

Post-Tsunami Land Parcel Reconstruction in Aceh: Aspects, Status and Problems

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SUMMARY

One of the impacts caused by the 24 December 2004 earthquake and tsunami in Aceh is the lost of several ten of thousands of land parcel boundary marks. Many land parcels have also been covered by the inundation of seawater. The disaster has caused damages not only to parcel marks and property rights but also to the land administration system in general. Land parcel reconstruction is very important since it will place a solid foundation for reconstruction work, spatial planning, compensation, and long-term economic development; and also will establish social justice and ensuring long-term social stability.

This paper describes and discusses the technical and legal aspects, status and problems related to land parcel reconstruction process in the areas affected by the 2004 earthquake and tsunami in Aceh. Some examples of the reconstruction results obtained by utilizing GPS and terrestrial surveys are also shown. Paper is sum up with some closing remarks.

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1. INTRODUCTION

One of the impacts of the 26 December 2004 earthquake and tsunami that has stricken Aceh is the lost of boundaries of several tenths of thousands land parcels in the field. Many parcels along the seashore were also submerged and many land parcel owners were died or missing. In addition, several land offices were either completely destroyed or structurally damaged. With this, thousands of land books and cadastral maps deposited in those land offices were also damaged or missing. In general it can be concluded that the damage caused by the earthquake and tsunami to property rights and land administration system in Aceh is severe. This wide spectrum of destruction has resulted in significant insecurity in land and property rights in Aceh, and it can be foreseen that the post-tsunami reconstruction of land property rights will not be an easy task.

The affected area of earthquake and tsunami is about 220 km long and around 5 km wide along the coastline of Aceh and North Sumatra. In Banda Aceh city, the tsunami-affected area is about 70% of the district's geographic area. In Aceh Besar and Aceh Barat districts, over 90% of their geographical areas were affected by the tsunami. Within these affected area, there was severe damage to the land administration system. Considering that certainty in location, status and ownership of land parcels are urgently needed to speed up the rehabilitation and reconstruction process after this disaster, therefore land parcel reconstruction process has to be completed as soon as possible in an effective and efficient manner. This paper describes the technical and non-technical aspects of post-tsunami land parcel reconstruction in Aceh in particular, and land administration system reconstruction in general. The status, problem and constraints of the reconstruction process will be highlighted and discussed, particularly related to technical, social and legal aspects. Paper will be sum up with some closing remarks.

2. CADASTRAL RELATED IMPACTS

The earthquake and tsunami of 26 December 2004 has introduced problems and complication into land administration system in Aceh. There are several cadastral related impacts of this earthquake and tsunami, which have resulted in significant insecurity in land and property rights. These impacts will certainly complicate the reconstruction process of land boundaries in particular and land administration system in general. They are briefly described in the following.

Firstly, the disaster has destroyed and wiped away the physical evidence of many land parcel boundaries. Many man-made and natural objects which actually can be used to identify these boundaries have also been destroyed or gone, as shown by an example given in Figure 1. The damage level of these parcel boundaries has spatial variation. Figure 1 indicates severe damage level, while a relatively less damaging case is shown in Figure 2.



Figure 1. Case where the parcel boundaries are completely disappeared.



Figure 2. Case where the parcel boundaries are relatively still identifiable.

Secondly, submergence of many parcels along the coast due to tsunami inundation and land subsidence caused by the earthquake. Figure 3 illustrates this phenomena around coast of Banda Aceh. In this case, there are parcels that are totally submerged and there also that just partly submerged. It both cases, parcel reconstruction will not be easy if it is tempted.



The 23 June 2004 image (before Tsunami)



The 28 December 2004 image (after Tsunami)

Figure 3. Submergence of land parcels along Banda Aceh seashore [Digital Globe, 2005].

Thirdly, the December 26th, 2004 earthquake has deformed the earth surface in both horizontal and vertical domain. Figure 4 illustrates these horizontal and vertical displacement of ground surface, as obtained from two GPS campaigns conducted in 1995/96 and 3-7 March 2005 [Meilano *et al.*, 2005]. From this Figure it can be noticed that the horizontal displacement can reach as much as 2.7 m at west coast of Banda Aceh. The subsidence and uplift related earthquake are also occurred in the east and west coast of Aceh, respectively, in the amount of several cm to a few dm. These ground displacements will affect the coordinates based parcel boundary reconstruction. Land subsidence along the coast will also submerge the parcels, as has been mentioned above.

Fourthly, loss and serious damage of land books and other land documents, including cadastral maps. BPN (the National Land Administration Agency of Indonesia) estimates that

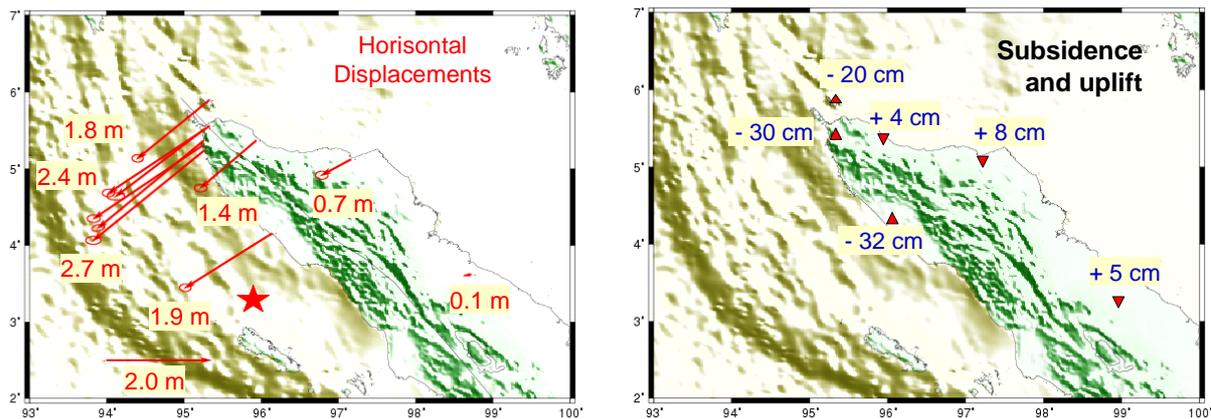


Figure 4. Ground surface displacements caused by the earthquake [Meilano et al., 2005].

about 10% of land books were lost. However, a significant amount of the remaining 90% of land books were found in a critical condition (e.g., flooded with sea water and mud) requiring urgent (within a short period of time) conservation and restoration work. In addition to the land books, there was also a serious loss of other land documents. BPN assessed that about 80% of land documents were lost, including almost all cadastral maps.

Fifthly, many land owners and their families and/or neighbours were died or missing. With this tragedy, substantial amount of virtual evidence on land boundaries were also gone and obviously will complicate the reconstruction process. It should also be mentioned here that the disaster has also washed away substantial witness evidence with the dead or missing of the landowners and their neighbors. With the total victims (died and missing) of about 300.000 peoples, it can be expected that many parcels will be affected.

Sixthly, large number of parcels was affected by the earthquake and tsunami. Approximately 300.000 land parcels have been affected by the tsunami. These comprise 170.000 urban land parcels and 130.000 rural land parcels. As is the case in many areas of Indonesia less than 25% of land parcels can be expected to be titled. Therefore, of the total number of affected land parcels, approximately 60.000 have been titled (40.000 being urban and 20.000 being rural). It is also estimated that 5% of titled land parcels were mortgaged, and these mortgages have been registered by BPN.

Finally, significant damages to BPN infrastructures and resources caused by the earthquake and tsunami. In Aceh province, more than forty BPN staff lost their lives, most of them from the Banda Aceh Land Office, which suffered about a 30% staff loss. Land Offices, including District Land Office in Banda Aceh were also completely demolished or damaged at different degrees and need to be rehabilitated. There was a severe damage and destruction of office facilities, and currently, there is a shortage of computers, photocopiers, scanners, digital cameras, printers, and stationery to support urgent record recovery.

3. PARCEL BOUNDARY RECONSTRUCTION

Land parcel boundary reconstruction is an important and critical stage for the restoration of land administration system in Aceh after tsunami. Boundary reconstruction in principle is the

process of relocating and re-coordinating the boundary monuments in the field, which were missing or destroyed. The relocation process can be conducted by using the previous known coordinates or based on other information sources, as indicated in Figure 5.

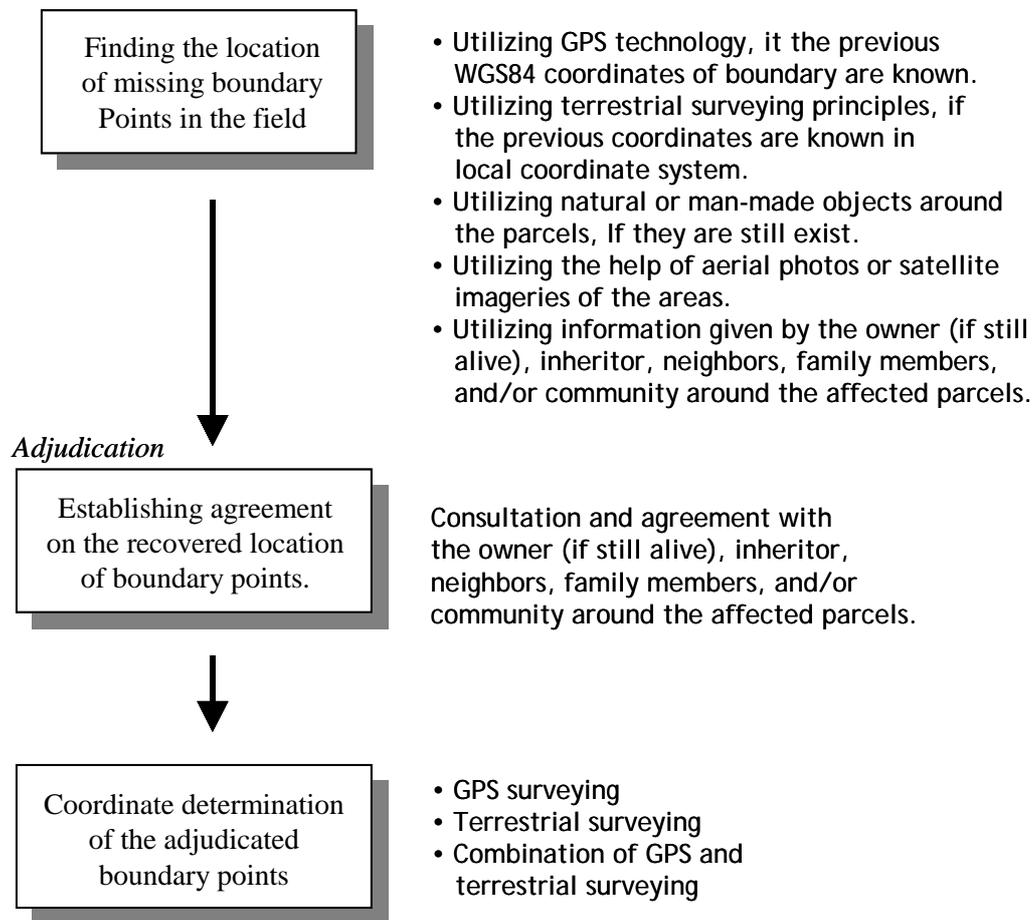


Figure 5. Parcel boundary reconstruction process.

In relation with reconstruction of land parcel boundaries in Aceh after earthquake and tsunami of 26 Dec. 2004, there are several problems that have to be taken into account, namely :

1. Most, if not all, of the affected parcels do not have their boundaries' coordinates in WGS84 system. The boundary relocation process using GPS technology [*Hofmann-Wellenhof et al, 1997; Abidin, 2000*], is therefore difficult to or can not be performed.
2. Many cadastral survey monuments were destroyed or missing by the earthquake and tsunami. This complicates the boundary reconstruction of parcels which their coordinates are related directly or indirectly to this survey monuments.
3. Because of very strong earthquake and damaging tsunami, many man-made and natural objects have gone or destroyed. This will complicate the rough location searching of the parcel boundaries.
4. Many parcels along the coast has either totally or spatially submerged by seawater

inundation. This phenomena complicate the searching and relocation of the affected parcel boundaries.

5. Many owners or inheritors of land parcels are died or missing because of disaster. This will complicate the verification of parcel boundaries obtained by the reconstruction process.
6. Many land certificates (books) and other land documents, including cadastral maps, were destroyed or missing because of disaster. With this a lot of information on land parcel boundaries were also vanished, and make the land reconstruction become more difficult.
7. There are fake statement of land ownership made by some irresponsible peoples.

Considering many problems that potentially can complicate the land boundary reconstruction, it can be realized that land administration reconstruction and restoration in Aceh after the earthquake and tsunami will not be an easy task.

4. REMEDIAL ENDEAVORS

National Land Administration Agency (BPN) undertakes remedial endeavors under special project of RALAS (**Reconstruction Of Aceh Land Administration System**), supported by a grant of USD 28.50 million financed by the Multi-Donors Trust Fund for Aceh and North Sumatra (MDTFANS), to improve land tenure security in Aceh after the devastation caused by the tsunami and the destruction of evidence of ownership [RALAS, 2005]. The specific objectives of the efforts are: (1) to recover and protect ownership land rights; and (2) to rebuild the land administration system. The proposed project would include the following components:

1. reconstruction of land records, community-driven adjudication, surveying and mapping, registration of rights and issuance of title certificates and assistance in policy, legal and regulatory issues;
2. reconstruction and rehabilitation of land offices that were destroyed or damaged by tsunami, provision of necessary equipment, training and capacity building for the BPN staff, computerization and development of a back-up system for land-related data; and
3. support to project management, monitoring and evaluation, complaint handling mechanism and technical assistance to support project implementation.

The RALAS project has been closely coordinated with other donors' activities related to land, notably, restoration of land records financed by Japan International Cooperation Agency (JICA), development of aerial photography maps for Aceh, funded by the Government of Norway, as well as programs supported by United Nations Development Program (UNDP), the Australian Government Overseas Aid Program (AusAID) and UN Habitat. The project helps bring consistency to the Community-Driven Adjudication (CDA) process (often referred to as "community mapping"), working with and supporting the other donors who are working with communities in doing this; and the BPN be able to complete the surveying, titling and registration of communities supported by the other donors, on the same basis as proposed for the project.

The central part of BPN efforts in performing restoration of land records is to reconstruct the land administration records system in the tsunami-affected provinces and to

recover the property rights of both formal, and informal land holders [Winoto, 2005]. This includes:

1. reconstruction of land records damaged by tsunami;
2. community-driven adjudication, public awareness and participation;
3. surveying, mapping and adjudication of land parcels to enable property rights to be registered and certificates of title to be distributed to land holders or their heirs; and
4. preparation of new regulations, laws and decrees to support the expedient implementation of the project.

RALAS is also working with a number of NGOs and providing them training and support. Through RALAS, particularly by CDA (Community-Driven Adjudication), BPN aims to ensure that community-led processes are conducted to a standard that will have a strong legal basis for future titling if desired by land owners. Organization of CDA being established for this purpose is shown in Figure 6. It should be emphasized here that the roles of NGOs in CDA include: facilitating community agreement on ownership and boundary demarcation; facilitating community-based dispute resolution; independent monitoring of land reconstruction; strengthening community institutions and decision-making processes with special attention to the rights of women, children and orphans [Winoto, 2005].

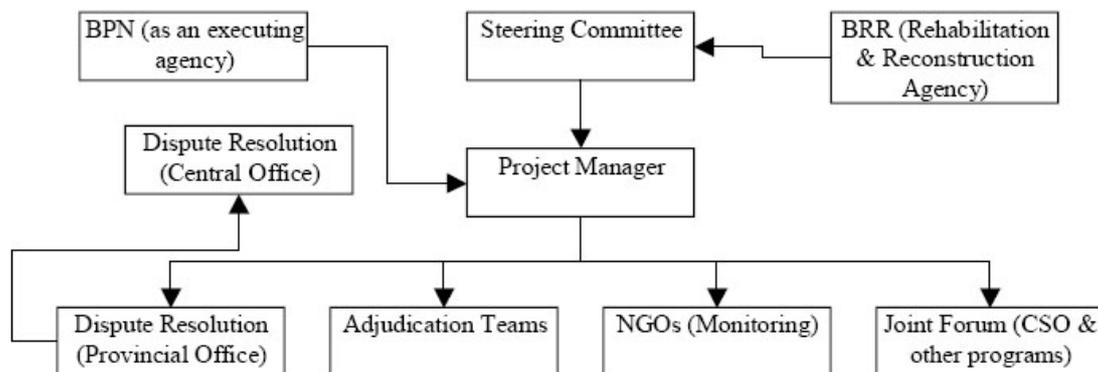


Figure 6. Organization of CDA [RALAS, 2005].

5. RESTORATION OF LAND RECORDS

Approximately 300,000 land parcels have been affected by the tsunami. These comprise 170,000 urban land parcels and 130,000 rural land parcels. As is the case in many areas of Indonesia less than 25% of land parcels can be expected to be titled. Therefore, of the total number of affected land parcels, it can be assumed that approximately 60,000 have been titled (40,000 being urban and 20,000 being rural). It is also estimated that 5% of titled land parcels were mortgaged, and these mortgages have been registered by BPN.

The tsunami damaged all of land records that were stored in the BPN province office and district land offices. All of these records were paper-based and stored on the ground floors of the respective buildings. Severe damage was sustained by all land register books (which hold the title certificate records) and all cadastral land parcel plans. Unfortunately, all of the cadastral index maps, showing land parcels were irretrievably damaged. No duplicate copies of these index maps are held outside of the offices. BPN has received initial support

from JICA, which has initiated the recovery of damaged land books retrieved from the Banda Aceh land office. Almost fifteen tones of records have been airlifted to Jakarta for stabilization, and have been stored in a freezer with a special chamber for controlled vacuum drying. The situation regarding land records is further complicated by the destruction of almost all title records held by landowners, the majority of whom are now deceased.

During the following 12-15 months, the records to be recovered have been specially treated and cleaned to enable digital reproduction using mounted 8 mega pixel cameras. JICA funding provides for only the initial freezing of the documents until June 2005. The project supported: (1) additional storage fees in the special freezer beyond that funded by JICA, at least 3 months from June to September 2005; (2) reproduction of all necessary paper-based working documents to enable BPN to provide its land administration services; (3) development of a computerized land records management system, which holds all of the imaged documents produced during the JICA-funded recovery operation; (4) any additional measures necessary to retrieve and use the land record documentation.

The efforts of restoration of land related records undertaken by BPN are absolutely uneasy. The impacts of the tsunami on BPN has severely affected its capacity not only to respond to the needs of the community following the disaster itself, but also to actually deliver its normal land administration services and fulfill its lawful responsibilities. At least 41 BPN staff died in the tsunami. As a result, BPN now has insufficient capacity. In addition, three BPN buildings have been destroyed and others have been severely damaged including the computing and communications equipment, software, furniture and vehicles.

In order to support the restoration of land related records, BPN in Aceh undertakes construction of new land offices to replace the ones destroyed by the tsunami, and the repair/renovation the offices damaged by the tsunami and subsequent earthquakes. Provision of the necessary furniture, computing and communications equipment, software and vehicles to support reconstruction work as well as normal land administration service delivery are also performed. Training and capacity building of BPN staff to support the implementation of the project and the on-going land administration services provided by BPN are the particularly of great consequence exercise to be accomplished.

Learning from the tsunami lesson regarding land recording system that paper-based records systems are vulnerable to all forms of disasters, including tsunami, BPN builds up a future program of Computerization and Development of Back-up System. The key outputs of the recovery of land records are digital land records and a computerized land records management system. The back-up system would also be computerized, and include safe off-site storage to ensure that the loss of information would never be recurred. The program supports (i) development and implementation of a computerized back-up system for land records management, including off-site storage; (ii) development of a procedures manual; (iii) training of staff.

6. SURVEYING AND MAPPING, REGISTRATION OF RIGHTS AND ISSUANCE OF TITLE CERTIFICATES

The priority of effort for providing security of property rights are: (a) Priority 1 – areas designated as settlement and housing areas, including areas necessary for the construction of public buildings such as schools, hospitals and government offices (estimated at 100,000

parcels); (b) Priority 2 - all other tsunami affected areas (estimated at 200,000 parcels); and (c) Priority 3 – land areas immediately adjacent to tsunami affected areas (estimated at 300,000 parcels).

Already, BPN has purchased a small amount of pre-tsunami satellite imagery and test-produced maps at a scale of 1:3,500. It is assessed that suitable pre-tsunami satellite imagery, when ortho-rectified, will reliably produce 1:5,000 scale maps, which would provide a positional accuracy of about 1 meter.

The Norwegian government has approved funding of aerial photography and production of high-resolution orthophoto-maps. This aerial photography is useful to prepare post-tsunami orthophoto mapping of the affected areas. However, its acquisition depends on the flying season, usually between November and March, when cloud cover is less prevalent. Aerial photography should be undertaken to allow ortho-photo mapping at scales of 1:1,000 and 1:2,500 for urban and rural areas respectively.

The project supports: (1). acquisition of suitable high-resolution pre-tsunami satellite imagery to prepare maps to support BPN's mapping, surveying and adjudication for reconstruction of the land administration system and to also prepare maps to be provided for CDA; (2) adjudicate community to prepare a complete official inventory of land parcels, parcel boundaries and land holders; (3) survey all land parcels and produce digital cadastral records and index maps necessary for the land administration system; (4) validate CDA and distribute land titles for previously titled land and also informal lands for which legitimate possessory rights can be claimed; (5) additional land surveying, geodetic infrastructure, mapping and imagery to support post-tsunami reconstruction of affected and adjoining areas, (6) hiring of contract staff, allowances; (7) payment of allowances and travel expenses for BPN staff to be re-deployed to Aceh and North Sumatra; and (8) procurement of any private sector surveying and mapping services.

A few study cases of land boundary reconstruction have been performed by using GPS surveying and terrestrial surveying using Total Station, as an example shown in Figure 7(a) and 7(b). From the study cases it was obtained that if the adjudication process has been completed, then by using GPS differential positioning technique, in general the boundaries of 120 parcels can be determined in one working day. It was also found that by using Total Station, only about 110 parcels can be determined their boundaries' coordinates in four working days.



Figure 7(a). Example of parcel boundary reconstruction in Aceh with GPS.

In land reconstruction process in Aceh, the roles of peoples (community) are very important, both in adjudication process and other cadastral survey and mapping activities. Figure 8 shows an example of mapping process in the village of Kajhu, Aceh Besar involving people as the key stakeholder.



Figure 7(b). Example of parcel boundary reconstruction in Aceh with Total Station



Figure 8. Mapping in the village of Kajhu, Aceh Besar. [*Haroen et al.*, 2005].

7. IMPACTS OF SOCIAL ISSUES TO LAND RECORDS

In the aftermath of the disaster, the geography and social structures has changed and the land control and ownership has become a crucial issue not only for the national reconstruction efforts but also at an individual level, for the survivors who need to recover their livelihoods. There are parts of the affected communities which are particularly vulnerable and which need to get a special attention in the recovery process, including property rights of these groups. The vulnerable populations are especially the widows and orphaned children. Sadly, they are potentially the first victims of land grabbing.

There are three critical social aspects that affect decisions on property rights that have impacts on land records:

1. inheritance aspects, especially that many members of the community have died;
2. potential land conflict, not only outside the family structure, but also within the family; and
3. rights of surviving widows and children, some of which were adopted outside the community.

The tsunami has resulted also in an estimated 100,000 inheritance cases. Within three months of re-opening the Syariah court (based on a religious law) in Banda Aceh, close to 6,000 inheritance-related cases were already filed. This would be affecting the data maintenance of land records.

Although Syariah law is mandated for resolution on inheritance cases amongst Muslims (per the local law since Aceh has a special autonomous status), the practice and interpretation of the law varies across the affected areas. The roles of inheritance were discussed in a workshop held in April 2005 among 600 Ulama Leaders (religious leaders), it was agreed to use a common interpretation of the Syariah law on inheritance to ensure that it is applied consistently across Aceh. The interpretation will be included in the CDA manual.

There are two specific elements that were agreed to ensure the proper application of the Syariah law. These are: (1) Village chief and Ulama would be included in the determination of the rightful heir(s); and (2) Village level "bait al maal" (treasury) will be the trustee to manage unclear inheritance. The entire community will use this land. In case a legal inheritor has been found, the land will be transferred in accordance to the Syariah law.

The head of Syariah court estimated that there are around 10,000 children orphaned by the tsunami and some of them could lose their inheritance rights (according to Syariah) if there is no proper protection system. In order to protect the rights of the orphaned children and widows, it was agreed that:

1. A village would utilize the existing administrative and religious leadership structure in the village to protect the rights of the vulnerable groups. This structure includes the village chief, Ulama as well as the representatives of the community.
2. The village council should establish a form of custodianship for underage inheritors. The surviving relatives and village council could oversee the custodian of the child. The land title will be issued in the name of the deceased parents and the property will be transferred to the surviving child after the child reaches the legal age.
3. Disseminate basic rights of widows and children under the Syariah Law according to the adjudication manual.

8. CLOSING REMARKS

Land reconstruction process in Aceh after the earthquake and tsunami of 26 Dec. 2004 is indeed not an easy task to accomplish. Many technical, social and legal complications that have to be taken into consideration. The previously turbulent political background in Aceh region and the peace efforts that are being established among a few factions there, should also be taken into account; especially in establishing a reliable and stable land administration system in the future. Parcel boundary reconstruction is only a part of the reconstruction and restoration process of land administration system. In the case of parcel boundary

reconstruction in Aceh after the disaster, actually there are 16 possibility of land, owner and document condition that have to be taken into account, as shown in Table 1. From this Table it can be realized that land reconstruction process will have not only technical aspect, but also social, cultural, economic and political aspects.

Table 1. Possibility of Land-Owner-Document Condition [Haroen et al., 2005].

No.	Land Parcel	Owner	Land certificate	Official Document
1.	Exist	Exist	Exist	Exist
2.	Exist	Exist	Exist	No
3.	Exist	Exist	No	Exist
4.	Exist	Exist	No	No
5.	Exist	No	Exist	Exist
6.	Exist	No	Exist	No
7.	Exist	No	No	Exist
8.	Exist	No	No	No
9.	No	Exist	Exist	Exist
10.	No	Exist	Exist	No
11.	No	Exist	No	Exist
12.	No	Exist	No	No
13.	No	No	Exist	Exist
14.	No	No	Exist	No
15.	No	No	No	Exist
16.	No	No	No	No

For successful reconstruction and restoration program of Aceh, it is compulsory that land rights recovery and protection should be completed as soon as soon as possible. Recovering and protecting land property rights will place a solid foundation for reconstruction work, spatial planning, compensation, and long term economic development; and it is also essential for establishing social justice and ensuring long-term social stability. Effective and efficient land reconstruction in Aceh will also require conducive cooperation and communication among all stake holder, e.g community, central and provincial governments, and the NGOs .

REFERENCES

- Abidin, H.Z. (2000). *GPS Positioning and its Applications* (in Indonesian language). P.T. Pradnya Paramita, Jakarta. Second edition. ISBN 979-408-377-1. 268 pp.
- Digitalglobe (2005). Situs internet dari DIGITAL GLOBE, Alamat situs : http://www.digitalglobe.com/tsunami_gallery.html, Tanggal Akses : 5 September 2005.
- Haroen, T.S., Chairul B. Achmad and Wenny Rusmawar (2005). “*Cadastral Reconstruction in Aceh: A Newborn Concept of Adjudication*”, Proceedings of the 8th South East Survey Congress, Bandar Seri Begawan, Brunei Darussalam, 21-25 November 2005.

Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins (1997). *GPS, Theory and Practice*. Springer-Verlag, Fourth, revised edition, Wien, ISBN 3-211-82839-7, 389 pp.

Meilano, I, Y. Oota, H.Z. Abidin, M.A. Kusuma, Didik, Agustan, T. Ito, F. Kimata (2005). "Co-seismic displacement of the 2004, $M_w=9.0$ Sumatra-Andaman Earthquake from GPS measurements." Paper presented at the Dynamic Planet 2005 Simposium : Monitoring and Understanding a Dynamic Planet with Geodetic and Oceanographic Tools. 22-26 August 2005, Cairns, Australia.

RALAS (2005). *Manual of Land Registration in the Affected Tsunami Areas of NAD dan North Sumatra*. Published by the Reconstruction of Aceh Land Administration System (RALAS), Keputusan Kepala BPN No.114-II.2005.

Winoto, Joyo (2005). "Reconstruction of Land Administration System in Nanggroe Aceh Darussalam (NAD) and Nias", Proceedings of the Expert Group Meeting on Secure Tenure: New legal frameworks and tools, Bangkok, 8-9 December 2005.

BIOGRAPHICAL NOTES

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