

# **RAPID ENVIRONMENTAL IMPACT ASSESSMENT**

## **BANDA ACEH, SUMATRA**



**MINISTRY OF THE ENVIRONMENT  
REPUBLIC OF INDONESIA**

**Cover illustration: virtually all that remains of the former commercial and port area, Banda Aceh, is this unfinished monument.**

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## EXECUTIVE SUMMARY

The northern tip of Sumatra, Indonesia, and the provincial capital of Banda Aceh bore the brunt of a *tsunami* which hit Indonesia and 11 other countries early in the morning of 26 December 2004. Satellite images show that 49km<sup>2</sup> or 80 per cent of the built up area of Banda Aceh city was either totally destroyed or extremely damaged. The precise overall area impacted by the *tsunami* is not yet known, but analysis of this and more precise impacts on marine and terrestrial ecosystems is gradually getting underway.

What is, unfortunately, already evident is that people and the natural environment have been seriously affected. More than 100,000 people are known to have lost their lives in Sumatra alone – at least an equal number are still missing. Bodies are still being recovered from the devastation: the true record of people who lost their lives from this natural disaster will never be known.

As the massive relief operation now moves out of the initial emergency phase, thoughts are moving to rebuilding affected peoples' lives and livelihoods, to rehabilitation and possible reconstruction of affected zones of Banda Aceh and outlying regions. As a first step towards assessing the impacts of this disaster on the environment, a rapid environmental assessment was initiated by the Ministry of Environment, with assistance from GTZ/ProLH. Following a standard approach, this assessment – carried out by one international expert and a team of three people from the Ministry of Environment over a seven day period – allowed some of the first concerted observations to be made of the situation on the ground. A number of potential future impacts were also identified, all of which have been considered and included in the final analysis of this REA's findings.

In an attempt to help translate some of the most urgent findings from this REA into concrete action, part of this REA process concentrated on prioritising a small number of these from the extensive list of concerns and key issues identified. The ten top priority issues are highlighted below and examined in greater detail in the main body of this report.

1. **Contaminated ground water.**
2. **Sanitation.**
3. **Lost livelihoods.**
4. **Lack of co-ordination in relief/recovery** response during the emergency response phase.
5. **Shelter**, and related domestic needs.
6. Enhanced roles identified for **local governance** and the role of communities in environmental management.
7. Volume of (mixed) **waste**.
8. Uncertain **land tenure** for *tsunami* survivors.
9. **Local government** still weakened due to destroyed infrastructure, loss of staff and resources.
10. **Low capacity to direct and absorb relief assistance for sustainable development.**

These issues, however, should not be looked at in isolation, as other issues identified through this REA process also need to be borne in mind, both in the immediate- and longer term. In addition, two overarching recommendations from this REA are that:

- ongoing and future planning for rehabilitation and reconstruction of Banda Aceh take environmental considerations into account; and
- in particular, any urban or peri-urban planning process is closely linked with equivalent coastal zone planning and management.

Evidence from other countries affected by the tsunami shows how well managed, more resilient natural ecosystems helped reduce the impact of this natural disaster. The same may prove true for other parts of Sumatra, largely possibly on account of its offshore reefs and near-shore mangroves. The tsunami tragedy, however, has been yet another startling example of the need to conserve and sustainably manage natural ecosystems, while pursuing economic development. While the relief operation continues to provide much needed assistance to the affected communities in Sumatra, it is however also an appropriate time to consider how the response from the people of Banda Aceh, in this instance, can demonstrate how something positive can emerge from such a terrible event. Natural resources at the disposal of people in this region could, if wisely used and carefully managed, play a vital role in the overall recovery strategy for Banda Aceh and other affected areas.



*A formidable task lies ahead in terms of physical clean-up and safe disposal or re-use of materials following the earthquakes and tsunami*

# 1. INTRODUCTION

## 1.1 BACKGROUND

Northern Sumatra was one of 11 countries impacted by a tsunami on 26 December 2004, the origin of which was a series of three undersea earthquakes, the largest of which measured 8.9 on the Richter scale. The epicentre of the largest tremor has been traced to a zone some 225km south-south-west of Banda Aceh, at the northern tip of Sumatra. A direct consequence of the earthquake, which caused the sea floor to rupture (up to 100km in places), was the displacement of a huge volume of water which translated into a *tsunami* or tidal wave of colossal proportions. The force of this event, judged to be one of the largest in living memory, was such that the impact even caused devastation and loss of life on the east coast of Africa, although to a much lesser degree compared with the havoc created in parts of South and South-east Asia.



Generally, there is a lack of up-to-date quantitative data, especially in relation to the scale, extent and precise nature of the actual damage, which hampers any early assessment to be made. Many critical habitats (offshore and nearshore ecosystems, freshwater reservoirs, agricultural lands, rice paddies, and coastal forests/plantations) are known to have been heavily impacted. A huge amount of waste – building rubble, municipal and industrial waste, sludge – has resulted from the thrust and reverse flow of the tsunami. Possible contamination may result from industrial installations which have either disappeared or have been damaged. People's livelihoods have been devastated. It is believed that more than 600,000 people in the province of Aceh (Nanggroe Aceh Darussalam) and Nias island – approximately one-quarter of the total working population – have lost their jobs as a result of the *tsunami*. The fisheries sector in this region alone accounted for some 130,000 jobs and ensured the livelihoods of 70 per cent of the coastal population.

A massive relief operation continues to be underway in Aceh province to accommodate immediate humanitarian needs, although the immediate emergency phase has now been concluded. Co-ordination on the ground, however, is sometimes lacking: plans for new, (still temporary) settlements have been discussed and 24 sites identified to relocate survivors. No opportunity, however, is being offered to conduct an environmental assessment of these sites, although some concerns have already been raised on at least one of the known locations. At the same time, a widescale clean-up operation is underway to clear rubble and debris: in the absence of any guidance, however, materials are merely being moved from one location to another – several kilometres away – an act which is not only wasteful in terms of time and funds, but one which may also be transferring contaminated samples of sludge or other materials from one location to another. Overall, little attention appears to be being given as to the negative (environmental and others) impacts of the relief operation itself – an oversight which is quite likely to have serious repercussions.

Accurate details of the true impact and gaps in the data must, however, be anticipated as it is not appropriate to intervene on the ground during the emergency phase unless this is absolutely necessary. In that regard, timing of this current assessment was judged to be just about right – access to affected areas was improving, people were able to discuss the event and survivors were even keen to begin to consider their future situation. Details provided in this report are based on best available information to 25 January 2005.

## 1.2 RAPID ENVIRONMENTAL IMPACT ASSESSMENT

Realising the extent and possible magnitude of the *tsunami* on parts of Sumatra, the government – in the case of this investigation the Kementerian Lingkungan Hidup (Ministry of Environment) – realised the need for fast action and response. One of the initial considerations was to commission a rapid environmental impact assessment (REA) of the situation, to allow preliminary analyses to guide further actions. Rapid environmental assessment is a tool which has now been used in many different forms of natural disasters – and is currently being used in other countries in the region also affected by the *tsunami* – and has already proven to be a best practise tool for effective disaster assessment and management.



The REA is relatively quick and simple to use, and does not require expert knowledge if guided by someone with previous experience of environmental assessment and/or disaster situations. The REA, however, does not replace a formal environmental impact assessment (EIA) – a legal requirement applied to many development-related activities in Indonesia and other countries – but it does fill a gap until such time as when a more thorough EIA can be safely and consistently carried out.



Rapid environmental assessment does not provide answers as to how to resolve environmental problems, but it should provide sufficient information to allow those responding to a disaster to formulate practical solutions to most of the issues identified while conducting the exercise.

### **1.3 MAIN OBSERVATIONS**

From early discussions with the Ministry of Environment, the main focus of this REA was deliberately placed on the affected coastal and inland (up to 10km inland) areas of Aceh Province, with particular reference to Banda Aceh. Particular attention is given to the combined effects of earthquake and tsunami, not the effects of the earthquake alone. Immediately affected outlying areas are thought to not differ significantly from the situation in Banda Aceh – the possibility of extrapolating results and findings from this REA should therefore prove relevant to at least some other situations. At the same time, however, the need for follow-up and more detailed, formal environmental impact assessments has already been recognised by government and donors, using information from this REA as a baseline.

Numerous observations arose from this study, a reflection no doubt on the sheer scale and breadth of the impact of the earthquakes and ensuing tsunami. Some of the most noteworthy are highlighted below, with additional details provided later in this report.

#### **Basic Needs**

The needs of the disaster survivors are being met to different degrees. A few of the largest spontaneous settlements are able to provide people with adequate shelter, safe water, food and clothing, although access to latrines is not always up to standard. Smaller settlements, however, often lack such facilities and conditions are not as high as elsewhere. At the time when this REA was being carried out, however, all survivors remaining in Banda Aceh (some had moved in with family or friends or had already gone to other towns and cities) were judged to have been reached with at least shelter and food aid. Adequate fresh water (for washing clothes and personal hygiene as well as for drinking) and proper sanitation facilities, however, remain the main concerns. Mosquitoes and other pests were problems reported from many of those consulted.

#### **Future Living Conditions for Survivors**

Particular concerns need to be highlighted regarding the future plight of survivors, in particular. Shelter needs have been addressed by a large number of agencies, to varying degrees of effectiveness. Moves are now underway, however, to build 24 temporary camps – sites have already been selected but the location of only two has been officially announced – for survivors; some 1,000 houses are also being built for survivors.

#### **Contaminated Ground Water Reserves**

One of the main concerns arising from this REA is the contamination of ground water reservoirs by saline intrusion, as well as secondary contamination by a range of substances. The formerly built-up part of Banda Aceh, for example, had at least some sewerage facilities, some of which have now been ruptured and emptied. Septic tanks have also been flooded. Added to this will be various chemicals, including petrol from crushed vehicles and overturned fuel trucks. One petrol storage facility near the port was also obliterated. Other chemicals may also be seeping into the ground water (see below), all of which renders the use of the ground water for drinking purposes impossible for now and an as yet undetermined time into the future. Shallow wells across the coastal strip have also been contaminated.

## Co-ordination

While recognising the need to try and restore at least some sense of order to the situation, it is apparent that lack of guidance and co-ordination in many sectors is not as effective as it might be. The lack of any clear plan for the immediate future certainly contributes to this, so that activities are proceeding on a piecemeal basis, rather than a co-ordinated or integrated effort. This situation urgently needs to be brought under control, but this may prove difficult given the sheer number of different organisations represented at the present time.

## General Clean-up

A massive clean-up operation is required for Banda Aceh and surrounding areas. Many different types of waste have been generated by the tsunami – iron, tin sheeting, building rubble, wood, crushed vehicles, household effects, personal belongings and, without a doubt, unrecovered bodies. While a speedy clean-up has been ordered in order to improve access, this has meant that waste materials are being rapidly collected, transported and dumped alongside roads, in open areas and, on occasion, into the sea. This is not seen as a cost-effective or appropriate response, especially given



the possibility that some contamination may be being shifted unnecessarily from one site to another. November and December are normally the months of heaviest rainfall but some rains also fall in January and February: leaching from the growing piles of debris is therefore still likely. Proper procedures of waste sorting (and storage for re-use where possible), collection, identification of safe disposal sites and supervised dumping are strongly advised.<sup>1</sup>

## Lost Livelihoods

The immediate livelihoods of a very significant number of people have been lost or destroyed as a result of the tsunami. Families who may have lost those traditionally responsible for generating income are left in extreme difficulty, while many individuals have suffered severe setbacks to their own livelihood security. Artisanal fishermen and coastal farmers (rice, plantations) are among those most affected, but the destruction of commercial centres and workplaces too will have a significant impact on this region and its people.

## Contamination and Spillages

A number of industrial installations were directly impacted by the tsunami, the largest of which included storage facilities (petroleum, pesticides and agrochemicals) at the former Banda Aceh Port, the Semen Andalus Indonesia (Lafarge) cement factory (and service port) at Lhoknga, and the Pertamina oil storage depot at Krueng Raya Bay, some 40km north of Banda Aceh. Many ruptured, empty, fuel delivery trucks lie among the debris – some must be presumed to have been full when the disaster struck. No immediate evidence was found of any large-scale contamination – much of the materials have presumably been washed to sea in the flowback, but there is evidence of localised contamination in some former *tambak* (prawn and fish farms) in Banda Aceh, as well as around the Pertamina facility. The contents of

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<sup>1</sup> A waste management specialist was dispatched through UNDP to Banda Aceh on 25 January, following this REA. Preliminary feedback suggests that recommendations made in this report, and further improvements, are at least being discussed and some action taken.

former warehouses containing pesticides and herbicides, and shops with solvents, are presumed to have been washed back to sea. Other lesser threats which should be noted are potentially hazardous materials from one of the major hospitals, and at least one ammunition depot. Examination is also needed of the former gas supply system as evidence from the port area showed many exposed and broken pipes.

### **Gaps in Information**

Despite many commendable efforts to gather a broad range of data on environment-related impacts, there is still a lack of reliable (even qualitative) data on the current status of some major ecosystems, especially coral reefs and mangroves. Prior to the *tsunami*, Banda Aceh had around 70 hectares of mangrove, a much reduced figure from previous years given its conversion to *tambak* and clearance for coastal development (port facilities and housing, for example). More precise information is also needed on the scale of overall impact of the tsunami, the degree of severity of salt intrusion in the coastal strip (including rice paddies and plantations), and the implications of this.

### **Integration of Environmental Considerations**

Environmental considerations should become a key strategy in rebuilding Banda Aceh. Early consideration of environmental systems in ongoing rezoning and development plans could prove highly beneficial in the longer-term. In this regard, relevant authorities are urged to consider a holistic approach to planning for this region, taking the Banda Aceh catchment as the terrestrial area for consideration and closely linking plans for this with future coastal zoning and management, since the two are intricately linked. Stabilisation of coastlines and riverbanks, including revegetation along the banks, should be encouraged where possible.

Communities, too, expressed a strong desire to become more involved in and responsible for local environmental management. An emerging need from discussions with survivors of the *tsunami* is a desire for stronger local governance regarding natural resource use and management.

## **1.4 PURPOSE OF THIS REPORT**

This report provides a summary of the REA process followed for Banda Aceh. It is based on a number of sources, in particular:

- personal insight and information from staff and associates of the Ministry of Environment, Jakarta, some of whom were actively engaged in the REA process;
- discussions with members of the *Bapedalda* (Badan Pengendalian Dampak Lingkungan Daerah – local government, part of which has responsibility for environmental issues) in Banda Aceh;
- a number of local people from Banda Aceh who witnessed the event, and who have practical first hand knowledge and observations of the situation prior to and following the aftermath;
- data provided in a series of papers collated by a specially commissioned Donor Group (with some data at least being obtained first hand in Banda Aceh through direct observations and information from other agencies);
- discussions with certain members of the aforementioned group as well as technical experts from the Ministry of Environment deployed to Banda Aceh shortly after the disaster happened;

- discussion with individuals from the donor community, UN agencies and non-governmental organisations; and
- on-site verification by this REA in affected areas of Banda Aceh.



**Preliminary findings from this REA were submitted by the Minister of Environment first to the Consultative Group Indonesia and, later, the Cabinet for consideration. This report, however, contains the full findings and final recommendations from the REA.**

## 2. RAPID ENVIRONMENTAL IMPACT ASSESSMENT

### 2.1 APPROACH

This REA was carried out following the broad guidance provided in the 2004 Guidelines for Rapid Environmental Impact Assessment in Disasters<sup>2</sup>, a tool which provides a means of identifying, defining and prioritising existing and/or potential environmental impacts during a disaster. It is designed around conducting simple analyses of information shown below:

- an appraisal of the **general context** of the disaster;
- determination of **disaster-related factors** which may have an **immediate or potential impact** on the environment;
- an assessment of **unmet basic needs** of survivors, which could have adverse impacts on the environment; and
- identification of potential **negative environmental consequences of relief operations**.

Using this approach, data is gathered from as wide a range of sources as possible, in as short a timeframe as possible through:

- a) an Organisational-level Assessment, which is mainly directed at institutions who may hold relevant data or who might be able to refer the REA Team to other possible sources of information; and
- b) a Community-level Assessment, where viewpoints are solicited from people on the ground who have experienced the disaster. This, to some degree, is an important means of data verification.

A third and final step is to compile all emerging issues and concerns from both levels of assessment and attempt to identify which, among these, are the most urgent to address. In this situation, three basic criteria are used to help in the ranking process:

- is the concern a threat to life?
- Is the concern a threat to welfare?
- Is the concern a threat to the environment?

Arriving at a short list, while helping prioritise issues for most immediate concern, however, does not mean that other issues identified through the REA process should be ignored. Careful reference needs to be made of these points also, and their existence brought to the attention of decision-makers and others capable of taking some appropriate form of response.

### 2.2 OBJECTIVE AND SCOPE OF THIS ASSESSMENT

The main purpose of the assessment was to identify – within as short a timeframe as possible – critical environmental issues resulting from the natural disaster which struck northern Sumatra on 26 December 2004. As is the nature of this REA methodology, work was to be largely based on secondary data sources. Results from the assessment are expected to guide the Ministry of Environment, and others, in future decision-making in relation to needed actions and follow-up by prioritising the most urgent actions through a consensus basis.

In the REA process, work is undertaken by a number of people – the results do not represent the observations or opinions of one person alone. In this instance, the REA was led by a

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<sup>2</sup> Elaboration of this REA was guided by the “*Guidelines for Rapid Environmental Impact Assessment in Disasters*” (version 4.3), developed by the Benfield Hazard Research Centre (University College London, UK) and CARE International.

Consultant (the REA Team Leader), working closely with a core group of specialists from the Ministry of Environment (including one member from the Program Lingkungan Hidup Indonesia, ProLH). Consultation was ensured with key donors, UN agencies, selected national and international non-governmental organisations, and members of the affected communities. (See Annex I for Schedule)

The rapid environmental assessment process tries to be as open and transparent as possible. For this reason, input from both the institutional and community levels are crucial to the identification of issues and concerns and the formulation of recommended actions. The latter was ensured through the involvement of a few people from Banda Aceh in Phase I of this process, together with community assessments and on-site interviews with survivors of the tsunami in Banda Aceh.

Following initial discussions – particularly given the timeframe and resources available – focus of this REA is on Banda Aceh alone. It is expected, however, that lessons learned from this exercise and on the job training provided by the REA Leader will allow selected Ministry of Environment staff to replicate the REA process at other sites in Sumatra, as needed. Additional training is to be provided to select staff for this purpose.

Findings from this assessment are expected to stimulate further action in designated areas, initially through elaboration of a more detailed, formal, environmental impact assessment (or, most likely, a series of assessments), and subsequently to assist in the design and implementation of future plans for rehabilitation and reconstruction of Banda Aceh. It is also anticipated that the results from this rapid study will help identify where environmental considerations should and might be taken into account in other sectors, which are similarly being investigated with a view to rehabilitation and reconstruction.

### **3. RAPID ENVIRONMENTAL IMPACT ASSESSMENT: APPLICATION IN BANDA ACEH**

#### **3.1 BACKGROUND**

This REA was initiated and commissioned by the Ministry of Environment (Kementerian Lingkungan Hidup) in Indonesia according to the following sequence of events:

- 27 December – Minister of Environment requests that a Rapid Environmental Assessment is undertaken as soon as possible;
- Centre for Rehabilitation, Reconstruction and Sustainable Development of Aceh initiated at the Ministry of Environment;
- 2-6 January – Ministry of Environment reconnaissance mission to Aceh;
- 7-10 January – Initial environmental assessment by technical specialists and support services of the Ministry of Environment;
- 10 January – Consultant search began; background information gathered; initial funding for Environment and Disaster Consultant provided by PRO-LH;
- 17-20 January – Ministry of Environment team (16 persons) dispatched to Banda Aceh to carry out initial analysis of water and air quality, as well as a general overall assessment of the situation;
- 15 January – REA exercise begins in Jakarta with Consultant;
- 16 January – Phase I (Organisational level Assessment) completed;
- 18 January – Draft report submitted by Ministry of Environment to a meeting of the Consultative Group Indonesia.
- 20-23 January – REA Team Field visit, Aceh; Situation analysis; verification of data available thus far; Community level assessments
- 24 January – data consolidation; ranking of priority issues; Recommended actions and next steps.
- 25 January – REA completion; Report preparation
- 28 January – Formal presentation to Ministry of Environment staff, donors and NGOs..

#### **3.2 METHODOLOGY APPLIED**

This REA, modified from the above-mentioned Guidelines in an attempt to represent the actual situation, and to allow the same approach to perhaps be used elsewhere in Sumatra where impacts from the tsunami/earthquakes had an impact, was completed through three consecutive stages, as follows:

##### **Stage 1. Organizational-level Assessment**

- Purpose: to identify critical environmental issues related to the disaster – from the perspective of organizations who provide relief and recovery assistance.

This phase was completed in one day with a working group of 11 people, eight from the Ministry of Environment, one from PRO-LH, and two community members from Banda Aceh.

## **Stage 2. Community-level Assessment**

- Purpose: to identify critical environmental issues related to the disaster – from the perspective of communities affected by the disaster.

Assessments were conducted using a simple questionnaire, again modified from the original REA Guidelines to be more in line with the situations in northern Sumatra. Interviews were conducted by a team of 2-3 people from the Ministry of Environment and PRO-LH, following initial guidance on how to conduct the interviews. Discussions were held in Bahasa Indonesia.

Assessments were carried out at five settlements around Banda Aceh, chosen on occasion by prior contact with or knowledge of the “leader” of the community. A total of 15 active participants took part in the assessments.

## **Stage 3. Consolidation and Analysis**

- Purpose: to identify and prioritise environment-related issues – especially those that may threaten lives, well-being and the environment.

This final phase of the REA process – discussing and combining the results of Phase I and Phase II and deciding which issues were judged to be the most important for future action – was completed with four members of the Ministry of Environment Staff and PRO-LH.

## **3.3 FINDINGS FROM THE REA ORGANISATIONAL-LEVEL ASSESSMENT**

The following concerns emerged from the first stage of this REA. Note, however, that these are not presented in any order of priority.

### **General Situation**

- Local weather conditions were not responsible for this disaster but will affect the ongoing relief operation – current and anticipated rains may help accelerate desalinisation of rice padies but currently add to localised flooding (due to blocked drains) and the expanse of standing water bodies which serve as breeding grounds for insects.
- More than 300,000 people have been displaced and are mainly living in more than 100 temporary settlements, the best equipped of which serve act as a pull factor for other people.
- There is no formal organisation of displaced persons settlements – future plans for siting settlements (and other potential infrastructure) still uncertain.

### **Waste Accumulation**

- Waste materials, while largely scattered over a wide area, have also accumulated in canals – blocking many – but some have also been washed back out to sea.
- Debris/waste (including corpses) is still being deposited on beaches by tides.
- There is no guidance or procedures for appropriate solid waste disposal: waste is being dumped 5-10km inland from Banda Aceh along the roadsides; some sites are near a river and temporary settlement (focus is on speed and ease of deposition). No safe disposal sites have been identified (or seem to be in the process of being identified).
- There is inadequate transportation for waste collection, delaying clean-up and prolonging infectious period.
- Composition of waste being dumped is not known.
- Hospital waste has been washed into open/pubic areas: there is no organised collection or safe disposal of such materials.



## Water and Sanitation

- Water and sanitation impacts are a concern at temporary camps; there are no waste disposal collection or disposal system, and no proper storage facilities for food or water (small containers only good for 1-2 days supplies).
- Realisations for longer-term access to fresh, safe drinking water are giving rise to concern.



*Complex problems to address: canals blocked with accumulated debris are starting to stagnate but also overflow in places due to additional rainfall. This gravesite, adjacent to the canal has also been impacted and damaged by the tsunami, a possible source of additional localised contamination*

## Health

- Fears of airborne transmission of infectious organisms from dust/dry sludge if rains stop, and during the collection and transportation of gathered wastes.
- Pollutants (many types – waste/toxic materials, corpses) are being transported and deposited in other areas – transferral of problem to other locations.
- Three mass graves exist: 4,000-6,000 bodies have been buried each night, to date.
- Open burning of solid waste and debris poses a serious health hazard.

## Livelihoods

- Many farmers report lost rice harvests – rice paddies have been contaminated by salt water and sludge.
- Prawn/fish farms (Tambak) have been lost along coast (lost investment, small scale businesses) – estimated loss of 37,000ha.

- Wholesale loss of livelihood – individuals and communities – security must be expected.
- Land tenure is now uncertain for many families who used to live in the coastal strip.

### **Ecosystem Destruction/Degradation**

- Many natural ecosystems (mangroves, coral reefs, near shore zones and the coastal strip) leaving them more vulnerable to possible future events such as high tides. Note: Banda Aceh is reported to have subsided by 2m).
- Impact on coral reefs and mangroves unknown but likely.

### **Toxic Leakage**

- There are fears of leakage of toxic materials (oil leaks/waste; pesticides from warehouses and shops in and around Banda Aceh).

### **Infrastructure**

- Destroyed infrastructure – public facilities (port, harbour, access roads, bridges, electricity, telecommunications, urban water supply, government offices, hospital, mobile environmental laboratory – makes a co-ordinated response more difficult).
- Shallow fresh water wells (household use) are now saline (water table around 5m deep) and contaminated by sludge (potentially infectious).

### **Security**

- Security in Banda Aceh – looting – is a growing concern for personal safety.

## **3.4 FINDINGS FROM THE COMMUNITY-LEVEL ASSESSMENT**

The community assessment, conducted at five different spontaneous settlements in Banda Aceh, confirmed much of the observations arising from the earlier phase of the REA. When prioritised, the following issues emerged as being of key concern:

- Guidance is necessary to enable communities to be better informed of the likelihood of natural disasters happening, and to enable them to prepare better for future eventualities;
- Communities expressed concern for greater community involvement in environmental management decision-making and practical management;
- Clearly, there is uneven distribution of relief assistance between the settlements, with some apparently being more “favoured” than others;
- Loss of jobs as a result of the *tsunami* is a concern – there are no immediate prospects of this situation improving;
- Solid (domestic) waste – collection and disposal – is an issue in most settlements;
- Sanitation, especially inadequate numbers of latrines is a widespread concern;
- Ground water quality shown no obvious signs of improving: water shortages are reported from some settlements;
- Presence of disease-carrying insects as a result of standing water bodies; no protection offered against mosquitoes.

## **3.5 OTHER DATA SOURCES<sup>3</sup>**

Given the need to conduct an assessment of this nature in a short a time as possible – while still attempting to ensure that as many sources of information as possible have been identified

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<sup>3</sup> Includes observation made by the REA Team in Banda Aceh

and consulted – the REA process depends to a high degree on available, secondary, data. The following environmental- and community-specific descriptions were based on information made available through other sources, primarily the data compiled by the international donor/co-ordination group mentioned earlier.

Overall damage to the environment is estimated at close to US\$650 million. Some degree of caution must, however, be attached to this figure pending the outcome of further, more detailed on-the-ground assessments of the environmental situation, and closer scrutiny of what steps need to, and will be, taken in other sectors which might also have direct or indirect impact on the environment.

### **Marine Ecosystems**

Marine ecosystems, primarily coral reefs, seagrass beds and mangroves, will certainly have been impacted by the tsunami but the actual extent of any damage can still not be verified, and indeed will take time until this can be carried out. What is known, however, is that certain ecosystems, primarily coral reefs and mangroves, were already damaged in this region. Mangroves around Banda Aceh, for example were cleared and converted into fish/shrimp ponds (*tambak*) – some 36,597 of *tambak* are reported to have existed, much of which has been lost as a consequence of the tsunami.

According to the World Conservation Monitoring Centre, the total area of coral reefs off Aceh was 409km<sup>2</sup>, of which an average of 30 per cent is estimated to have been damaged. Reefs in this broad region, however, were already impacted by other El Nino related effects.

Only small patches of seagrass occur off Aceh, but these are likely to have been impacted through silt disturbance and later sedimentation. The potential for damage from waste materials (some of which are thought to be toxic in nature) washed back out to sea should also not be discounted.

Coastal erosion has been significant in many areas, with at least 40m of shoreline being lost in some areas. Affected coastal areas will need to be remapped. Sea defenses will also need to be reconstructed in many areas – these should also serve as useful barriers to high tides and floods in future. Associated with this should be a systematic dredging of lower river mouths, since much debris and silt has accumulated following the *tsunami*.

### **Freshwater Resources**

The main freshwater resources impacted in Banda Aceh appear to be the lower stretches of rivers and, in particular, the shallow wells providing drinking water to households and communities. Canals are also reported to be blocked and contaminated by waste debris which will likely require mechanical removal.

Replacement water from the head flow of rivers can be expected to wash out much of the saline inflow and deposition in the river estuaries, but some dredging may be required in the lower reaches. Desalination of the shallow wells, however, will require considerable intervention. The cost estimate for rehabilitation of shallow wells is stated as US\$1,000 per well. A rough estimate place the number of contaminated wells at 1,000, although how many of these are located within the Banda Aceh region is uncertain.

A recent survey of water quality carried out by the Ministry of Environment indicated high levels of *E. coli* in the majority of ground water samples taken around Banda Aceh. While the source of this contamination has not been located (and baseline data is missing) it is not

unreasonable to assume that contamination from sewage and other waste materials is responsible.

### **Land and Agriculture**

The area of rice paddy and coastal plantations affected by the *tsunami* remain unknown, but much of the coastal strip around Banda Aceh has been significantly affected. Many rice paddies are now covered in thick sludge, stagnant water and considerable amounts of solid, waste debris. Crops have been lost and the immediate future potential of these fields is uncertain. Loss of crops, however, relates more to the household level rather than imposing any imminent threat of food shortage.

Countless livelihoods have also been impacted. Without specific tests of the soil and water in rice paddies, it is impossible to gauge how long the overall recovery process will take.

### **Infrastructure**

Satellite images show that 49km<sup>2</sup> or 80 per cent of the built up area of Banda Aceh city was either totally destroyed or extremely damaged. Preliminary estimates of damage and loss in Aceh and North Sumatra is US\$1.4 billion, based on a rapid damage assessment of reconstruction and rehabilitation costs, temporary shelter, removal of debris, tertiary infrastructure repairs and furniture. Some 1,000 villages and urban communities have been affected and 117,000 houses completely destroyed.

### **Health**

Five hospitals and 19 health centres are thought to have been destroyed, with heaviest losses taking place in Banda Aceh and Kabupaten Aceh Jaya. The total damage is estimated at over Rp750 billion. Provision of health care, as well as the prevention of outbreaks of disease are now major concerns in Banda Aceh.

### **Sanitation**

Sanitation services in Banda Aceh are reported to never have been extensive – pre-*tsunami* figures suggest that clean water and sanitation services probably reached only 30-50 per cent of the population of Aceh and North Sumatra provinces. Both, however, may now be in a critical condition the physical destruction that has taken place in the area, as well as the shortage or lack of clean water. Septic tanks and pit latrines can expect to have been impacted, and spillage from these will be likely. Sanitation facilities at temporary settlements for displaced people are reportedly often lacking, which again gives rise to health concerns for those affected communities.

Many mass graves are situated near former rice paddies and near roads. In the latter, some roads are severely degraded following the *tsunami*, the concern being that of these graves are not clearly marked, they may risk being disturbed at some stage later on.

### **Livelihoods**

Many people's livelihoods have been devastated in Banda Aceh, with many families losing all or a considerable number of their possessions. Overall, it is feared that more than 600,000 people in Aceh and Nias – one-quarter of the working population – have lost their jobs. Fisheries alone accounted for 130,000 jobs and ensured the livelihood of an estimated 70 per cent of the coastal population. In Banda Aceh, 60 of the original 97 larger fishing *prahus* disappeared following the *tsunami*. According to local sources, earnings of up to Rp2 million

a month have been lost (mainly from *cakalang* – small tuna – fishing), in addition to skilled crew members and equipment. Government assistance (Rp72 billion has allegedly been made available to help fishery crews in Aceh to begin to recover their losses.

### 3.6 CONSOLIDATION AND ANALYSIS

As with other phases of the REA process, the task of consolidating information and ranking at least some of the priority issues emerging from the exercise is based on a consensus. The main issues emerging from Phase I and Phase II of the REA are shown in Table 1. This part of the exercise was completed by the REA Team with one staff member from the Ministry of the Environment: no local representation was unfortunately possible at this stage, but it was felt that the involvement of the community at the earlier stages, and their expressions of concern, were taken into account.

There are two main objectives to this stage of the REA:

1. To identify **environment-related issues which need immediate attention** as part of the relief operation; and
2. **To develop a single, prioritised list of environment-related issues, to help allow future actions to be determined**

In considering responses, the following guidance was used to rank the most important concerns:

- Does the issue pose an immediate threat to life?
- Does the issue pose an immediate threat to welfare? or
- Does the issue pose an immediate threat to the environment?

Issues for which the answer is “Yes” to the first question are given top priority. Among these, issues involving the greatest threat to life are in turn given the highest priority

**Table 1. Main Issues of Concern**

ORGANISATIONAL LEVEL ASSESSMENT	COMMUNITY LEVEL ASSESSMENT
<b>FACTORS WITH IMMEDIATE IMPACT ON THE ENVIRONMENT</b>	
Volume of (mixed) waste resulting from tsunami: inadequate guidance, plans and co-ordination	
High concentration of affected people	
Low degree of self-sufficiency among affected population	
Few immediate livelihood options for survivors	
Low capacity to absorb waste	
Low environment resilience	
Possible toxic waste leakage	
Contaminated ground water reservoirs	Water quality
Eroded shoreline	
Future threats due to flooding	
Physical destruction of coral reefs, mangroves	
Sanitation	Sanitation/insufficient latrines
Solid waste disposal	Solid (domestic) waste disposal

<b>ORGANISATIONAL LEVEL ASSESSMENT (contd)</b>	<b>COMMUNITY LEVEL ASSESSMENT (contd)</b>
Airborne pollution and disease vectors	Standing water bodies; insect breeding sites
<b>UNMET BASIC NEEDS</b>	
Uncertainty regarding the future of farming and fishing (tambak, open sea...)	
Lost personal assets and belongings	
Lost livelihoods – tambak, rice padies, plantations	No jobs; poor prospects of regaining work at present
Shelter (and related domestic needs (clothing, lighting...))	
Fresh water for drinking and washing	
<b>NEGATIVE ENVIRONMENTAL CONSEQUENCES OF ASSISTANCE</b>	
Lack of co-ordination in relief/recovery response	
No organised management of displaced persons settlements – quality highly variable	
Sanitation and solid waste disposal	
Clean-up after people transferred to temporary settlements	
Low capacity to direct and absorb relief assistance for sustainable development	
	Uneven distribution of relief supplies/assistance to spontaneous settlements
<b>OTHER CRITICAL ISSUES</b>	
Difficult to access certain areas	
Local government still paralysed due to infrastructure destruction, loss of staff...	
Uncertain land tenure	
Lack of overall guidance materials	No prior knowledge of <i>tsunami</i> events: lack of guidance in dealing with disasters
	Enhanced role identified for local governance and role of communities in environmental management
	No communication or information about relocation plans

Following a simple ranking exercise, the 10 issues listed below were selected as being the priority concerns at the present time. Note, however, that other issues identified during the course of this REA should not be immediately discounted: many are relevant and of high importance – but the need to address them was at this time, and for the criteria considered in this REA, judged to be for the more immediate rather than the immediate timeframe.

Further details of these issues are given in Section 4.

## 4. CONCLUDING OBSERVATIONS AND RECOMMENDATIONS

### 4.1 INTRODUCTION

The full scale of the *tsunami's* impact has in many ways yet to be realised, as the onerous task of rebuilding damaged and destroyed infrastructure as well as peoples' lives and livelihoods now begins to be discussed and planned.

This is a time for considerable possibility, but also a time when costly mistakes can easily be made. As a guiding principle, one of the key messages emerging from this REA – built on the priority recommendations previously mentioned, and taking into account the many other observations raised during this investigation – is the need for integrated planning and response. Making sure that environmental considerations are at least taken into account at all relevant levels of discussion and planning should help ensure that future rehabilitation and reconstruction activities are founded on more sustainable principles that could benefit the local population and region in the longer-term.

### 4.2 SUGGESTED FOLLOW-UP ACTIONS

In order to help mediate actions to at least the priority recommendations from this REA, the following table identifies what are thought to be the main root causes of the some of the problems, as well as some suggested actions. Note however that these lists are not definitive and additional analysis should be carried out at the level of Banda Aceh for further clarification, revision and additions.

ROOT CAUSE(S)	RECOMMENDATION(S) FOR FOLLOW-UP	ONGOING IMPLICATIONS
<b>1. CONTAMINATED GROUND WATER</b>		
<ul style="list-style-type: none"> <li>• Saline intake following inundation by tsunami</li> <li>• Seepage from spilled sewage and accumulated sludge</li> <li>• Possible localised seepage from chemical contaminants</li> </ul>	<ul style="list-style-type: none"> <li>• Overall assessment of extent of contamination to be undertaken, with projection on time required for cleansing through natural processes</li> <li>• Alternative means of accelerating desalinisation through biological means to be investigated and considered</li> <li>• Standing water bodies should be drained/cleared asap to prevent further percolation (see Sanitation)</li> <li>• Full damage assessment of localised seepage of contaminants (pesticides, oil products...)</li> </ul>	<p>Tanker provision of water (untreated largely) by Public Works</p> <p>Water shortages among vulnerable communities</p>

ROOT CAUSE(S)	RECOMMENDATION(S) FOR FOLLOW-UP	ONGOING IMPLICATIONS
<b>2. SANITATION</b>		
<ul style="list-style-type: none"> <li>• Inadequate number of latrines at shelter facilities</li> <li>• Poor hygiene</li> <li>• Standing bodies of contaminated water (pools, canals...)</li> <li>• Sewage system seriously impaired following tsunami (although never widely or fully functional in Banda Aceh)</li> </ul>	<ul style="list-style-type: none"> <li>• Construct additional latrines at temporary shelters; ensure sufficient latrines built to recognised standards at future settlements</li> <li>• Ensure adequate provision of clean fresh water for washing clothes and personal hygiene</li> <li>• During clean-up, priority should be given to freeing canals of blocked debris, draining stagnating pools of water</li> <li>• Sewage system for Banda Aceh needs major overhaul and redevelopment; anticipated future needs should be taken into account in appropriate zoning and reconstruction plans</li> </ul>	<p>Continuing poor and inadequate hygiene facilities can lead to outbreak and spread of disease, as well as environmental pollution.</p> <p>The dignity of people – to have access to clean and appropriate clothing for prayers, and clean water for washing and cooking facilities – should also be respected.</p>
<b>3. LOST LIVELIHOODS AND OPPORTUNITIES</b>		
<ul style="list-style-type: none"> <li>• Rice paddies flooded with salt water, sludge and other contaminants – immediate crops lost; medium-term cultivation prospects uncertain</li> <li>• <i>Tambak</i> ponds destroyed (physically or through contamination)</li> <li>• Intact <i>tambak</i> ponds abandoned</li> <li>• Loss of boat crews for off-shore fishing</li> <li>• Loss of materials (boats, nets...) for offshore and coastal fisheries</li> <li>• Loss of employment opportunities</li> <li>• Coastal plantations (coconut...) damaged</li> </ul>	<ul style="list-style-type: none"> <li>• Assess the extent of damage to rice fields within immediate area of Banda Aceh</li> <li>• Identify best solution(s) for clean-up, e.g. accelerated flushing by clean ground water, or intensive physical turn-over of soils</li> <li>• Identify future zone for <i>tambak</i>; provide assistance to farmers with redeveloping this system in a more environmentally friendly manner</li> <li>• Provide assistance (e.g. micro-credit facilities) to fishing crews to allow them to rebuild their trade</li> <li>• Conduct series of livelihood analysis and security assessments to help determine needs and opportunities of survivors. Help re-establish market systems</li> <li>• Assess damage to coastal plain plantations and determine best options for redevelopment of mixed plantations where possible</li> <li>• Assess possibility of engaging communities in coastal zone and riverbank stabilisation and development through integrated forestry and perhaps agricultural practice where appropriate</li> </ul>	<p>Survivors (and other members of the community) may become dependent on relief</p> <p>Out-migration to other centres/ regions</p>



ROOT CAUSE(S)	RECOMMENDATION(S) FOR FOLLOW-UP	ONGOING IMPLICATIONS
<b>4. LACK OF CO-ORDINATION IN RELIEF/RECOVERY PHASE</b>		
<ul style="list-style-type: none"> <li>• Weakened local government structure</li> <li>• Difficult of co-ordinating an international relief operation of this scale</li> <li>• Inexperience of situations and response mechanisms</li> </ul>	<ul style="list-style-type: none"> <li>• Immediate closer co-ordination between agencies leading the relief operation with government authorities</li> <li>• Identification of activities underway and clearer designation of roles and responsibilities</li> <li>• Monitoring system in place with re-inforced local government structure (see below)</li> <li>• Technical (and other relevant) guidance provided to direct and co-ordinate recovery activities on the ground</li> </ul>	<p>Relief assistance risks being diluted to only certain sectors, leaving some more vulnerable and needy communities</p>
<b>5. SHELTER</b>		
<ul style="list-style-type: none"> <li>• Housing either totally or seriously destroyed</li> <li>• <i>Tsunami</i> survivors may lack funds to buy building materials for their own proper house construction</li> </ul>	<ul style="list-style-type: none"> <li>• Provide practical guidance to local authorities and other agencies involved in temporary settlement construction and management</li> <li>• Environmental impacts associated with construction of temporary shelters to be investigated, e.g. source of building wood materials</li> <li>• Environmental impacts of the 24 planned transit camps should be investigated</li> <li>• Clean-up operations (incl safe disposal of waste) should take place following closure or consolidation of temporary settlements</li> <li>• Opportunities investigated to enable families/communities to begin rebuilding their homes/<i>kampung</i>s</li> <li>• Appropriate assistance (compensation) should be provided to survivors to help them rebuild their own shelter/homes in areas zoned for rebuilding</li> </ul>	<p>Housing may prove inappropriate to peoples' needs and customs</p> <p>Housing may induce direct local and indirect distant negative environmental impacts</p> <p>Solid and liquid waste will remain uncollected and risk future contamination/ disease spread</p> <p>Siting of future <i>kampung</i>s to be done in physically safe and environmentally appropriate manner</p>

ROOT CAUSE(S)	RECOMMENDATION(S) FOR FOLLOW-UP	ONGOING IMPLICATIONS
<b>6. ENHANCED ROLES IDENTIFIED FOR LOCAL GOVERNANCE AND THE ROLE OF COMMUNITIES IN ENVIRONMENTAL MANAGEMENT</b>		
<p>Community members wish to see greater transparency in decisions taken regarding environmental management, opportunity for involvement, and stronger responsibility for overall management of natural resources</p>	<ul style="list-style-type: none"> <li>• Develop principles of good guidance</li> <li>• Elaborate a system of conflict management</li> <li>• Develop a consistent approach to environmental management following the <i>tsunami</i></li> <li>• Enable public participation (multi stakeholders) in decision-making</li> <li>• Provide access to information and justice – open communication/ transparency</li> <li>• Decision should be taken through consultation with affected citizens</li> <li>• Develop an accountability and monitoring framework</li> </ul>	<p>In the absence of clear guidance natural resources may be negatively impacted through over-use or degradation</p> <p>Opportunities for (re)creating livelihoods may be overlooked</p>
<b>7. ACCUMULATED WASTE/DEBRIS</b>		
<p>Vast quantities of materials destroyed and dispersed over a wide area: likelihood of contamination (biological, chemical), possibly exacerbated by current speed of clean-up operation moving waste from one location to another (incl some dumping in sea)</p>	<ul style="list-style-type: none"> <li>• Safe collection of waste materials; basic training and provision of protective equipment to waste handlers</li> <li>• Screening and sorting and recycling (to extent possible) of solid waste materials</li> <li>• Identification of possible re-use of certain materials, e.g. building rubble</li> <li>• Identification of safe waste disposal sites outside Banda Aceh</li> <li>• Clear and appropriate guidance provided on waste management process</li> <li>• Improved co-ordination of waste collection, treatment and disposal services</li> <li>• Mid- to longer-term waste management and disposal plans elaborated</li> </ul>	<p>Localised contamination and pollution through seepage</p> <p>Health hazard; Infection and possible disease outbreaks</p> <p>Clean-up not co-ordinated or cost-effective at present</p>

ROOT CAUSE(S)	RECOMMENDATION(S) FOR FOLLOW-UP	ONGOING IMPLICATIONS
<b>8. LAND TENURE</b>		
Survivors – now homeless – from the <i>tsunami</i> – are concerned about being allowed to return to their previous areas of living and working (e.g. agricultural lands, plantations, <i>tambak</i> )	<ul style="list-style-type: none"> <li>• Clear guidance and direction needed for survivors on their rights and opportunities regarding regaining possessions and activities</li> <li>• Involve different stakeholders by working at the local level to promote decision-making institutions and collaborative management</li> <li>• Promote collaborative management and address need to promote national processes that empower local communities' right and responsibilities to fully participate in the planning, implementation and decision-making processes affecting resource management</li> <li>• Support government to invest in stakeholder consultation and negotiation mechanisms and to adapt legal and institutional frameworks to allow participatory management of natural resources</li> <li>• Promote tenure systems that support fair access to land and natural resources</li> </ul>	<p>Uncontrolled (re)settlement in areas perhaps being set aside as low activity or protection zones</p> <p>People moving to other areas</p>
<b>9. STRENGTHENED LOCAL GOVERNMENT</b>		
Local government ( <i>Bapedalda</i> ) capacity has been seriously affected due to destroyed infrastructure, loss of staff...	<ul style="list-style-type: none"> <li>• Technical assistance and clear guidance on a range of pertinent issues needed in the interim to enable local government to deal with immediate clean up</li> <li>• Longer-term rebuilding of government capacity, including infrastructure, equipment and facilities</li> <li>• Institutional strengthening</li> </ul>	Unco-ordinated and poorly controlled recovery; missed opportunities of rebuilding Banda Aceh
<b>10. LOW CAPACITY TO DIRECT AND ABSORB RELIEF ASSISTANCE FOR SUSTAINABLE DEVELOPMENT</b>		
Weakened local government structures  Scale of relief operation in Banda Aceh, overwhelms capacity to channel and absorb assistance in a sustainable manner	<ul style="list-style-type: none"> <li>• Early guidance on at least initial thinking of future plans for rebuilding and reconstructing Banda Aceh, to allow potential partners engage in dialogue and planning processes</li> <li>• Improved structures and systems for receiving, channelling and disseminating assistance</li> <li>• Improved co-ordination between institutions (government, international, national) responsible for, e.g. environmental management</li> </ul>	Missed/lost opportunity for people of Banda Aceh/rebuilding process



In addition to the above specific issues, the following points should also be noted:

- First, there is an urgent need to **fill the many gaps in our knowledge** of the situation on the ground. Much has been done in the short period of time since the disaster happened, but more concrete quantitative data are now required for all of the above (and other) issues to allow appropriate responses to be determined and implemented.
- Additional **guidance is urgently required** on a number of those issues above. Technical guidelines (many themes, e.g. waste management, local governance, livelihood recovery) should be developed, in time, taking into account experience from other disaster response situations, but the priority at this juncture should be to ensure that future development (rehabilitation and reconstruction) efforts are based on sound information – including being subject to an environmental assessment – are carried out to respected standards.
- The opportunities for **rehabilitation and reconstruction of Banda Aceh** (and, in time, other affected areas) represent an important opportunity for improved and integrated planning and development to be conceived and implemented. This process should begin without delay to capitalise on a number of opportunities, including the expressed desire from donor organisations to assist with this rebuilding process. Two critical factors should be considered in the reconstruction planning of Banda Aceh:
  - a) integration of environmental considerations in other sector plans – many aspects of this REA highlight key areas where environmental considerations of the aftermath of the *tsunami* need to be taken into consideration, e.g. re-alignment and reconstruction of roads; and
  - b) much closer integration between proposed coastal management plans and similar activities based around urban and peri-urban areas.<sup>4</sup> To be effective, both now and in the future, the two should work closely in tandem with each other.

The same considerations should provide a useful template which might be applied to other rehabilitation/reconstruction programmes for other *tsunami*-affected areas of Sumatra.

- Some degree of **institutional strengthening** (appropriate training and capacity building as well as equipment) should be considered to enable local government, in particular, to recover from their sizeable (and sometimes irreplaceable) losses incurred as a direct result of the *tsunami*. Strong leadership, as well as (re-)enhanced management and monitoring capacities are essential to preparing, guiding and overseeing the anticipated programmes of rehabilitation and reconstruction.
- Finally, it is timely that an appropriate **monitoring** system is now elaborated and set in place in and around Banda Aceh, to assist with future data collection and co-ordination with regards the environment, as well as to allow informed decisions to be made. This process should also take into account the recording of **lessons learned** thus far in the response process and to begin to clearly record and analyse future actions in a similar manner. This will help with the development of future **guidance** or elaboration of **technical guidelines** in environmental disaster response management.

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<sup>4</sup> A sketch of how proposed activities might be organised is provided in Annex V

### 4.3 CRITIQUE OF THIS PROCESS

Overall this REA process is judged to have gone very smoothly, despite the short lead-in time and inexperience of the nature and/or use of this tool by the majority of users. Several factors can be identified which positively contributed to the overall results, including:

- the quality and breadth of data gathered prior to or parallel to the early phase of this REA by the Donor Co-ordination Group. While much of the data relevant to this process was qualitative, the fact that some first steps had already been taken was a major advantage to the REA exercise as it gave it a useful point of departure;
- having input from direct observations of the situation by a few individuals, in this instance staff of the Ministry of Environment;
- quality information from a small number of people who survived the *tsunami*, or who had pertinent knowledge of the area prior to the disaster;
- satellite imagery being available for immediate consultation; and
- a dedicated and qualified team of people to work on this task as part of the REA process.

These sources together allowed, what is in hindsight judged to be an accurate picture of the situation – the overall REA process was completed within 10 days, of which four were spent on site in Banda Aceh.

One of the intentions of applying this methodology in the Banda Aceh situation has been to allow the Ministry of Environment to prepare also for similar undertakings in other affected areas. In this respect, some additional training is perceived for staff of the Ministry, the hope being that if similar approaches are taken in each location, it will be easier to compile a regional response to the disaster, with appropriate modifications as individual cases may merit.



## **ANNEXES**

I Timetable: REA Mission and Team Leader

II People Met

III Map of Critical Damage Areas

IV Map of Existing Spatial Plan and Land Status

V Sketch of possible considerations to take into account in the planned/ongoing zoning and spatial planning exercises

## **ANNEX I WORK SCHEDULE – REA TEAM LEADER**

14 January	Flight: Geneva - Jakarta
15 January	Briefing (Ministry of Environment/PRO-LH) Information review; Planning next steps
16 January	REA Phase I – Organisational-level Assessment – concluded
17 January	Analysis of REA Phase I results Meeting, Minister of Environment and senior staff REA presentation to Ministry of Environment Staff Meeting: World Bank; Donor Consultation Group
18 January	Writing report for Consultative Group Indonesia on early REA findings
19 January	Meeting: UNEP and UNDAC Environmental Consultants Preparation of field mission, REA Team
20 January	Flight, Banda Aceh Meeting, GTZ, Bapedalda Site visit of affected area
21 January	Community Assessments Site visits
22 January	Community Assessments Site visits Preliminary assessment of observations and findings by REA Team
23 January	Debriefing with Bapedalda Report drafting
24 January	Ministry of Environment debriefing; Report drafting
25 January	Phase III REA – Consolidation and Analysis Report preparation for Cabinet presentation
26 January	REA report preparation
27 January	Debriefing on overall observations and findings, Ministry of Environment Preparation of presentation
28 January	Presentation of REA findings to invited agencies Report completion

## **ANNEX II PEOPLE MET AND CONSULTED**

### **JAKARTA**

Mr Rachmat Witoelar, Minister of State for the Environment, Republic of Indonesia  
Ibu Masnellyarti Hilman, Deputy Minister for Technical Infrastructure for Environmental Management  
Dr Henri Bastaman, Senior Advisor to the Minister of Social Culture Affairs, Ministry of Environment  
Ibu Liana Bratasida, Assistant Minister for Global Environmental Affairs, Ministry of Environment  
Ibu Amanda Katili-Niode, Special Adviser to the Minister for Environment  
Mr Agus Purnomo, Special Adviser to the Minister for Environment  
Mr Hendra Setiawan, Assistant Deputy, Standards and Technology, Ministry of Environment  
Mr Rasio Ridho Sani, Assistant Deputy Minister for Information, Ministry of Environment  
Mr Noer Adi Wardoyo, Acting Division Head, Environmental Management Standards, Ministry of Environment  
Mr Heddy Suhandi Mukna, Division of Early Warning Information, Ministry of Environment  
Dr Helmut Krist, Programme Leader, GTZ/ProLH  
Mr Heirma Poernomo, Assistant Programme Leader for Spatial Environmental Management, ProLH  
Dr Wicaksono Saroso, Urban and Regional Development Institute  
Mr Josef Leitman, Lead Environment Specialist, EASEN Co-ordinator, The World Bank  
Ms Farida Zaituni, Environmental Specialist, The World Bank  
Mr Axel Hebel, Agriculture and Natural Resource Management Specialist, Asian Development Bank  
Mr Sergio Feld, Environment Advisor, UNDP  
Mr John Carstensen, Acting Deputy Director, UNEP Regional Office for Europe  
Dr Albert Sabroe Welinder, Chief Co-ordinator, Climate Change for Asia, Royal Danish Ministry of Foreign Affairs  
Mr Tim Walsh, Environmental Management Resources, Singapore  
Mr Andrew Jones, UNEP Environment Consultant  
Mr Sander van Dijk, UNDAC Environment Consultant  
Mr Dan Claasen, UNEP Senior Consultant  
Ms Patricia Charlebois, UNEP Consultant

### **BANDA ACEH**

Pak Surya A Hisjam, Bapedapda of NAD, Banda Aceh  
Pak Fauzi, Bapedalda of NAD, Banda Aceh  
Pak T. Zulfikar, Bapedalda of NAD, Banda Aceh  
Pak Syarif, community member, Banda Aceh  
Mr Holger Neuweiger, GTZ Co-ordinator Reconstruction Aceh  
Mr Regan Potangaroa, RedR Consultant to UNHCR  
Pak Endin Saprudin, Pelabuhan Perikanan Pantai Lampulo  
Pak Herman Sutrisno, Consultant, Persero Virama Karya, Dept of Public Works, Jakarta

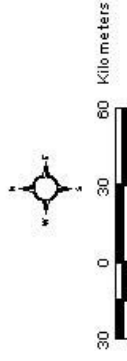


## **COMMUNITY MEMBERS INTERVIEWED**

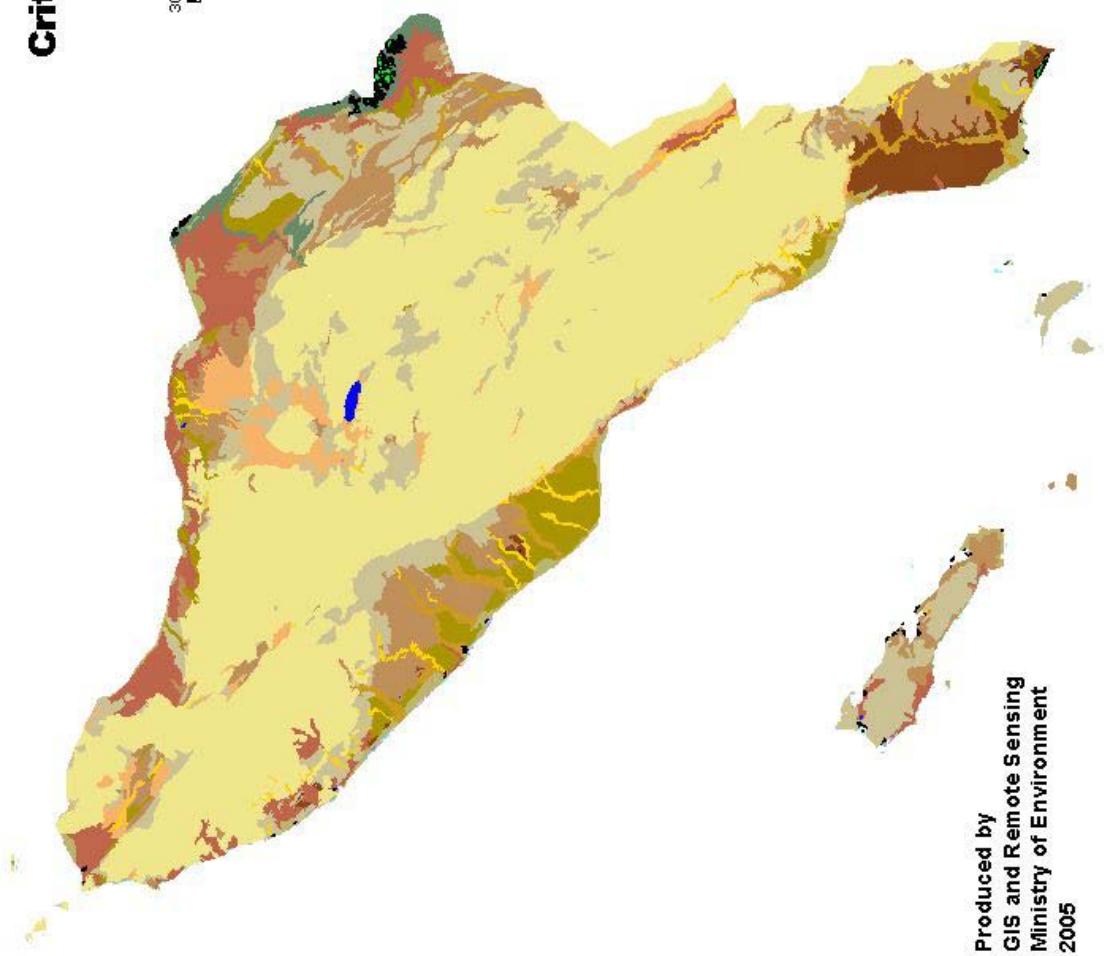
Pak Edi Novianto (driver)  
Syahrudiansyah (fisherman)  
Maftul (teacher)  
Dahlan Umar (Telkom)  
Zaelani Ibrahim (Cleaning services)  
Zaelani H (Private)  
Fauzi (Youth Association)  
M Jamal (Fisherman)  
Budi Hardiawan (BRI Sigli)  
Sayed Attah (PNS Diknas)  
Murhadis (Fisherman)  
Abdul Gani Abdi Basah (Small shop owner)



# Critical Damage Areas



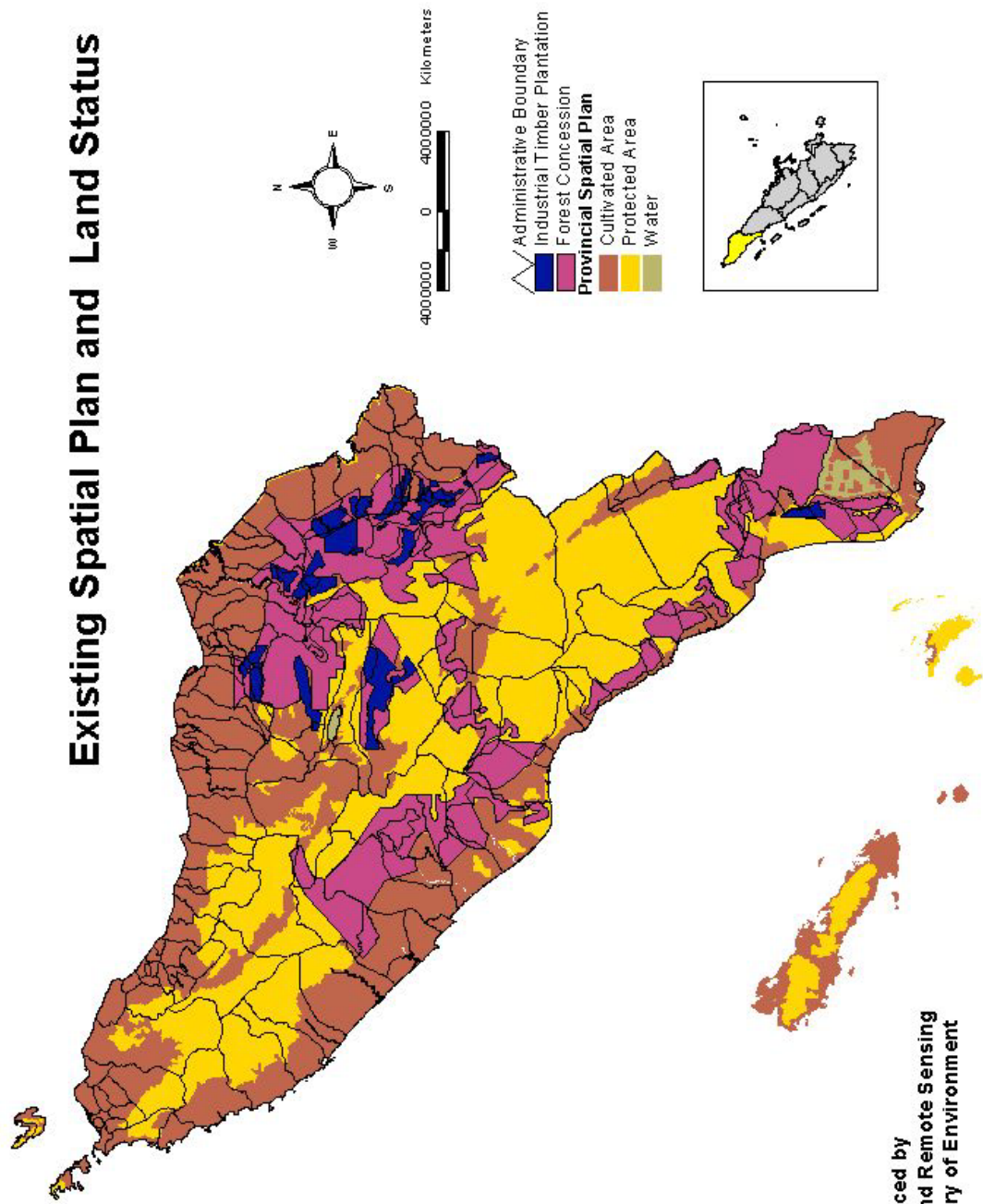
- Legend :**
- Province
  - Mangrove
  - River/ Lake
  - Coral Reef**
  - Beach
  - Fringing Reef
  - Mud
  - Patch Reef
  - Sand
  - Shoal
  - Land System**
  - Alluvial Plains
  - Alluvial Valleys
  - Beaches
  - Fans and Lahars
  - Hills
  - Meander Belts
  - Mountains
  - No Data
  - Plains
  - Swamps
  - Terraces
  - Tidal Swamps
  - Water



Produced by  
 GIS and Remote Sensing  
 Ministry of Environment  
 2005



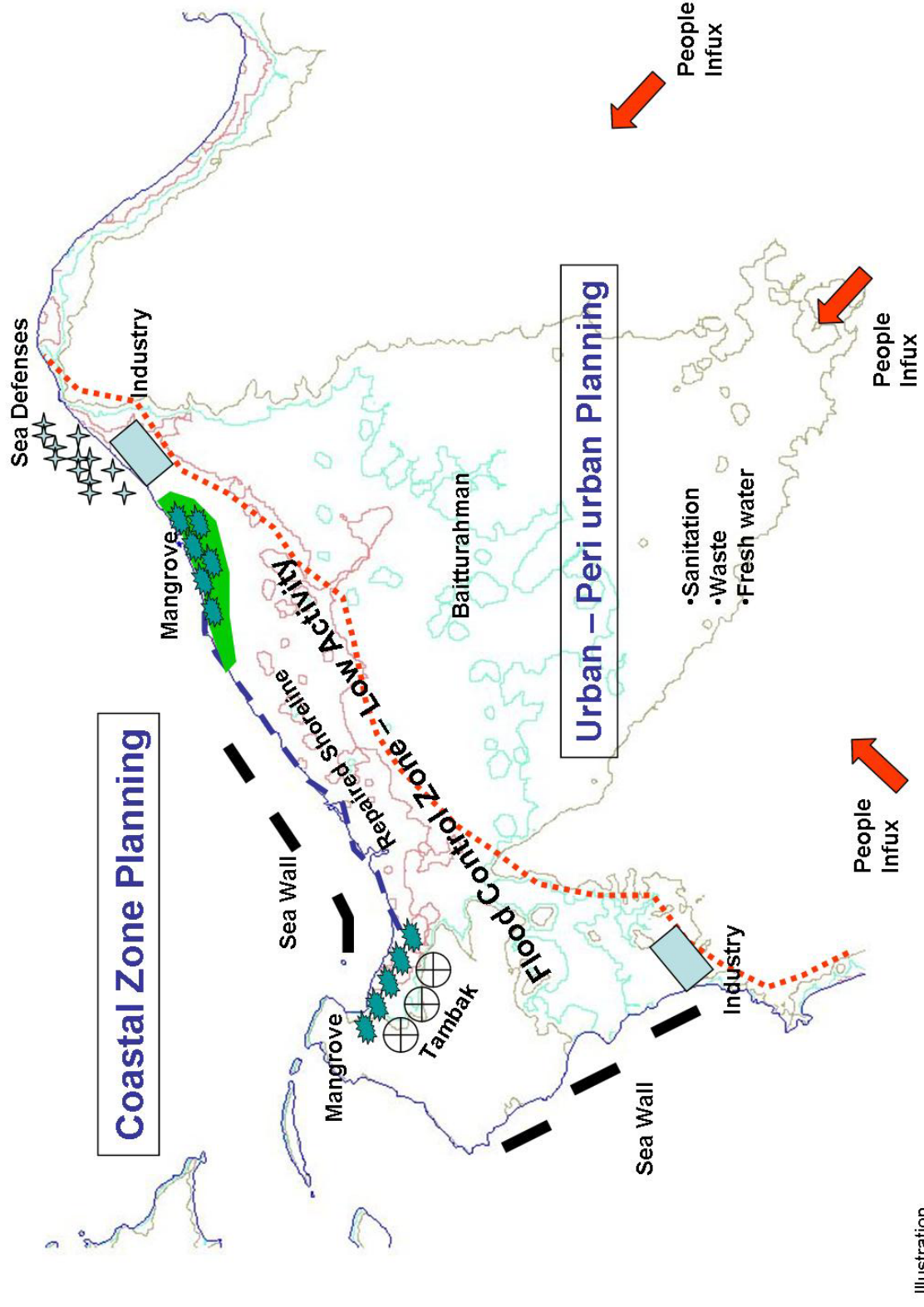
# Existing Spatial Plan and Land Status



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Ministry of Environment  
2005



# Integrated Urban and Coastal Planning – Banda Aceh



Illustration