement of fishery activities

The main activities comprise: To recover catching fishery activities, rehabilitating fishponds of the public and its other fishery cultivation and facilitate economic activities from the public of the coastal areas.

4.2.3. Availability of basic material for construction from natural resources that do not threaten the preservation of the environment

The main activities comprise: Supply of wood and the supply of materials and other construction building materials. The alternative development of building materials from coconut wood, cultivation and controlling of forest business efforts and the cultivation of beneficial control of the forest production of NAD and North Sumatra.

4.3. Community involvement and use of local social cultural institutions in facing disasters and development activities

In implementing development of the natural resources and *environment* sectors, the role and the local public constitute a main element in the process of handling disasters and development phases.

Strategy

4.3.1. Development of integrated early warning system

The main activities comprise: To compile the standard operation and procedures (SOP) in order to respond to the disaster emergency. To increase the capacity of human resources and government institutions, and develop the means and infrastructure for the early warning system.

4.3.2. Improvement of community care in anticipating disasters

The main activities comprise: To benefit the value of the local ability as part that is supplementing the early warning system. To empower the role of the public in handling the mechanism in disasters. To develop education in respect of disasters.

4.3.3. Community involvement in the implementation of development of the natural resources and environment sectors

The main activities comprise: Empowering the existing social and traditional institution regulations in the planning and implementation process and to develop the supervision mechanism subject to the social, cultural and aspiration values of the local public.

4.4. Recovery of the governance institutional system in the natural resources and environment sectors.

Means and the infrastructure of the governance, which for the greater part was destroyed due to the tsunami, require rehabilitation and re-development such that the wheels of the governance may turn normally.

4.4.1. Completion and refilling of Employee formation (experts and supporting staff)

The main activities comprise: To conduct a responsive institutional review towards the development vision in the future, to conduct recruitment of new civil workers and to increase the capacity of the apparatus in the human resources and *environment* sectors.

4.4.2. Recovery of facilities and infrastructure of governance in the natural resources and environment sectors

The main activities comprise: To carry out development and rehabilitation of the office and supporting means in the agency's operational activities in the natural resources and *environment* sectors in the regions.

CHAPTER V
PLAN FOR ACTIVITIES AND PROGRAM FOR
REHABILITATION AND RECONSTRUCTION IN
THE NATURAL RESOURCES AND ENVIRONMENT SECTORS

Taking into consideration the former chapter, it was decided that 4 main policies are to become the reference for the rehabilitation and reconstruction programs in the *environment* and natural resources sectors, i.e.: 1) To recover the environmental supporting power and anticipate the threats of disasters, 2) To recover the public's economic activities based on the natural resources, 3) To involve the public and to use the social and local cultural regulations in facing disasters and development activities and 4) To recover the governance institutional system in the natural resources and *environment* sectors. Each of said policies has also been clarified in various strategies and main activities. Further in this chapter, such main activities shall be further explained up to their operational activities.

5.1. Recovery of support for the environment and anticipation of natural disasters

The extensive damage to the natural resources and the ecosystem as a result of the earthquakes and the tsunami requires special attention in implementing rehabilitation and reconstruction in NAD and Nias. The ability of the environmental supporting power for the requirement of development must be recovered in order that it would be better than the condition prior the occurrence of the disaster. While, the potential natural resources and the environmental condition, which were not hit by the impact of the disaster must be secured and used as wise as possible taking into consideration that in the development phases of the rehabilitation and reconstruction many natural resources materials as raw material shall be needed as raw material for the basis of development. Therefore a strategic analysis for the environmental management and development of its other natural resources (Regional Strategic Natural Resource and Environment Assessment /RSNREA), containing matters related to the environmental support power and natural resources shall become one main priority especially at the rehabilitation phase. RSNREA must be followed with obvious steps in the fields in order to recover the environmental condition considering that the life of so many people depend on the local environmental condition. Security actions and the wise use on the potential natural resources assets contained in the NAD earth, Nias and its neighboring areas from the development impact shall also become a matter to be prioritized. KSNREA, obvious actions on the environmental recovery, security and benefiting of the natural resources shall constitute a large job, which requires intensive, inter agency cooperation and coordination starting from the planning phase up to implementation. Taking into consideration that these activities constitute the issue of sector crossing and in order to prevent overlapping of the implementation program at the rehabilitation and reconstruction phase, all government agencies, donor institutions, the business world sector and the public private institutions shall be required to be able to follow the main activities and the steps, which shall be specifically explained in this chapter. The main activities to be implemented comprise following matters:

1. To clean the city;
2. To secure and to inform the area hit by pollution and the danger of earthquakes;
3. To rehabilitate the land for agricultural activities;
4. To build the green belt, fishponds and city forest subject to the lie-out Plan and the character of the coast;
5. To secure the still existing preservation areas;
6. To rehabilitate the coral reefs ;
7. To rehabilitate the River Stream Areas.

5.1.1. *Cleaning up of Kota*

The city cleaning activities comprise activities: a) cleaning the mud, remainders of the tsunami. b) cleaning the debris and waste of tsunami, c) determining the location, the place for the mud, debris and waste of tsunami, d) restructuring the system of collecting domestic waste including planning the old TPA rehabilitation and planning of a new TPA location, e) restructuring the urban drainage system, and f) developing a fluid waste management system.

1. Cleaning of the mud, debris and waste and the repair of the system to collect the waste.¹

Cleaning of the mud and waste of tsunami constitutes a priority program at the phase of emergency and shall continue up to the rehabilitation phase. Cleaning of the debris and waste of the tsunami is at present dominantly handled by volunteers, BUMN (State-owned enterprises) and on the initiative of certain public groups. At the phase of rehabilitation and reconstruction, the role of the Government of the Mayoralty and the increase of involving the public more systematically in the cleaning of debris and waste activities through safe methods shall become the main priority.

The objective:

To clean the settlement area, fishponds, agriculture and rivers from mud, debris and waste, remainders of the tsunami, which settled and scattered all over the area, hit by the impact of tsunami and earthquakes.

Activities to be carried out:

- To compile a detailed planning fast and integrated to pick up and dredge the mud, remainders of the tsunami;
- To pick up and dredge the areas planned to be built subject to the Planning of the Lay-out, which has been agreed upon;
- To conduct basic trainings and supply protection equipment for those who are implementing dredging and transportation;
- To separate and filter solid waste, which can still be used as raw material for rehabilitation and reconstruction;
- To make remake a plan for the collection and transportation of the domestic waste from the city and the regions.

2. Determining the location of the Final Disposal Area (TPA)²

Determining the TPA location in order to accommodate the remainder of mud, debris and waste, remainder of the tsunami as well as the earthquakes, and the handling and management of the existing

^{1 1} UNDP has started the program *cash for work* to clean the debris and waste due to the earthquakes and tsunami in the phase of emergency. To continue this program, in the phase of rehabilitation and reconstruction, integrated coordination and cooperation is required for handling the debris across the sectors and the JICA donor has conducted a research to benefit the tsunami waste for the recycling program and will develop the Urgent Development Study (USD), including the plan to insist for waste handling. It is hoped that the result of this research may be benefited and adopted to make one of the options for handling the debris and waste post tsunami. The German Government through Gtz is also compiling a program to assist in the completion of the problem of debris and waste, remainders of the tsunami in the rehabilitation and reconstruction phase.

² Especially for Banda Aceh, the Government of the mayoralty of Banda Aceh will remain to use TPS *Gompong Java* as Final Disposal Area (TPA), result of the every-day activities of the public of the Banda Aceh mayoralty. It is estimated that said TPA may be used up to 3 years in the future. The ESDM Department has submitted several new alternative TPA locations for the Banda Aceh mayoralty, which are relatively sufficient safe viewed from the view of geology, which require further study. The BPPT (The Agency for the Study and Application of Technology) has proposed to apply the Re-use Sanitary Landfill technology and did not recommend the new TPA location alongside the coast.

TPA to accommodate domestic waste shall become an important consideration in the friendly-environment rehabilitation and reconstruction phase.

The objective:

- Securing the public from solid waste contamination, remainder of the tsunami.
- Empowering the existing TPA (Final Disposal Area);
- Compiling a long-term planning for the building of a new TPA;

Main activities to be carried out:

- To compile several options for the technology and location for the tsunami waste disposal area
- To plan and determine the tsunami and earthquakes waste TPA location by considering the condition and quality of the environment, the geological condition, the impact towards the public and the operational technical worthiness;
- To build a TPA for the tsunami waste;
- To compile a plan for the rehabilitation of the existing TPA for the efficient use by considering the condition of the environment and the public around the TPA;
- To implement rehabilitation and at the same time revitalize the existing TPA by considering the quality of the environment and the degree of the public's aspiration in the neighboring TPA to accommodate the daily public waste;
- To determine the criteria of the new TPA location by following the regulations of the Indonesian National Standard (see attachment);
- To compile a detailed plan for the design of new TPA's.

3. To restructure the mayoralty drainage system

Restructuring the drainage system in the mayoralty area, especially in Banda Aceh constitutes a very important and pressing matter, considering that at this moment in many locations there are still many floods by sea water or rainwater, occurring because of the failure of the mayoralty's drainage system for the solid waste of tsunami, waste from the public activities as well as the damaged drainage system of the mayoralty. When this condition continues, the rate of the pollution of the ground water and the quality of the fertility of the land will increasingly decrease.

The objective:

- To carry out rehabilitation and build a mayoralty drainage system able to effectuate disposal of the rain water simultaneously endeavor absorption water into the ground as maximum as possible as part of the endeavor to protect the ground water sources.

Activities to be carried out:

- To draw up an inventory of the mayoralty drainage systems, which are damaged;
- To conduct a feasibility study and a plan for an integrated technical design with a macro system for the control of floods;
- To compile a plan for areas for the absorption of water and to determine a standard for buildings following the environment-friendly terms and conditions;
- To carry out physical rehabilitation and building new integrated drainage systems with macro system for the control of floods.

4. To build a liquid waste management system

The objective:

- To protect the environment of the public's waste pollution particularly in the urban areas

Activities to be performed:

- The compilation of a plan for the disposal of domestic waste by using a communal approach, and not an approach with the urban scale;
- The compilation of a feasibility plan for the integrated Installation of Waste Management (IPAL) for domestic and hospital waste subject to standard. The establishment of said Integrated

IPAL must also be supported by a process system design and a technology for the management of waste pursuant to standard.

- To conduct rehabilitation towards the existing Installation for the Management of Feces and to build a new waste management system by public-based communal approach.

5.1.2. Security and Information on regions inflicted by pollution and earthquake danger

1. Periodical Survey on Pollutant Parameters and Soil Movements Vulnerability³:

The objective:

To gather the latest information about environmental quality, especially regarding various pollutant parameters and information in the form of maps about soil movements vulnerability and geological natural disaster in all tsunami-stricken areas.

The activities cover the following:

- Sample-taking and laboratory test of surface water quality, ground water and the air of all tsunami-afflicted areas.
- Data collection of possible dangerous toxic materials (*B3*) in all tsunami-stricken areas.
- Measurement of soil movements and periodic earthquake mapping in the Aceh, Nias and the surrounding areas.

2. Development of Data Base Information System on the Environment and Geological Danger Vulnerability.

The objective:

- To produce a systematic, integrated database, and to be speedily and easily accessible for the early-warning system and for public interest.

The activities cover the following:

- To create a clearing house (database) to develop a data on the environment and geological danger vulnerability.
- To develop an information system of the environment and geological danger, which is integrated with the national and regional early-warning systems.
- To formulate an institutional mechanism that is integrated with the national and regional early-warning systems.

3. The designation of natural disaster-vulnerable areas.

The objective:

To designate a natural disaster-vulnerable and environmental polluted-prone areas as inputs in the form of technical advice on drafting a more detailed planning on spatial layout and zoning. This should ideally be carried out together with community leaders such *panglima laot*, *keucik*, Moslem scholars and so on.

The activities cover the following:

³ The Ministry of the Environment (*KLH*) has conducted a limited monitoring on the pollutant quality of water, mud and the air in several locations in Banda Aceh. The Department of Energy and Mineral Resources has also monitored the quality of soil water in several points in Banda Aceh. So far, there has not been any routine monitoring of the environmental quality aimed at monitoring the progress of the latest environmental quality. The Department has conducted studies on earthquakes in NAD (*Nanggroe Aceh Darussalam*) and its surroundings. Further studies must still be conducted to sustain a more accurate analysis on earthquake potentials in NAD and also other vulnerable areas along the western coast of Sumatra.

- To have a cross-sectional coordination to analyze areas vulnerable to pollution and geological natural disaster;
 - To delineate areas or regions vulnerable to pollution and geological natural disaster;
 - To make predictions on environmental management models about the possible restoration of the environmental quality of areas affected by geological and tsunami disasters.
3. The socialization of environmental quality and the danger of earthquakes.
- The objective:
- The protection and socialization of tsunami-affected areas are basically conducted by the community (especially local inhabitants who want to return to their village or to resume activities in the former place), to get accurate and quick information about the risks and the means to confront them.
- The activities cover the following:
- To socialize the community about the polluted locations, the pollution risks and, simultaneously, to build the community's awareness about the danger of pollution;
 - To enhance the community's awareness about the benefit of the growing cultural values in the community about the danger of pollution, natural geological disasters and the importance of environmental management;
 - To enlighten the public knowledge about environmental management in the polluted regions and, at the same time, it becomes part of the primary and secondary educational curriculum.

5.1.3 *Rehabilitation of land for agriculture*⁴

The soil rehabilitation is carried out on areas destroyed by erosion of waves and tsunami waste pollution. Based on the observation and studies in the field, several soil deformations are noticeable from the soil texture changes and coastline alterations that have affected almost the entire tsunami-stricken regions. The soil deformations were also caused by the continuous landfill and solidification of waste from tsunami in a number of locations. Other forms of soil deformations were also due to waste pollution and seawater intrusion that led to the degradation of the soil's chemical characteristics and fertility.

The objective:

To restore the soil's function as arable land to be replanted with agricultural crops, fishponds and settlements.

The activities cover the following:

- To conduct survey and evaluation of tsunami-stricken soil, including studies on soil salinity and other pollutant factors, such as heavy metal content and dangerous toxic materials;
- To group soils into a certain soil classification system and an illustration of the pollution pattern on a soil map;
- To make evaluation and recommendations on the soil potentials and adaptability to various utilizations;
- To rehabilitate or improve soil quality for replanting.

5.1.4 *Development of green belt buffer zone, fish breeding ponds and kota forestry in accordance with the plan for spatial layout and character for coastal areas*

⁴ The Department of Agriculture has conducted studies on the soil condition and quality contaminated by seawater. Some views stated that the soil's condition will improve because the pollutant parameters will be diluted by rainwater. However, to date, it is still difficult to replant areas affected by the tsunami mud, especially areas on the northern part of Banda Aceh, which is covered by quite a thick layer of mud.

In the development of a buffer zone, consistent with the *kabupaten* and urban spatial layout plan, it was decided that the coastline zone, especially coastal areas, consist of protection zone with protection plants or protection structures, fishponds and urban forest.

1. To rehabilitate mangroves in areas where they formerly grew⁵

Highly dense mangrove forests may stifle the impact of tsunami. Meanwhile, mangrove areas in NAD have drastically shrunk due to their conversion into fishponds and other economic undertakings.

The objective:

To rehabilitate and develop mangroves covering 164,840 ha in NAD and 9,750 ha in North Sumatra for the 2006-2010 periods, for coastal protection or areas for hatchery and aquaculture and a new sustainable ecosystem.

The activities cover the following:

- To chart a map of the mangrove ecosystem condition in NAD and Nias;
- To conduct studies on coastal characteristics and potentials;
- To draw a plan on the rehabilitation of mangrove forests and the planting of other coastal plants;
- To draw up a mangrove forest technical rehabilitation plan and a medium-term plantation of other coastal plants;
- To rehabilitate mangrove forests in the coastal and fishery/fishponds zones (consistent with the spatial layout plan), both individually and integrally, especially by adopting a silvo-fishery method (environmentally-oriented aquaculture);
- To formulate an institutional mechanism to maintain, monitor and evaluate the outcome of mangrove forests rehabilitation.

2. To rehabilitate fishponds area and critical ecosystem habitat.

The objective:

To allow the ecological function of the coastal ecosystem and critical habitat, in order to enhance the ecosystem value and function.

The activities cover the following:

- To make a detailed plan on the coastal area zoning that function as protection, fishponds and urban forest areas;
- To rehabilitate and rearrange coastal ecosystem, including fishpond ecosystem, by involving the community's participation;
- To draw up a detailed master plan of every area of development of fishpond culture;
- To rehabilitate pioneering vegetation, in addition to mangroves in the coastal areas, in line with the coastal community's characteristics and aspirations;
- To monitor and preserve the biodiversity value in critical ecosystem.

3. Greening and Urban Forest Development.

Priority is accorded to the open green space that functions as an urban forest in the spatial layout plan. The urban forest, not only functions as a protection or a natural defense system against tsunami, hopefully it would serve as a tourist area and a means for research on biodiversity in the coastal areas.

The objective:

To build the ultimate defense system against the threat of tsunami (in compliance with the Spatial Layout Plan) and, at the same time, to expand open green space in the urban areas.

⁵ The technical approach to the development of mangrove forests should ideally takes into account the environmental feasibility. The Bogor Agricultural Institute has suggested that the silvo-fishery approach (a combination between fishpond and mangrove) should be applied. JICA has also offered the use of its mangrove research center for the management of silvo-fishery.

The activities cover the following:

- To draw up zoning plan and detailed working plan together with the local community, based on the environmental characteristics of the respective regions;
- To provide seeds for urban forest, suitable to the soil characteristics, weather and other local environmental conditions;
- To plant in urban forest and, simultaneously, reinforce the security system of the planted plants by relying on the local community's participation.

5.1.5 ***Rehabilitation of coral reef***

Based on the rapid studies made by various authorities and institutions, there has not been any accurate analysis made on the condition of post-tsunami coral reef. In general, there are more coral reefs on the western coastal area of NAD than on the eastern part. The coral reefs on the western coastal area were completely destroyed by the tsunami, whereas the condition of post-tsunami coral reefs in Weh, North Aceh; has not changed significantly, compared to the pre-tsunami period.

The objective:

To protect and capitalize on the coral reef ecosystem potentials in an optimum and sustainable manner;

The activities cover the following:

- To evaluate and rearrange the varieties and conditions of coral reefs in various locations, which have been identified as area that have suffered damages and, consequently, are being prioritized, including the application of Transek Monitoring (Rapid Ecological Assessment), with the aim of identifying further the types of coral reefs, in terms of its level of density and destruction.
- To build artificial fishing ground (*rumpon* and artificial reef);
- To form an institutional mechanism for coral reefs management.

5.1.6 ***Security of function of the existing preserved regions***

To protect the function of the existing protection forests against two kinds of threats, namely: (1) threats from tsunami waves and (2) threats from illegal logging.

a). Threats from tsunami waves

Tsunami waves have no impact on lands above 30 meters. Meanwhile, most of the forests in Aceh are situated above 30 meters or far from the coast. Consequently, the impacts of tsunami on lowland forests are not too significant.

b). Threats from illegal logging.

The greatest threat of illegal logging is instigated by the high demand for wood for the construction of houses, boat making and other needs, whereas the availability of legal wood is limited. Unless this disparity between wood supply and demand is not corrected, the wood in the protection forest in Aceh will be severely compromised. The threat of illegal logging may also come from the construction of new roads that connect growth centers on the eastern and western coastal areas of Aceh (Indian Ocean-Gayo Alas-Malacca Strait/*LADIA GALASKA*), which crosses Mount Leuser protection forest and other protection forest areas. The existence of this short-cut road that splits this protection forest is feared to encourage illegal logging or encroachment into protection forests.

The objective:

To protect the function of protection regions from the impact of development of the rehabilitation and reconstruction, including the protection over Mount Leuser National Park

(*TNGL*) from possible illegal logging and infrastructure expansion that threaten the preservation of *TNGL*.

The activities cover the following:

- To enhance the controlling system of protection regions and *TNGL*, by raising the quality and quantity of controllers;
- To promote conservation cadres and the young generation in securing protection regions and other conservations;
- To promote the management and operation of production forest operation and utilization through promotion, reordering and review of the already granted Forest Timber Royalty Permit (*IPHHK*), due to the continuing decline of forest production potentials.

5.1.7 *Rehabilitation of River Water Flow Areas (Banks)*

The objective:

The rehabilitation of River Banks is aimed at maximizing the sustainable use of soil, water and vegetation for the well being of mankind.

The activities cover the following:

- Land management through land use, including soil conservation activities in the widest sense through the Forest and Land Rehabilitation (*RHL*), in agronomic, vegetative, structural, managerial terms and a combination of the above;
- To protect and develop water resources by raising the river's capacity (recharge) to water storage;
- To manage vegetation through forest management that functions as soil and water protection, and provide recommendations on the measures to be adopted with the objective of restoring critical lands;
- To enhance the awareness and abilities of man in utilizing wisely natural resources, so as to participate in managing River Banks.

5.2 *Recovery of Natural Resources-Based Community Economic Activities*

Based on the observation in the field and studies on the level of destruction and damage caused by tsunami, obviously it has inflicted very serious and comprehensive destruction along the productive coastal areas, such as: erosion that led to the shrinking number of fishponds and agricultural lands, rice fields flooded by sea water, mud and other destructive materials, damages to fishponds, both physically and environmentally, damages to coastal agricultural lands, loss and destruction of boats, ships, fishnets and other fisherman's implements. This has brought about adverse impacts on the fishermen, breeders and farmers, for instance harvest loss, uncertain medium-term agricultural prospects and disappearance of job opportunities and earnings from harvests.

For this reason, therefore, the main activities of the rehabilitation and reconstruction of Aceh start with the resumption of the community's economic activities (natural resources-based), which are a) to restart agricultural activities; b) to restart fishery activities; and c) to secure the provision of natural resources as the basic materials of development.

5.2.1 *Recovery of Agricultural Activities*

The tsunami calamity has not only devastated the physical agricultural means and infrastructures, but it has also ruined the rural economic base, such as agriculture. The Department of Agriculture puts the estimate of severely damaged agricultural lands (*puso*) around 20,101 hectares and 31,345 hectares of fields. Rice fields submerged under seawater and mud, and other destructive materials, wiped out harvests and uncertain medium-term agricultural prospects. This is why the priority of rehabilitation is

to help farmers, and other members of the community whose livelihood depends on agricultural activities, so they can restart their production and trading.

The first step of post-tsunami efforts is verification, in order to identify the magnitude of the damage and the relief assistance to be distributed to the afflicted areas, and to plan for the rehabilitation and reconstruction stages, to ensure the optimum distribution of the relief assistance. This verification stage will take around 3 months and an allocation of Rp. 600 million and funded by the Food Security Enhancement Program (*PKP*).

The short-term rehabilitation strategy is as follows: urgent and speedy result-oriented actions are needed for the resumption of agricultural activities, such as drying the still sea-water-flooded areas, cleansing lands and adding gypsum and regrouping stray animals. Furthermore, to enable farmers to start with production, they should be provided with simple agricultural implements, seeds and fertilizer.

The Department of Agriculture, in its endeavors to restart the agricultural economic activities, is taking the following steps:

a. To rehabilitate agricultural lands. Apart from drying the still-flooded lands, soil cleansing and gypsum adding, the rehabilitation of damaged or destroyed agricultural lands is carried out by rehabilitating the supporting infrastructure such as agricultural irrigation and road networks, as well as providing agricultural infrastructures;

b. Restoration of land ownership deeds

Only 25% of lands in NAD are furnished by official land deeds. Many of the documents were lost during the disaster. Subsequently, due to the great number of victims, the official land deeds have to be put on data again, especially lands that are deprived of any legal documents. The initial step to reinstate land ownership is to form a group in a community, headed by the local community's prominent leader.

c. Agricultural business capital assistance

The capital assistance provided to farmers is in the form of seedlings/agricultural seed/stock and other production means, as well as capital for the processing of agricultural produce, like rice mills.

d. Reinforcement of farmers and social organization.

The farmers and rural community organization has to play a pivotal role in the rehabilitation and reconstruction of the agricultural sector. It is indispensable to draw the principal plans and actions implementation in cooperation with them.

e. Personnel assistance.

Because so many human resources have perished, and in order to accelerate the rehabilitation process, obviously personnel assistance is needed. This is carried out in providing public services by the state apparatus and also to farmers in their agricultural activities. Since many of the agricultural lands have such high salinity content, it is essential to introduce new technology to resolve the problem. Some of them are by the introduction of high-salinity-resistant variety. Moreover, it is also necessary to monitor and to solve the problems during the restoration of lands and water for the next few years.

In connection with the above, the Department of Forestry has also made preparations for the resumption of the rural economic activities, especially in the buffer zones of Jantho National Park, Suaka Margasatwa Aceh Singkil and Sabang Natural Tourism Park. To intensify the rural economic activities of the buffer zones, the estimated funds to be allocated for the 2005-2009 periods will be around Rp. 600 million.

5.2.2 *Recovery of Marine and Fishery Activities*

The short-term restoration of fishery activities is aimed at restoring the potentials of fishermen and fish cultivation in order to enable them to quickly recommence their business and production as before and, if possible, to intensify them even more. To generate the fisherman's economic community and fish culture, as well as the people in the coastal areas, the policies adopted by the Department of Marine and Fishery are, among others, as follow:

During the first year, immediate livelihood supports to the rural economic activities shall be provided, including temporary livelihood, namely to create temporary employment opportunities in the work for cash scheme. Such temporary economic activities may consist of boat repair, fishponds cleaning, restoration or cleaning of other intended means and infrastructures.

The working capital needed for the preliminary economic recovery, both for the fishermen and fish culture, is expected to come from the budget earmarked by the Government (State/Regional Budget – APBN/APBD), or from foreign grants, which shall be focused on the Empowerment of Coastal Community Economy, Empowerment of Fish Culture and Empowerment of Small-Scale Fish Farming. In connection with the encouragement for the restarting of economic activities, technical assistance is being provided to the private sector, such as production means and infrastructures for hatchery, fish processing units, pumps, vessels, implements, shipyards and so on, whereby the investments are expected to come from the Banking sector or private sector investment.

At the reconstruction stage (medium-term), efforts are being made to restore all processing and marketing production systems of catch fishery, fish farms and promotion of alternative sources of income.

The efforts to develop fishery are conducted through the following primary activities:

a. Rehabilitation of catch fishery

The policy of providing means during the first year is prioritized on the small-scale fish farm with a view to encouraging fishermen to go immediately to the sea again. This is expected to generate production increase of fish that come from the sea beyond the 12-mile range around NAD, whose processing is carried out through the rolling system, partnership pattern with fishermen and through the Small-holder Business Enterprises (BUMR), and also through the promotion of fishery centers based on integrated fishery.

b. Rehabilitation of Fish Cultivation

This is carried out by the rehabilitation and reordering of the existing fishponds prior to the tsunami disaster. The provision of cultivation means, particularly for sweet and sea water cultures, is targeted to fish farmers as working capital assistance in the form of baby fish/seeds, fertilizer, pesticides, feed mills, and cultivation implements.

c. Rehabilitation of Fishery Means and Infrastructures.

The Department of Marine and Fishery (DKP) is planning to rehabilitate training facilities which were damaged by the tsunami, such as: Cultivation Place, Secondary Fishery School (SUPM), Fishery Quarantine Station, including the rehabilitation of fishery harbors and fish landing base (PPI), hatchery managed by Central technical execution units (UPT) and other regional fishery means and infrastructures.

5.2.3 Guarantee of Natural Resources-Based Community Economic Activities

The physical activities during the rehabilitation and reconstruction stages of post-tsunami Aceh brought about consequences in terms of the provision of building materials such as wood, cement, steel and many others. One of the main components of development is wood, whereby for rehabilitation and reconstruction purposes for all over NAD, a great quantity of wooden materials shall be needed. To meet this great demand for wood, a number of domestic sources are available through: a) confiscated/found wood, b) contribution from surrounding provinces, c) land clearing, d) relinquished forest.

As far as the demand for wood is concerned, table 14 illustrates the estimate of wood requirements for house construction, shipyard, means and infrastructures. This estimate is based on the assumption of 80% of the total damaged houses that need repair. The demand for boats is based on the number of boats to be built by the Department of Marine and Fishery during the 2005-2009 periods. Whereas the demand for means and infrastructures is calculated on the basis of the destruction of office buildings, health and educational facilities, in addition to spiritual infrastructures damaged by the tsunami and earthquakes.

Table 5.1.1: Estimated wood requirement for development

<i>Description</i>	<i>Unit *)</i>	<i>Volume of processed wood **)</i>
<i>Requirement for new houses</i>	<i>90,158 units</i>	<i>721,264 m³</i>
<i>House repairs</i>	<i>155,838 units</i>	<i>779,190 m³</i>
<i>Total wood requirement for houses</i>		<i>1,500,454 m³</i>
<i>Requirement for ship building</i>	<i>2,415 ships</i>	<i>29,295 m³</i>
<i>Needs for means & infrastructures</i>		<i>159,645 m³</i>
<i>Total need for sawn timber or equivalent to total log requirement</i>		<i>1,689.394 m³ 3,378,788 m³</i>

*Explanation: *) Working group on Means and Infrastructures of R3WANS*

****) Working group estimate of Natural Resources and LH R3WANS*

With regard to the capacity of national wood provision, the Department of Forestry, during the coordinative meeting at the National Development Planning Agency (Bappenas) last February 16, 2005; presented the possible wood provision for the rehabilitation and reconstruction stages in details in table 15.

Table 5.2.: Wood availability estimate (supply side)

<i>Explanation</i>	<i>Total wood</i>
<i>Confiscated wood</i>	<i>92,690 m³ log and 2,072 m³ sawn timber</i>
<i>Contribution from several provincial timber industries</i>	<i>950 m³ sawn timber and 22,700 plywood sheets, with a thickness of 4 mm and 9 mm</i>
<i>Wood from land clearing in Riau, Jambi, North Sumatra in 2005</i>	<i>428,493 m³ log*)</i>
<i>Wood from forest relinquishment</i>	<i>1,6 million m³ log*)</i>

*Explanation: *) As national supply to other regions*

Due to the huge amount of wood required for the rehabilitation and reconstruction, while it is estimated that the wood provision is insufficient, it is therefore necessary to get wood supply from other countries. Some of the strategies to be adopted to meet this demand are as follows:

1. To promote negotiations between the government and donor countries to obtain grants for wood (in-kind assistance)
2. To this end, a special team, comprising of representatives of the government and non-governmental organizations is necessary. The non-governmental bodies are needed to lobby forestry global network, particularly in the provision of perpetual wood sources.
3. The provision of imported woods.
4. To develop alternative building and shipping materials from other materials, such as coconut trees and concrete cement for houses and fiber for ships. For this purpose, it is important to socialize the people to change the social habit that has been adopted thus far.
5. It is indispensable to build a safeguarding mechanism to bring the woods from the harbor to the destination where they will be used. This mechanism includes the arrangements for transportation, warehouses or storehouses, whether at the entry harbors or its safe destination,

also the verification system to clarify the accountability of every step of the way from the country of origin to the final destination.

Especially in connection with the idea of importing woods, attempts are being made at present to materialize this “idea” of importing woods by the Government in cooperation with the World Wildlife Foundation (WWF) and Greenomics. The plan to import woods still requires implementation design that supports “import mechanism” from the upstream (importer) to downstream (user). On the level of importer, the Government is expected to provide special facilities that shall facilitate the wood import mechanism to Indonesia by imposing duty free and simplification of import procedures.

Some of the technical aspects that should be taken into considerations *are as follow*:

1. Not all kinds of wood, especially those originating from sub-tropical countries, can be used, because these woods are from fast growing species and cultivated (not natural) forests. Most of them have inferior strength and vulnerable to wood-destroyer elements, such as fungi, weather, microbiology when used in tropical areas. To qualify for tropical use, its water content must be around 10%-14% and a special drying process is necessary to kill the fungi and termites;
2. There must be an evaluation of wood specification, both in terms of quality and size, conducted by Indonesian wood grader or evaluator, as well as in the country of origin, to ascertain the feasibility of the wood quality to be sent to Indonesia, and to avoid the shipment of unqualified wood that would be a waste of shipment expenses;
3. The imported wood should be in the form of sawn timber, and not in log, as it will require further processing and the profitability is also low;
4. A safeguarding mechanism should be in place to bring the wood from the harbor to the final destination where it will be utilized. This mechanism is mainly designed for transportation, warehouses or storehouses, both in the entry harbor and at the safe destination, distribution and delivery, and a verification system to clarify on the accountability every step of the way from the country of origin to the final destination.

5.3 Community Involvement and use of local social and cultural institutions as basic reference for the natural resources and environment sectors

The utilization of the existing and growing social and cultural institutions is believed to be the most effective and efficient means to put into practice the rehabilitation and reconstruction programs in Aceh in the fields of natural resources and the environment. This is also considered as the democratization of reconstruction in post-tsunami NAD. Some of the strategies to be adopted cover the following: a) to enhance public awareness in anticipating disasters; and b) to involve public participation in natural resources and the *environment*.

5.3.1 Improvement of community care in anticipating disasters

1. To capitalize on the value of local wisdom as a complementary aspect of the early-warning system. It has been attested that the value of local wisdom has protected the people from numerous disasters that struck the Island of Simeulue. It is therefore necessary to promote various local cultures and wisdom to anticipate the threats of other natural disasters.

The objective:

To place local culture and public knowledge on natural resources and the environment as one of the main terms of reference in the national early-warning system.

The measures to be adopted shall comprise the following:

- To rediscover the local community’s culture and knowledge about the aspects of natural resources and the environment;
- To develop the local community’s culture and knowledge aimed at applying them in the early-warning system.

2. To empower the community's role in the mechanism of coping with disasters affecting the environment and natural resources.

The *objective*:

- The community is aware of its function and duty in the face of similar disasters that may happen in the future.

The measures to be adopted are the following:

- To involve the community in the drawing up of the standards, operations and procedures in coping with local disasters, in a participatory manner, as an integral part of the national early-warning system;
- To socialize the community with the drafted local standards, operations and procedures;
- To conduct simulations of local natural disaster management.

3. To develop Education on disasters

The *objective*:

To enhance the horizon and attitude of the community on the phenomena of the environment, potentials and vulnerability of natural resources.

The activities involve the following:

- To include the education about the environment and natural disasters in the school curriculum, starting from elementary to senior high school;
- To include the aspects of disasters and the environment in the informal education, in order to awaken the people's awareness about the sustainable management of the environment and natural resources.

5.3.2 Community involvement in the implementation of development of the natural resources environment sectors

1. To empower the existing social and traditional institutions in the development planning and implementation of Natural Resources and the Environment.

The *objective*:

To enhance the sense of belonging and contribution of the community in the development of natural resources and the environment

The steps to be taken are the following:

- To form or use various existing communications in the society in order to draw up the plan for the development of natural resources and the environment;
- To gather numerous inputs from the communication as counter points in the development process.

2. To establish a supervisory mechanism consistent with the social values, culture and aspirations of the local community.

The *objective*:

To improve the quality of the development of natural resources and the environment and to protect from any deviations of its implementation process.

The measures to be adopted are the following:

- To revitalize the local social and cultural institutions in the drafting of a development supervisory mechanism;
- To supervise development in congruence with the local social and cultural institutions and make use of its outcome as the primary term of reference in the development accountability process of NAD and Nias.

5.4 Recovery of government institutional system in the natural resources and environment sectors

The impacts of the earthquakes and tsunami disasters have also paralyzed the government services function because most of the government working means and infrastructures has been damaged. With the still paralyzed government's services role and function, it would be difficult to carry out development in the post-disaster areas. This is the reason, therefore, why the following steps must be taken.

5.4.1 Completion and refilling of employee formation (experts and supporting staff)

1. To Open Admittance of Civil Servants for Agencies that deal with natural resources
The objective:
To restore the government services function in NAD and Nias
The activities involve the following:
 - To reformulate the employees structure and formation which are needed in the fields of natural resources and the environment
 - To select and to recruit new civil servants

2. To enhance the apparatus competence in the fields of natural resources and the environment:
The objective:
To enhance the competence of government apparatus in generating the wheels of government and in providing public services;
The activities cover the following:
 - To draw up apparatus training plan in the field of natural resources in an integrated fashion between sectors;
 - To provide trainings to employees in advancing their administrative, technical and operational skills.
 - To restore the government means and infrastructures in the fields of natural resources and the regional environment

5.4.2 Recovery of facilities and infrastructure of governance in the natural resources and environment sectors of the region

1. To Rehabilitate and Build Offices
The objective:
To put public service means in operation again
The activities cover the following:
 - To draw up an integrated plan for the rehabilitation and reconstruction of office infrastructures, in order to put in operation natural resources and the environment
 - To Rehabilitate and Build Offices in the fields of agriculture, forestry, marine and fishery, the environment and mining and energy in every *kabupaten* and city that has been affected by tsunami.

2. To Rehabilitate and Build supporting infrastructures.
The objective:
To put in operation again the supporting infrastructures aimed at providing public services such as laboratory and research and training facilities.
The activities cover the following:
 - To rehabilitate damaged supporting infrastructures and restore public services from the remaining infrastructures;

- To build new supporting infrastructures needed for the improvement of public services.

The President of the Republic of Indonesia,

Dr. H. SUSILO BAMBANG YUDHOYONO

QUALITY STANDARD

In the rehabilitation and reconstruction of tsunami-afflicted areas, there have been direct impacts on the environment, both the soil and the air. It is therefore essential to observe the prevailing basic quality standard, so that the environmental supporting potentials can still be relied upon in a sustainable manner.

1. Water Quality Standard

During the reconstruction, habilitation stages and beyond, water is an extremely basic necessity and its availability must be secured at all times. Countless potable water processing equipments and installations has been brought in to the tsunami-afflicted areas. Standard water that has been used as drinking water must be carefully attended to because both artesian and surface water in these areas have been contaminated.

The water processed for drinking water must meet the prevailing basic quality standard in compliance with the Decree of the Ministry of Health of the Republic of Indonesia Number 907 of July 29, 2002; as shown in table 33 below.

Table L.1.1.: Drinking Water Quality Standard for Various Parameters
No. Parameters Drinking Water Quality Standard

1. Free chlorine	5mg/L
2. Turbidity	5 NTU
3. T. Coli	0
4. E. Coli	0
5. pH	6.5 – 8.5
6. Klodira	250 mg/L
7. Color	15 TCU
8. TDS	1,000 mg/L
9. Organic Material	10 mg/L
10. Total hardness of water	500 mg/L
11. Iron	0.3 mg/L
12. Manganese	0.1 mg/L
13. Sulfate	0.1 mg/L
14. Nitrate	250 mg/L

Source: Decree of the Ministry of Health RI No. 907/2002

2. Air Quality Standard

Table L.1.2: Ambient National Air Quality Standard

No.	Parameter	Time of Measurement	Quality Standard	Analytical Method	Equipment
1	SO ₂ (Sulfur Dioxide)	1 hour 24 hours 1 year	900 ug/Nm ³ 365 ug/Nm ³ 60 ug/Nm ³	Pararosanilin	Spectrophotometer
2	CO ₂ (Carbon Monoxide)	1 hour 24 hours 1 year	30,000 ug/Nm ³ 10,000 ug/Nm ³	NDIR	NDIR Analyzer
3	NO ₂ (Nitrogen)	1 hour 24 hours	400 ug/Nm ³ 150 ug/Nm ³	Saltzman	Spectrophotometer

No.	Parameter	Time of Measurement	Quality Standard	Analytical Method	Equipment
	Monoxide)	1 year	100 ug/Nm3		
4	O3 (Oxidant)	1 hour 1 year	235 ug/Nm3 50 ug/Nm3	Chemiluminescent	Spectrophotometer
5	HC (Hydro Carbon)	3 hours	160 ug/Nm3	Flame ionization	Gas Chromatography
6	PM10 (Particle <10 um) PM2.5 (Particle <2.5 um)	24 hours 24 hours 1 year	150 ug/Nm3 65 ug/Nm3 15 ug/Nm3	Gravimetric Gravimetric Gravimetric	Hi-Vol Hi-Vol Hi-Vol
7	TSP (Dust)	24 hours 1 year	230 ug/Nm3 90 ug/Nm3	Gravimetric	Hi-Vol
8	Pb (Black Tin)	24 hours 1 year	2 ug/Nm3 1 ug/Nm3	Gravimetric Extractive Ashing	Hi-Vol AAS
9	Dustfall	30 days	10 tons/Km2/ Month(Residential)	Gravimetric	Cannister
10	Total Fluoride (as F)	24 hours 90 days	3 ug/Nm3 0.5 ug/Nm3	Specific Ion Electrode	Impinger or Continuous Analyzer
11	Flour Index	30 days	40 ug/100 cm2 from limed filter paper	Colorimetric	Limed Filter Paper
12	Chlorine & Chlorine Dioxide	24 hours	150 ug/Nm3	Specific Ion Electrode	Impinger or Continuous Analyzer
13	Sulfate Index	30 days	1mg SO3/100 cm2	Colorimetric	Lead Peroxide Candle

Source: Government Regulation No. 41 of 1999

In addition, attention must be accorded to the air supporting potentials during the rehabilitation, reconstruction stages and beyond, because the dust, odor and fine particles will mix and fly all over the place causing health hazards. The air must meet the prevailing basic quality standard. Table 34 above shows the prevailing air basic quality standard by virtue of Government Regulation of the Republic of Indonesia Number 41 of 1999.

L2

DEFINITIONS AND CRITERIA OF REGION

To put the NAD Province in order during the rehabilitation and reconstructions stages, it is necessary to understand certain definitions and criteria of a region. This is intended to avoid misunderstanding in determining a region, especially in relations with regions where its original functions will be reinstated as before or regions where its functions will be altered. Table 30 describes the definition and criteria of various regions.

Table L2.1.: Definition and Criteria of Region

Definition	Criteria of Region
<p>Protective Forest Region: Forests that have unique characteristics and are able to protect the surrounding and lower areas as regulator of water, flood prevention and soil preservation.</p>	<p>Must comply with one and/or more the following criteria: Average slope about 40% Over 2,000 m above sea level Soil vulnerable to erosion with a value of 5 (regosol, litosol, organosol and rezina) and a slope of 15%. The region has a score of higher than 175 according to Decree of the Minister of Agriculture No.837/Um/11/1980. Specific cases shall be decided by the Minister of Forestry.</p>
<p>Agricultural Wetland Food Crops Region: Region designated for wetland food crops where irrigation is obtained naturally or technically</p>	<p>Region suitable for agriculture of wetland food crops with a system and/or irrigation development that covers: Height < 1000 m Slope < 40% Effective soil depth > 30 cm Rainfall between 1500-4000 mm annually</p>
<p>Agricultural Dry-land Food Crops Region: Region designated for agricultural dry-land food crops, like secondary crops, horticulture or other food crops</p>	<p>Criteria of Region Suitable for Agricultural Dry-land Food Crops: It has no irrigation system or development covering: Height < 1000 m Slope 40% Effective soil depth > 30 cm Rainfall between 1500-4000 mm annually</p>
<p>Fishery Region: Region designated for fish cultivation, in the form of fish ponds or other sweet and salt water aquaculture</p>	<p>Region suitable for fishery physically determined by main factors: Slope < 8% Sufficient water supply</p>
<p>Settlements Region: Region designated for both urban and rural settlements</p>	<p>Region suitable for settlements. Adaptability between technological input and assured water supply. Location linked to existing settlements. Not located in protected areas, agriculture wetlands, fixed and restricted production forests,</p>
<p>Industrial Region: Region designated for industry where it is</p>	<p>Region suitable for industry: Sufficient basic air supply</p>

Definition	Criteria of Region
centralized and/or industrial units.	Good waste disposal system Does not create serious negative social impact. Not located in agricultural irrigated wetlands and has potential for irrigation development. Not located in protected area and fixed or restricted production forest.
Mining Region: Region designated for mining, whether present or future mining activities.	Region suitable for mining: Sufficient and high-quality raw materials are available. Good waste disposal. Does not create serious negative social impacts. Not located in irrigated agricultural wetlands with possible irrigation development. Detailed criteria will be determined by the Department of Mining.
Tourism Region: Region developed for tourism.	Region suitable for tourism: Natural and panoramic beauty admired by tourists (nature tourism). Society with highly-valued culture. High historic cultural values of heritage buildings.
Mangrove Coastal Region: Coastal region as the natural habitat of mangrove that protects living things on the coast and at sea.	Region with a minimum of 130 time the annual average of the highest tide from the lowest ebb towards inland.
To be developed as a buffer zone, especially for coastal forest buffer zone	Type of vegetation of coastal forest that can be planted among others are mangrove, broquiera spp) and terminalia catappa. Along the shorelines plants like casuarinas equasitifolia, hibiscus tiliaceus and pandanus spp can be planted. For zoning code, there should be a limitation on the functional change of buffer zone, for instance, 60% of the buffer zone function definitely cannot be changed.

TECHNICAL BASIS AND CRITERIA

1. The Basis and Criteria of Reusable Sanitary Landfill

In line with the current new paradigm of waste management, landfill does not only serve as a place to dispose of garbage but it must serve as a waste processing site, where useful products are produced such as energy and compost. Thus, waste processing sites become production centers that absorb manpower.

Due to the fact that waste is endless products of an urban metabolism process, operate incessantly and its volume continues to increase, in tandem with the increase of population and intensified urban activities, it is therefore imperative to designate a fixed location for waste processing, it should not be relocated and it is used continuously without creating any negative impacts on the surrounding environment.

This is based on the following:

To provide reusable sanitary landfill and this must be a combination of and improvement on the Sanitary Landfill technology, Anaerobic Bioreactor Landfill/Anaerobic Composting, Landfill-Mining and Reuse, so that it meets the demands for waste disposal that may continuously process the waste, parallel with unending production process of solid waste, so as to ensure a sustainable hygienic and health services of the urban environment.

The model of this waste disposal is demonstrated on a piece of land that is divided into two parts of certain expanse, so that in an orderly manner solid waste from all its sources goes to section 1, to be processed into inorganic components that can still be used/absorbed, whereas the remaining is collected, leveled, solidified and put in a safe place so garbage trucks, scavenging animals, biogas, leachate will not pollute the surrounding areas, and finally it is abandoned when the holding capacity of section 1 is completely filled. Subsequently, the same activities will be transferred to section 2. Thus, the process continues, and when the holding capacity of section 2 is full, the waste processing goes back to section 1. The produced methane gas (CH₄) can be put under control and used as a source of energy. When the production of methane gas (CH₄) in section 1 reaches its minimum level, a Landfill-Mining and compost processing, a waste holding space rehabilitation and solid waste refill process will take place in section 1 and so on, in a continuous alternate process. This is the last facility of solid waste processing that comes from residential areas.

This reusable sanitary landfill must be a fixed location and purposely designated in the urban spatial layout plan, and is located in a technically suitable place for a sanitary landfill (in accordance with the *SNI* standard) and consistent with a disaster-prone urban area. For this reason, therefore, the designation of such a reusable sanitary landfill must be based on the feasibility study and its implementation has to be in line with the city Detailed Zoning (Site Plan), the outcome of which may serve as an input for the drawing up of the city's Site Plan. Ideally, the location should not be in a Coastal Zone or Fishery/Fishponds Zone, which is vulnerable to disasters, as proposed in the concept. Apart from the fact that it is not sustained by geomorphologic condition adaptable to the Reusable Sanitary Landfill (RSL-TPSA) (vulnerable to floods, porous rock beds, high sea water intrusion, alluvial soil), it may also harm the fishponds/fish farm and is vulnerable to tsunami that will potentially pollute the environment if tsunami reoccur. This is the reason why the designation of *TPSA-RSL* location must be based on a feasibility study.

The Reusable Sanitary Landfill must meet the following criteria:

- The location is within the 30 km radius from the center of a residential area. It is better to have the location closer to the city center, which shall economize transportation cost.
- The requirements for the location selection must be in compliance with *SK-SNI* Location Selection of *TPA-RSL* (slope, soil/rock formation type, soil porosity, distance from water source, distance from ground water table, and so forth)

- Location boundary must at least be 200-300 meters from a residential area.
- Located at the dominant upstream airflow crossing the residential area.
- Not located in a flood-prone area.
- The volume capacity must be able to constantly collect solid waste from the residential area it serves, for at least 15 years.
- The location area must have a land-filling depth of 10-25 meters, with a waste density of 800-1000 kg/m³, in addition to 2-4 ha for leached treatment pond, 2-4 ha for waste collection and 10% of the location area serves as a buffer zone in the form of a Green Open Space (*RTH*).
- The Green Belt Open Space (*RTH*) is created around the RSL with a minimum width of 100 meters.
- The Main Entrance-Exit preferably should not pass through a dense residential area and has a ROW suitable to a 40 feet Container Truck two-way street.
- The *TPSA-RSL* location must be furnished with a water leaching control system to avoid pollution of ground and surface water in the surrounding areas, methane gas (CH₄, CO₂, H₂S, odor, etc) control system, rainwater catchments system to wash garbage trucks and maintenance of Buffer Zone (Open Green Space/*RTH*), daily waste cover system to reduce the number of flies and other scavengers, recycling facilities for saleable anorganic materials (such as PVC, PET) and operational supporting facilities of *TPSA-RSL*.
- The *TPSA-RSL* location must be welcomed by the surrounding community.

2. The Basis and Criteria of Temporary Well Construction

Usually the drinking water facilities in disaster-afflicted areas are either damaged or totally destroyed. Since water is the most basic need, it is indispensable that water sources must be provided. To this end, a temporary well may be constructed on the disaster-stricken areas.

The basis for the construction of a temporary well in the disaster-stricken area is the following:

- The location is contamination-free.
- To consider the environmental carrying capacity in the planning of service level between the existing potential discharge of water and the actual demand.
- To take also into consideration, if possible, the continuity of benefit, in both managerial and technical terms.
- It does not cause other environmental damages such as seawater intrusion.
- The technical criteria should be compatible to the approved technical standard and the legal regulations in force in the respective regions.

3. The Basis and Criteria of Cover Vegetation

The tsunami disaster caused extensive damage to areas directly bordering the shorelines. However, the degree of damage is not identical in each area. The least damaged areas usually have cover vegetation along the coastlines.

The technical criteria of soil rehabilitation are the following:

- To reduce soil salinity, to change from reductive to oxidative condition and reduce sodium surplus held by soil colloid. By way of the following:
 - Soil cleansing with sweet water (rain/irrigation/ river)
 - Hyper-accumulator plants
- The rapidity of soil restoration depends on, among other things, topography, mud texture and thickness, original soil type, mud organic substance that can still be changed through aerob/oxidative means, availability of fresh cleansing water, availability of ion replacing Na, and lands designation.

- Cleansing is an attempt to remove soluble salt content. Fresh/rain water may serve as diluter and carrier. The conditions that must be fulfilled are the following:
- The mud must ideally be dry/moist and loose, so the mud particles are not carried along the cleansing water;
- The dry mud is arranged perpendicularly with the direction of water flow.
- The thinner, looser and coarser the sea mud is, the faster will be the cleansing process of the remaining sea water;
- The end of the cleansing process is indicated by the low chlorine and sulfate contents of the cleansing water.

On the basis of above experience, it is important to plant cover vegetation along the tsunami-prone coastal areas. The basis for cover vegetation is the following:

The adaptability to a high-salinity-content environment. Since the location where plants will be planted is at the sea or on the coast, the types of plant are: Avicennia (high-salinity-resistant), Rhizophora Sp (roots breathing system), Bruguiera (roots knee system), Soneratia, Xylocarpus, Nipah and Terminalia Catappa.

The resilience against extreme conditions at the time of tsunami or the capacity to dampen the onslaught of natural wave energy. In the studies and survey conducted by the Bogor Agricultural Institute, it was discovered that in several tsunami-affected areas some of the survived vegetations were: mangroves (Bruguiera Sp), casuarinas equisetifolia and cocos nucifera. Hence, these three types of plant are recommended as cover vegetation. Ideally they would also have high economic value-added, either direct or indirectly. Mangroves may serve as the habitat and the hatching areas of seawater fish. It would be an easy catch for fishermen. Alternatively, it may function as marine tourism.

The suggested planting pattern is, among other things, the following:

1. For sloping coastal areas facing the sea:
 - Zone I: mangrove forests and infrastructures (roads, seaports, electricity, clean water, water canals)
 - Zone II: governmental areas, public facilities, residential areas, commercial services
 - Zone III: residential areas and public facilities
2. For flat coastal bay areas facing the open sea:
 - Zone I: lowland vegetation (coconut and other hard crops)
 - Zone II: infrastructures (roads, seaports, water canals, clean water, electricity), fishermen settlements, market places, fuel oil depot.
 - Zone III: governmental areas, public facilities, commercial, settlements area.
3. For flat coastal areas facing the open sea:
 - Zone I: mangrove forests and infrastructures (roads, seaports, water canals, clean water, electricity)
 - Zone II: fishermen settlements, market places, fuel oil depot, lowland vegetation
 - Zone III: governmental areas, public facilities, settlements, commercial.

4. The Basis and Criteria of Land Rehabilitation

The basis of land rehabilitation is to draw up a priority list of location based on its strategic value, whereby the first priority is given to productive lands. The rehabilitation of post-tsunami lands, particularly those vulnerable to sea water is carried out through the following:

- Land cleansing from mud, garbage, ruins, etc
- Cleansing from remaining sea salt
- Disentanglement of reductive components, both organic and inorganic
- Soil amelioration

- Formation of business plots
- Restoration of water resources provision (in addition to rainwater catchments)
- The selection of the appropriately effective and economical technology and method.

L4

THE ENVIRONMENT SPATIAL LAYOUT MODEL

The Concept of Coastal Area Spatial Layout as Buffer Zone

Based on the results of the expedition conducted by the *KMNRT BPPT* Team to the NAD Province from 16 January to 4 February 2005, it was found out that a greater damage caused by the impact of great tidal wave energy was on areas where the mangroves areas have a width of around 250 meters, whereas in areas where there were dense coconut trees (width 100-200 meters) suffered lighter damage. For example: dense line of coconut and palm oil trees protected the rear areas up to 0.5 to 1 kilometer from the shore line. This shows that with earthquake strength of 9 on the Richter Scale, the buffer zone would not function optimally if the protective plants or structures, built purposely to protect the shores, are unable to withstand the intense impact of the disaster.

The Detail Engineering Design (DED) must first be completed for buffer zones that would able to reduce the impact of tsunami waves up to 40% as indicated in the Spatial Layout Concept. The details outlined in the detail engineering design cover, among other things: the suitable buffer-zone model/technology (whether natural protection, hard protection or the combination of both), in the case of a natural protection: what is the most suitable plant, its density, its planting methods, etc.

To minimize the impact on coastal ecosystem, the fishponds in the fish farm zone should be an environmentally sound aquaculture, and this is achieved through, among others, the introduction of silvo-fishery, namely a combination between fishponds and mangroves, such as illustrated in the picture L4.1 here below.

Picture L4.1: Silvo fishery application scheme

Silvofisheries	Greenbelt:	Coverage lands
	* Mangrove forests	
	* Crabs	
	Coral reefs	Deep Sea

The Concept of Agro Ecolopolitan Development for the Rehabilitation of Coastal Areas

It is necessary to have a clear concept of the recovery plan of the coastal areas that have been devastated, which is aimed at restoring the functions of lands for agricultural activities, coastal areas conservation and social and economic development of the community and, at the same time, all must be based on disaster mitigation. The basic principle is to harmonize the agricultural aspect in the widest sense of the word (including: fishery, livestock, food crops, horticulture and plantation) combined with the knowledge about earthquakes, tsunami, social, economic and environment issues, with a view to building a sustainable development system.

Based on such agro-ecopolitan approach, the reconstruction of the tsunami-afflicted areas is planned on the foundation of three (3) primary elements, namely:

Element 1: the characteristic, pattern and intensity of earthquakes-tsunami disasters. The variable of this element is essential in order to draw up a physical spatial and regional layout that is adaptable to the earthquake-tsunami disasters.

Element 2: the characteristic of agro-ecology, natural resources and the environment at post-disaster time. The variable of this element is indispensable for the drawing up of a post-tsunami physical spatial and regional planning, adaptable to a sustainable agricultural development.

Element 3: The post-tsunami social, economic and cultural characteristics of the community. The variable of this element is necessary for the formulation of spatial analytical planning, due to the fundamental social and cultural changes that are taking place in Aceh.

Furthermore, based on the analysis and synthesis of the above 3 elements, a development plan of urban and rural systems will be drafted with the following characteristics:

- It has an adaptive spatial structure and function to earthquake and tsunami disasters.
- It contains programs and measures for the stability, reconstruction and rehabilitation in a planned, systematic and gradual manner.

Some of the rulings and views or suggestions about the basis of spatial development in Aceh are the following:

- In principle, there should not be any residential structure around the 500-meter radius. It is suggested that within the 500-meter radius, it should serve as an effective buffer zone to dampen the velocity and height of tsunami waves.
- The plantation of mangroves with a 200-meter width that may mitigate the height of 4-meter waves.
- The length of the buffer zone may extend to 5 kilometers, because the impact radius of tsunami reaches 5-km.
- In addition to the planting of mangroves or casuarina equisetifolia, terminalia catappa and *nyamplung*, it is also possible to plant coconut trees interspersed with the ipil-ipil. Cattle breeding are also possible in the coconut and casuarina equisetifolia areas.
- The accessibility to land or water transportation, as well as to the existing assets, such as sea ports, fish auction markets, must be preserved and immediately put in function because of their highly vital role in the mobilization of humans, food stuffs and medicines, including to restore places of worship.

L5
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