PART III

EVALUATION

Chapter 9 Evaluation

9.1 Framework of the Evaluation

One of the main objectives of the Project was the examination of post-disaster management methods developed in Japan, largely through its experience in the aftermath of the Hanshin-Awaji Great Earthquake of 1995 as applied to the Sri Lankan situation as stated in Section 1.2. The evaluation presented in this chapter therefore deals with the methodological approaches adopted in this Project, rather than the evaluation of individual Pilot Projects, which is presented in each of the chapters describing them respectively. Through the implementation of the project, the methodological approaches evaluated are the bottleneck identification approach and the co-assistance approach, as described in Chapter 2.

9.2 Evaluation of Bottleneck Identification Approach

Three major aspects of the methodology are evaluated. They are:

- Whether the checkpoints identified in Japan were applicable in post-tsunami southern Sri Lanka or not?
- Whether or not the identified bottlenecks were appropriate for recovery? Were there other bottlenecks?
- Was the implementation method adopted for the bottlenecks appropriate?

The degree of applicability was assessed and a score was given to each item on a scale of 0 - 10 as shown below.

Very Appropriate/Applicable: 7 - 10
Reasonably Appropriate/Applicable: 4 - 6
Low level of Appropriateness /Applicability: 0 - 3

(1) Field 1. Refugee Area Closing and Temporary Housing Provision

Semi Field	Checkpoints	Eval. Score	Bottlenecks (Covers all Semi Fields)	Eval. Score	Implementation Method (Covers All Semi-Fields)	Eval. Score
1:Prolonged refugee shelter area	How do we manage the shrunken refugee camp efficiently?	8	• Suitability of the location of semi-permanent housing	7	• Select some camps with issues and provide adequate facilities and services, while considering the impact of the provision with or without the Project	8
	How do we manage the original facility where the refugee camp stands?	4	• Absence of land in areas preferred by people	8	• With community participation, construct wells and other utilities	8
2.Refugee area closing	How de we encourage the refugees to move to temporary housing?	7	• Mixing people from different villages and cast in the same housing scheme	7		
3.Offers for temporary provision of existing public housing in other areas	Was the supply of temporary housing enough for the demand?	0	• Lack of utilities	9		
	Is there any capacity for housing provision in other areas?	0				
4.Provision of temporary housing	Does institutional coordination for temporary housing work efficiently?	7				
	Do land acquisition and materials for housing meet the demand?	7				
5.Construction and leasing of temporary housing	Does the plan for temporary housing damage the surrounding environment?	5				
	Does the design of the temporary housing fit the demand of the refugees?	7				

1) Field: Score 7.0

Appropriateness of each field is also evaluated and field number 1, relating to the closing of camps and temporary accommodation, achieves a high of 7, as it is appropriate with the large number in tents and camps.

2) Checkpoints: Average Score 3.9

Of the eight checkpoints selected based on Japanese experience, five are very appropriate to Sri Lankan conditions, two are fairly appropriate, while two had low levels of relevance or no relevance. “Offers for temporary provision of existing public housing in other areas” is inappropriate as this option has not been explored in Sri Lanka due to the lack of available public housing. Due to this, the two checkpoints relevant to this also became inappropriate.

In terms of managing people that live in refugee camps for prolonged periods, the first checkpoint in the semi-field, prolonged refugee shelter area, is a very appropriate checkpoint as majority of people had to stay six to eight months or more in refugee camps before getting temporary accommodations. This meant little privacy for women and difficult living conditions in tents due to heat and rain. The semi-field, provision of temporary housing, is also critical due to delays in providing such housing; its two checkpoints are also very appropriate.

3) Bottlenecks: Average Score 7.8

All four bottlenecks identified by the project are appropriate, as these have been impacting the return to normal life. Two of the identified bottlenecks (lack of utilities as well as mixing people of different villages and casts), impacted the quality of living in the camps, while the other two bottlenecks (absence of land in areas preferred by people and appropriateness of the location of the semi-permanent housing) delayed the provision of temporary housing and the willingness of these people to move out of the camps. The camps were under the management of the Central Government, as represented by the District Secretary and Divisional Secretary’s. They came directly under the latter (Divisional Secretary), whose office had never faced a disaster of anywhere near this magnitude. In the south, normally the largest disasters are relatively small floods as well as droughts - the type of displacement seen had never happened in living memory.

In addition, the government lacks the resources and skills to cope with such a huge number of displaced persons. Although many international and local agencies, including NGOs, political parties, volunteers, and other forces came to help, coordinating this task

itself was beyond the government's capacity. Due partly to the efforts of primarily INGOs and projects such as this, however, these bottlenecks were overcome eventually.

4) Implementation: Average Score 8.0

The method followed was to select some camps and then provide urgently required utilities and furniture. The utilities and equipment provided included generators for the camp to provide lights when the main power was off (which frequently occurred in the area). This was very necessary and appropriate. The furniture provided included gas cookers and cupboards for each house. This was a basic need as people used kerosene cookers, which were neither safe nor efficient. People also did not have any place to keep their few belongings and hence cupboards were given to each family.

The second approach in the implementation was to obtain community participation for camp needs through co-assistance. This was very appropriate, although some implemented activities (such as well construction) did not involve community participation. Community participation, however, was achieved in other activities as discussed in the co-assistance evaluation. As such, both implementation approaches scored high as being appropriate.

(2) Field 2. Reconstruction of Houses

Semi Field	Checkpoints	Eval. Score	Bottlenecks (Covers All Semi-Fields)	Eval. Score	Implementation Method (Covers All Semi-Fields)	Eval. Score
House repair	How and who decides the measures of building rehabilitation?	7	• Large amounts of land required for construction of new houses	8	• Monthly targets and schedules to be given to agencies doing construction and close monitoring conducted	6
	Does the decision process work properly?	8	• Legal transfer of these lands from existing ownership (even government agencies) to new owners	7	• Joint procurement techniques to be introduced	6
House reconstruction	How are the existing disqualified buildings treated?	3	• The poor location and quality of some of the lands identified	8		
	How are the shared buildings treated?	2	• The buffer zone rule and people's reluctance to leave this area	7		
	How does the public sector specify the demand for housing?	5	• Lack of capacity of NGOs to construct housing	8		
Budget as assistance program	Is there any public fund to assist housing reconstruction?	7	• Lack of skilled labor required for construction	8		
Charitable donation money	Does institutional coordination for the distribution of charity donation work efficiently?	8	• The price of construction materials impacts the construction of housing	6		
	Are the criteria of distribution of charity donation prepared properly?	8				

Semi Field	Checkpoints	Eval. Score	Bottlenecks (Covers All Semi-Fields)	Eval. Score	Implementation Method (Covers All Semi-Fields)	Eval. Score
Public assistance and loans	Do such assistances and loans exist to rehabilitate the life of sufferers?	5				
	Are the criteria for condolence money provision prepared properly?	3				
	Are there such tax reductions and exemptions?	2				
Reconstruction Foundation	Is such a public foundation established?	7				
	Are the criteria for funding prepared properly?	8				

1) Field: Score: 9.0

This is really the biggest area of challenge in Sri Lanka's post-tsunami recovery, as the number of houses required and land required for this purpose, together with the ever-changing rule of the buffer zone and lack of capacity of both INGOs and the government in this type of work, makes this a daunting task. Even after a year, only 2,164 houses were constructed.

2) Checkpoints: Average Score 5.6

Eight of the 13 checkpoints identified in the Japanese list applied to Sri Lanka are appropriate. These refer to the decision-making process regarding house construction, repair, funding for house repair or construction, criteria and distribution of charity funds for house construction and repair, implementation of the agreed criteria, and the Foundation for Reconstruction. These are all very relevant to south Sri Lanka. What is not so relevant is the treatment of existing buildings, shared buildings, and tax exemptions, as these issues are not key issues in Sri Lanka. Some issues, such as how the government decides on public buildings are somewhat appropriate.

Some other key checkpoints relevant to Sri Lanka in the context of house construction are missing, however. These relate mainly to issues of land availability, land transfer delays to NGOs, legal issues regarding land, weaknesses of NGOs and agencies constructing houses, and the total inexperience of both the Government, NGOs, and most agencies in this type of work.

3) Bottlenecks: Average Score 7.4

All bottlenecks were appropriate and well-chosen, with some being very appropriate. The biggest bottleneck was the lack of land, however, the Government's inexperience in this type of first-time event was a factor. The knee-jerk reaction vis-à-vis the buffer zone (which changed twice already) was the result of this inexperience. Even to this date, this has an influence on why so many persons are unhoused or unable to repair their own houses.

4) Implementation: Average Score 6.0

Three of the five implementation methods were very appropriate, while two were considered appropriate. Once again, however, this was in relation to livelihoods and not to housing reconstruction, the main field under discussion.

(3) Field 3. Township Rehabilitation Planning and Institutional Development

Semi Field	Checkpoints	Eval. Score	Bottlenecks (Covers All Semi-Fields)	Eval. Score	Implementation Method (Covers All Semi-Fields)	Eval. Score
Governmental actions	Are there activities of Central Government for financial support?	7	• The township program preparation activities started one month after the disaster. This was due to the fact that the public sector's capacity to make decisions during the disaster situation was insufficient. • Lack of expertise in township planning during the disaster situation	7	• Provide adequate consulting services for planning agencies	7
Municipality action, and institutional issues	Does the public sector prepare such investment/ rehabilitation programs?	7			• Provide consulting services for tender, design and supervision. Consult with JICA HQ for implementation budget for rehabilitation work	7
	Does the public sector prioritize any sectors for early reconstruction?	7		7	• Conduct disaster management training and consultancy for municipality offices and other government agencies	6
Township planning	How quickly do the municipalities start to prepare township rehabilitation programs?	5			• Ensure greater coordination and leadership for township development	7
	Does the public sector issue reconstruction guidelines?	5			• Participate in agency coordination meetings, as well as obtain and provide lists of assistance given	5
	Is the rehabilitation program for the public sector referred to the voice of residents properly?	3			• Provide consulting services for tender, design and supervision	7
Township improvement activities	Are existing committees and groups involved in the township improvement program development?	3				

1) Filed: Score 7.0

The field was appropriate as the towns of Galle, Matara and Hambantota were affected seriously. These, however, were not the major cities. City planning for them in Sri Lanka has been in short supply in any case.

2) Checkpoints: Average Score 5.3

Most of the checkpoints are valid. Some checkpoints such as the roles of other agencies including the Urban Development Authority and Provincial Government and coordination between them and Municipality are not covered.

3) Bottlenecks: Average Score 7.0

Both bottlenecks are valid, but another major bottleneck is the lack of government funds and delays in obtaining adequate donor funds. It was only a few months ago that ADB commenced a project to provide Rs.20 billion for construction and repair of government buildings including local government buildings. The weak nature of the local government (such as municipalities with very little funding) was a major reason for the bottlenecks and why they have yet to be overcome.

4) Implementation: Average Score 6.7

All the implementation methods are appropriate.

(4) Field 4. Demolition of Damaged Buildings and Debris Disposal

Semi Field	Checkpoints	Eval. Score	Bottlenecks (Covers All Semi-Fields)	Eval. Score	Implementation Method (Covers All Semi-Fields)	Eval. Score
Public assistance	Are there public services to stimulate the demolition of damaged buildings? Are there any bottlenecks in the demolition of damaged buildings?	1	• Lack of expertise • Lack of resources and machinery • Lack of knowledge in reuse of material	1	• Contract consultants and provide training and consultancy • Provide assistance to buy machinery or provide money for renting machinery • Provide state-of-the-art consultancy and technology on wreckage	1
Removal of debris	Is there any target month for wreckage treatment? Who manages the wreckage treatment?	1				
Environmental issues	Is there any pollution generated through the wreckage treatment activities? Are any countermeasures implemented to ease the pollution?	1				

This was not a major field as no large buildings were completely destroyed due to the tsunami. The Sri Lankan coastal areas are mainly rural and even in towns, such as Matara, primarily only small single storied buildings exist. More relevant to Sri Lanka were fields such as education as 195 such facilities (mainly schools) were completely or seriously damaged. Health was also another field affected, with over 100 government hospitals and dispensaries damaged. In the Hanshin-Awaji Great Earthquake, education and health were not singled out as separate fields, although issues related to them were included in the fields shown in Chapter 2 and here. Apparently, they were not a major issue as in Sri Lanka. In the Japanese list, health and education issues are more prominent for the rescue and evacuation work phases, both of which are not the subjects of this Project. It is highly desirable that a list of checkpoints, based on Sri Lanka's own experience, be compiled in a similar manner to lists prepared in Japan. However, the approach itself appears to be sound and useful.

1) Filed: Score 0

This field is not appropriate as this aspect was not critical for southern areas in Sri Lanka after the tsunami since buildings were small (and most of those impacted were small houses in rural areas). Even in affected urban areas, the buildings were small. Large buildings were not structurally affected, causing few problems with demolition and debris clearing.

(5) Field 5. Industry Rehabilitation

Semi Field	Checkpoints	Eval. Score	Bottlenecks (Covers All Semi-Fields)	Eval. Score	Implementation Method (Covers All Semi-Fields)	Eval. Score
Damage to industry and financial support	Is damage to industry quantified?	8	• Large number of people who lost their livelihoods and the diversity of such livelihoods	7	• Assess based on survey results and secondary data from GA office, followed up by questionnaire/ interview for needs assessments	7
	Is there any financial assistance for industry rehabilitation?	8	• Loss of productive assets like machinery, equipment, and boats due to the tsunami	8	• Organize those who need assistance into CBO or trade associations by raising awareness of the benefits of such organization	7
			• Slow provision of such assistance	8	• Provide business consultants (Business Development Centre, Matara etc.) to develop business plans and to provide training, consultancy, and marketing assistance	3
			• Lack of trade associations to enable the affected to work together	7	• Develop savings and credit programs or link associations to existing programs	7
			• Lack of technical assistance	6	• Lobby government to build infrastructure and link other agencies working on market development	5
			• Lack of access to capital in the form of credit or grants to replace lost assets	8	• JICA provides assistance within their budget and for needs such as credit, boats, nets equipment. • Link the associations to agencies	8

Semi Field	Checkpoints	Eval. Score	Bottlenecks (Covers All Semi-Fields)	Eval. Score	Implementation Method (Covers All Semi-Fields)	Eval. Score
			• Loss of infrastructure	6	• Participate actively in the District Secretary office-led coordination meetings at Matara and CHA-led coordination meetings in Colombo • Provide all information regarding assistance to avoid duplication	7
Manufacturing and local industry	How is the overall condition of business recovery?	6				
	What is the major local industry and how is damage to the industry?	7				
Service sector, commercial, trading, and tourism	Are there any bottlenecks identified in the recovery of these sectors?	6				

1) Field: Score 8.0

Next to house construction, this is the most challenging field and thus gets a high score. However, this would have been better if it was called “livelihood revival”, rather than industry in Sri Lanka. Though there has been much attention on a few key sectors such as fishing, coir, and weaving, as well as considerable effort in assisting very poor self-employed, the efforts to support small- and medium-sized businesses have been very limited. JICA did well to support at least two of these sectors (ornamental fish and food processing). The extent of assistance, however, was still inadequate. Many small- and medium-sized businesses still remain closed or operate at levels far below their previous capacities. As such, many are still unemployed and this impacts the economy.

2) Checkpoints: Average Score 7.0

Most of the checkpoints are appropriate. However some checkpoints, which are not covered, are the lack of proper survey and proper database of assistance given by agencies, the lack of coordination between agencies, and a greater focus on self-employment, and not on small- and medium-sized businesses.

3) Bottlenecks: Average Score 7.1

Bottlenecks are very appropriate. One bottleneck, which is missing, is the need to construct business buildings, which were damaged or destroyed. This applies more to small- and medium-sized business, but not to the self-employed. The government’s lack of focus on the business sector outside of fishing was a major issue, as those most affected were sundry small- and medium-sized businesses in activities such as services, restaurants, hotels, processing, manufacturing, etc.

4) Implementation: Average Score 6.4

Most are appropriate.

(6) Overall Evaluation

The table below shows the average scores for each of the evaluation categories and an indication of missing checkpoints under the circumstances in Sri Lanka.

Table 9.1 Average Score of Evaluation Categories

Field	Field	Checkpoints	Bottlenecks	Implementation	Missing Checkpoints
Refugee Area Closing and Temporary Housing Provision	7.0	3.9	7.8	8.0	0
Reconstruction of Houses	9.0	5.6	7.3	6.0	-2.0
Township Rehabilitation Planning and Institutional Development	7.0	5.3	7.0	6.7	-2.0
Demolition of Damaged Buildings and Debris Disposal	0	1.0	1.0	1.0	0
Industry Rehabilitation	8.0	7.0	7.1	6.4	-2.0

Source: Project Team

Bottlenecks identified by the listed checkpoints are generally found quite relevant. Implementation methods that have been derived from these bottlenecks are also found appropriate, although slightly less. However, some of the checkpoints applied directly from those complied in Japan after the Great Hanshin-Awaji Earthquake were found to be irrelevant, while there also seems to be some missing checkpoints that are necessary for Sri Lanka. The difference can be attributed to the fact that the list developed in Japan was compiled after the earthquake experience, whereas the disaster in Sri Lanka was caused by a great tsunami, a very different phenomenon. Also, economic and social circumstances were quite different, which makes some difference in the weighting of issues in each respective society.

However, the list itself proved quite useful in identifying work to be done in a very systematic manner, quickly reaching practical solutions. It is therefore most desirable for Sri Lanka to prepare such a list in a fashion similar to the Japanese one, through a thorough compilation of its own experience in post-disaster management.

9.3 Evaluation of the Co-Assistance Approach

9.3.1 Methodology of Evaluation of the Co-Assistance Approach

(1) Background

The co-assistance approach aims to enhance the cooperative behavior of community groups with the final goal of a better life. Pilot Projects implemented in this project are positioned as tools to verify this co-assistant approach. Therefore, it is necessary to evaluate the Pilot Projects in terms of how the co-assistance contributed to outcomes resulting in the improvement of the quality of life of victims.

Based on the co-assistance approach, the Pilot Projects included various community activities, such as the establishment of committees, publishing of newsletters, and lending of equipment. There is no doubt that these activities contributed to the rehabilitation of the lives of victims directly. It is, however, quite difficult to clearly figure out how co-assistance involved rehabilitation processes through these activities.

(2) Introduction of the Concept of Social Capital

To clarify the difference from activities without co-assistance (such as the simple provision of equipment), the concept of "social capital" is introduced for the evaluation (this is one of the five capitals necessary for the Sustainable Livelihood Approach[2], originally proposed by DFID.[3] Although there is much debate about social capital, social capital can be defined as, *"various factors affecting the cooperative behavior of a human group aiming at some development goals in a human group".* Since co-assistance aims to enhance the cooperative behavior of community groups that are aiming at a better life in the context of the project, co-assistance can be considered to strengthen social capital.

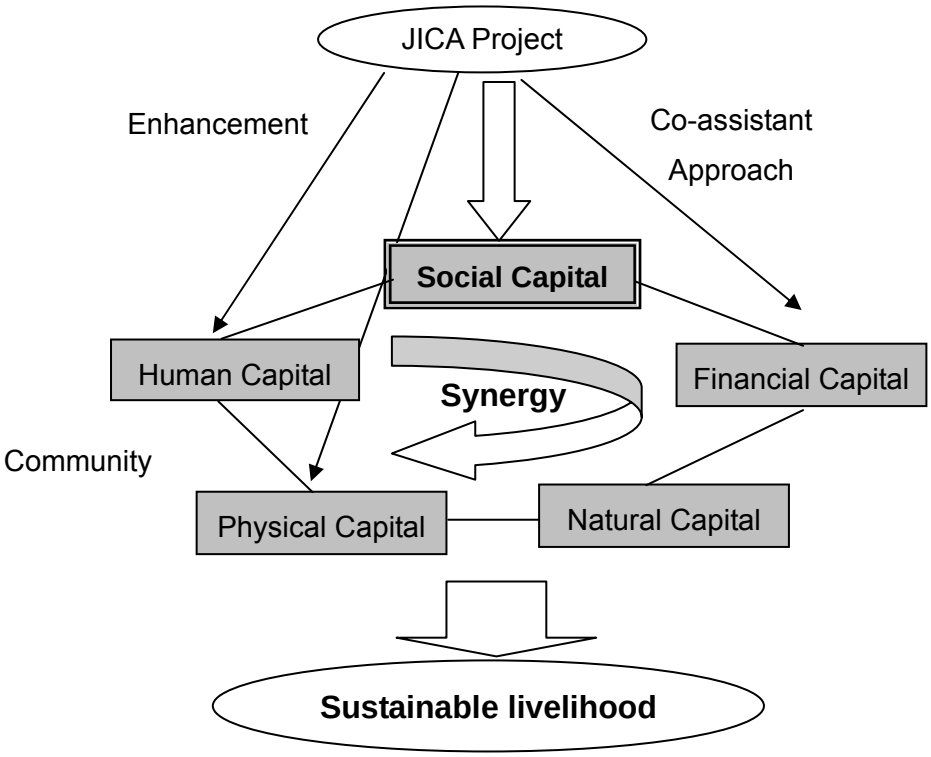
Besides social capital, there are four other capitals: human capital, natural capital, physical capital, and financial capital (as shown in the Sustainable Livelihood Approach). The balance among these five capitals determines the quality and sustainability of lives. Once a disaster devastates the capital balance in a household or a community,

[2] In the context of DFID, the term "livelihood" has a wider meaning, including not only ways to earn money, but also implies life quality or living environment.
[3] According to DFID, social capital is defined as: "the social resources upon which people draw in pursuit of their livelihood objectives". Source: http://www.livelihoods.org/info/info_guidancesheets.html.

sustainable livelihood is disturbed. For rehabilitation from a disaster, damage to each of the capitals should be examined in order to set priorities. Recovery of the damaged capitals may effectively facilitate the reconstruction and development of communities.

Generally speaking, the social capital has a synergy with the other capitals and enhances sustainable livelihood. The activities in the Pilot Projects can be explained as the enhancement of these four capitals, together with the social capital. For instance, the lending of equipment coordinated by the committee is considered as an enhancement of the physical capital, together with the social capital.

Based on the above considerations, the JICA Project Team focuses on social capital in the evaluation of the co-assistance approach.



Source: Project Team

Figure 9.1 Five Resources Needed for Sustainable Livelihood

Information Box

According to DFID, the five capitals are summarized as follows:

1) Human Capital

Human capital represents the skills, knowledge, ability to work, and good health that together enables people to pursue different livelihood strategies and achieve their livelihood objectives. At the household level, human capital is a factor in the amount and quality of labor available (which varies according to household size), skill levels, leadership potential, health status, etc.

2) Natural Capital

Natural capital is the term used for natural resource stocks from which resource flows and services useful for livelihoods are derived. There is wide variation in the resources that make up natural capital, from intangible public goods such as the atmosphere and biodiversity, to divisible assets used directly for production. Examples of natural capital and services deriving from it include land, forests, marine/wild resources, water, air quality, erosion protection, waste assimilation, storm protection, biodiversity degree, and rate of change.

3) Financial Capital

Financial capital denotes the financial resources that people use to achieve their livelihood objectives. The definition used here is not economically robust in that it included flows as well as stocks, and can contribute to consumption as well as production. However, it has been adopted to try to capture an important livelihood building block, namely the availability of cash or an equivalent, which enables people to adopt different livelihood strategies. Examples include cash, savings, access to credit, and employment with a regular income.

4) Physical Capital

Physical capital comprises the basic infrastructure and producer goods needed to support livelihoods.

- Infrastructure consists of changes to the physical environment that help people to meet their basic needs and be more productive.
- Producer goods are tools/equipment that people use to function more productively.

The following infrastructure components are usually essential for a sustainable livelihood:

- Affordable transport;
- Secure shelter and buildings;
- Adequate water supply and sanitation;
- Clean and affordable energy; and
- Access to information (communications).

5) Social Capital

There is much debate about what exactly is meant by the term "social capital." In the context of the sustainable livelihoods framework, it is taken to mean the social resources upon which people draw in pursuit of their livelihood objectives. These are developed through:

- **Networks and connectedness**, either vertical (patron/client) or horizontal (between individuals with shared interests) that increase people's trust and their ability to work together and expand their access to wider institutions, such as political or civic bodies;
- **Members of more formalized group,** which often entails adherence to mutually-agreed or commonly-accepted rules, norms, and sanctions; and
- **Relationships of trust, reciprocity, and exchanges**, which facilitate cooperation, reduce transaction costs, and may provide the basis for informal safety nets among the poor.

(3) Characteristics of Social Capital

According to past studies, the characteristics of social capital are classified in several ways. The following two kinds of characteristics are classified according to the function of the social capital:

(i) Internal Bonding Social Capital (SC); and
(ii) Bridging Social Capital (SC).

The internal bonding SC strengthens internal bonds in a group. Considering that co-assistance aims to enhance cooperative behavior in a group and quicken improvement of life quality under conditions that public assistance does not work well enough, internal bonding SC is one of the pre-conditions for realizing the co-assistance.

On the other hand, the bridging SC strengthens relationship between a community and outside groups or organizations. The bridging SC is considered to contribute to the improvement of life quality from the point of view that good communications with local authorities and donors encourages them to understand what communities exactly need and to provide proper assistance. In addition, sharing information with other communities, as the Pilot Project promoted in study tours and newsletters, is one aspect of bridging SC.

Thus it is assumed that both the internal bond SC and the bridging SC were enhanced as a result of various pilot activities in the communities. We will use this classification for the analysis of the social capital.

In addition to the above, there is another classification as following, which are classified according to the appearance of social capital:

(i) Cognizant SC; and
(ii) Institutional SC.

While the cognizant SC is reflected in improved recognition among concerned people and in morale, the institutional SC appears as establishing institutional systems and customs within the community.

(4) Methodology of Evaluation

The evaluation method will include: (i) how the social capital was enhanced by projects involving community activities; and (ii) how the social capital contributed to the improvement of the quality of life. Importantly, it is necessary to be aware of social backgrounds and characteristics of small communities in Sri Lankan society. The JICA Project Team carried out the evaluation in the following steps.

1. Evaluation of Social Capital from the Perspective of Beneficiaries

This evaluation is from the perspective of the beneficiaries. It can clarify how beneficiaries recognize social capital and its contribution to the improvement of the quality of life through community activities of the Pilot Projects. This was done through a series of workshops as described in Sections 4.4, 5.4, and 6.4 in this report. This process has three stages and is to be done in three sessions as follows (detailed results of the evaluation workshop are shown in Annexes 4-7, 5-5, and 6-5):

Session 1: Assistance offered to the Society (except for that by the Pilot Project);
Session 2: Assistance from the JICA Pilot Project; and
Session 3: Institutional capacity before and after the tsunami.

2. Evaluation of Capitals for Improvement of the Quality of Life Enhanced by the Project

Through the assessment of the five capitals, the second step clarified how each capital was enhanced by Pilot Project activities and identified the differences between the JICA Project and other donor assistance. This was implemented from the results of evaluation workshops and the first step.

3. Evaluation of Social Capital from the Perspective of the Improvement of the Quality of Life

Based on the above evaluations, the third step is the evaluation of social capital from the perspective of the improvement of the quality of life. Through this evaluation, the following issues were detailed: (i) how the enhancement of social capital contributes to improve the quality of life of affected people; (ii) how financial, physical, natural, and human capitals were enhanced/complemented by social capital; and (iii) how social backgrounds and characteristics affected social capital.

9.3.2 Evaluation of Social Capital from the Perspectives of Beneficiaries

Based on the results of the evaluation workshops as described in Sections 4.4, 5.4, and 6.4 in the report, this section summarizes the evaluation of the social capital from the perspectives of beneficiaries. The detailed results of the evaluation workshop are shown in Annexes 4-7, 5-5, and 6-5.

(1) Correct Understanding of the Requirements/Needs in the Community

The Noonwella Fisheries Society stated that earlier, they were focused mainly on “individual” or their own needs. Now, however, there is a greater awareness of community needs. Dodampahala members also pointed out that they have now gone beyond the needs of their members, looking at broader village needs (such as the need for a road).

In one camp, people felt that there was a common consensus. In another, however, others felt there was no clear recognition of community needs due to poor

communication and management of the working committees. The key reasons for the difference was the fact that in the first camp, all people came from the same village and knew each other before the tsunami, while in the other camp, people originated from nine different villages.

(2) Fairness of Management

All members of the three fishery societies felt management was fair as the executive committee was in close touch with members and addressed their concerns. This was very evident in the Noonnewlla Co-operative and improving in Dodanpahala. The food processing and diver association members felt that there was no fairness in management, due to the weakness of the divers association and the dispersed location of members of both trade associations. One camp reported a high level of fairness, while another said it was poor, but improving. The second camp was where people came from nine different villages.

(3) Trust Among Members

Trust among members was rated as high in all three fisheries co-operatives. In the Food Processing Association, it was reported as very high and growing (where some members passed technology to others and some assisted others in marketing (particularly in terms of getting orders)). One camp scored high in trust, while another stated it was improving from what it once was. Members of the Gurubibile Camp seem to trust the secretary more than other office bearers do, due to his high motivation to serve.

(4) Internal Spontaneous Mutual Help

The two camps showed improvement in mutual help after the associations were formed. There was no such spirit in the divers association for the same reasons given earlier, but this was developing in the Food Processing Association with at least some members helping each other (especially in business). In the three fisheries co-operatives, mutual help is very extensive (both in business as well as private issue, deaths, marriages and other events), due to the fact that all members came from the same hamlet and know or are related to each other.

(5) External Negotiation

All three fisheries co-operatives reported improvements, especially in attempting to obtain tsunami assistance from other agencies. The most significant improvement in this sphere was reported from the Pathagama Camp, where the association was able to negotiate with the Loadstar Company (who managed the camp) to extend its management when the latter decided to withdraw. The divers association also reported that they managed to negotiate with the Sri Lankan Navy to obtain diving training for members.

The fisheries co-operatives improved their relationship with other co-operatives (due to the study tours) and obtained requests to supply dry and Maldives fish to an inland co-operative in Kotapola. The Gurubibila and Pathagama Camps developed relationships and exchanged issues, while also establishing contacts with other camps.

(6) Cooperative Attitude for Community Activities

Cooperation was very high in the Pathagama Camp and the three fisheries co-operatives, while improving in the Gurubibile Camp and in the food processing association. Cooperation, however, was deemed poor in the diving association. Members of all fisheries associations and camps organize many religious and social activities.

9.3.3 Evaluation of Capitals for Improving the Quality of Life by the Pilot Project

(1) Activities of Pilot Project Enhancing Capitals for Improving the Quality of Life

In summary, the assistance given by the Pilot Projects for the development of the five capitals is as follows.

Type of Capitals	Specific Activities in the Pilot Projects
Social Capital	Forming/strengthening society
	Conducting study tours to visit strong societies
	Introducing a constitution for the new societies
	Training persons in the maintenance of books and accounts of society
	Providing cupboards and stationery for society
	Assisting the fisheries co-operatives that lost their records to develop them

Type of Capitals	Specific Activities in the Pilot Projects
	with assistance from the Fisheries Department
	Providing continuous advice
	Monitoring progress
	Facilitating monthly meetings of all new societies (with at least one staff member present)
Human Capital	Computer Training - Pathagama Camp
	Maldives Fish-Making - Fisheries co-operative and food processing societies
	Net-Making - Fisheries co-op
	Positive Thinking - All co-operatives and camps
	Business Management and Business Plan Development Training - Camps, garages, and food processing societies
	Society Management Training
	Food Processing Training
	Out-Board Motor Repairing Training - Fisheries Co-operatives
	Seminar on Sustainable Management of Coral Reefs
	Providing Licenses to Divers without Licenses
	Technology Training for Garage Owners and Workers (January 2006)
	Training in Revolving Loan Fund Management (January 2006)
Financial Capital	Linking with UNDP to procure Rs.7.5 m in credit funds for the three fishery co-operatives
	Linking with UNDP to procure Rs.2.9 m of credit funds for the three trade associations
	Linking with Berndiana DS to procure Rs.600,000 of credit funds for the two camp societies
Physical Capital	Replacing assets lost by businessmen in trade associations (Rs.4m)
	Providing gas cookers for camp residents
	Providing cupboards for camp residents
	Providing generators for Camp Society
	Providing rechargeable flashlights to Camp Society
	Providing bank buildings for two fisheries co-ops
	Providing out-board motor locker building for one fisheries co-operative
	Providing one community hall for one fisheries co-operative
	Providing fish auction hall for one fisheries co-operative

Objective evaluation of the benefits of the co-assistance approach has been done in the following sections.

(2) Livelihood Capitals of Refugee Camps before and after the Tsunami

Since the objective of the rehabilitation assistance is to recover the situation prior to the tsunami, this report supposes that each capital used to be a benchmark. This does not mean that communities of tsunami-affected areas had a better life and were free from poverty, but is used to established the pre-tsunami situation as the benchmark for the rehabilitation work. Thus, Figure 9.2 shows the situation of the five capitals before the tsunami, while Figure 9.3 shows that after the tsunami.

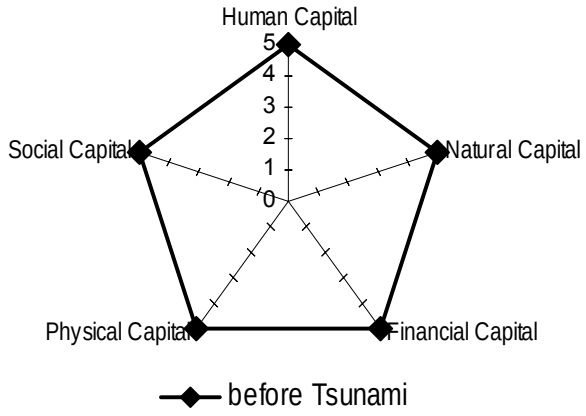


Figure 9.2 Five Livelihood Capitals before Tsunami

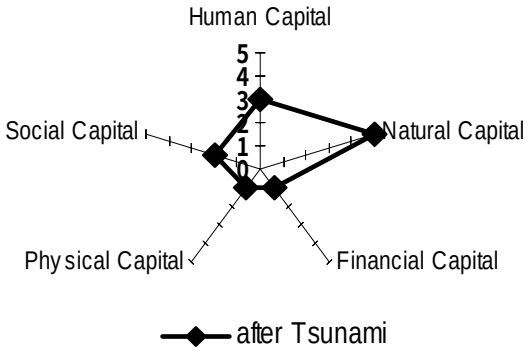


Figure 9.3 Five Livelihood Capitals After Tsunami

1) Human Capital

The score for this capital was reduced from five to three, due to tsunami-related casualties. Refugees evacuated from the coastal villages and towns to the camp faced completely new circumstances and had difficulties in using their conventional capacities.

2) Natural Capital

The score for natural capital did not change as fish resources were not seriously damaged. Concerning the control of the natural disaster, nothing improved after the tsunami (although the possibility of another tsunami is very remote).

3) Financial Capital

The score for this capital was reduced from five to one as fishermen lost their boats and gear, while victims in other jobs lost their employment. Generally speaking, their savings were too small to recover these lost assets.

4) Physical Capital

The score for this capital was reduced from five to one as refugees lost their houses and properties and moved to camps, where basic infrastructure was not sufficiently provided. Neither the Gurubewila or Pathegama Camps had sufficient water for bathing. Furthermore, the Pathegama Camp is 3.0 km away from the sea and had serious transportation problems.

5) Social Capital

The score for this capital was reduced from five to two, as traditional social capital was lost when the community was broke up after evacuation. None of the camps had any mechanisms to control the communities by themselves. At the individual household level, however, Pathegama refugees had more remaining capital than did Gurubewila refugees, as refugees from the former came from one village, while those at the latter came from seven different villages and did not previously know each other.

(3) Camp Assistance from Other Donors

What the JICA Project Team did for the refugee camps (through the pilot project activities) was only a small part of the total assistance offered by various organizations. Nevertheless, the JICA Project Team carefully observed the needs of the refugees and allocated resources to those areas that have not witnessed improvement from other organizations.

Figure 9.4 shows the pattern of assistance from government agencies, NGOs, and donors other than this JICA Project. Among other activities, they assisted camp refugees in a way to compensate for the damage in financial and physical capitals, with some assistance for human capital.

Figure 9.5 shows the status of the five capitals after recovery with other donors' assistance. Physical and financial capitals made considerable recoveries.

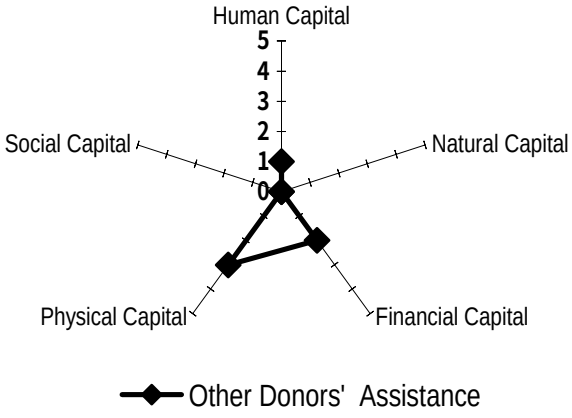


Figure 9.4 Assistance from Other Donors

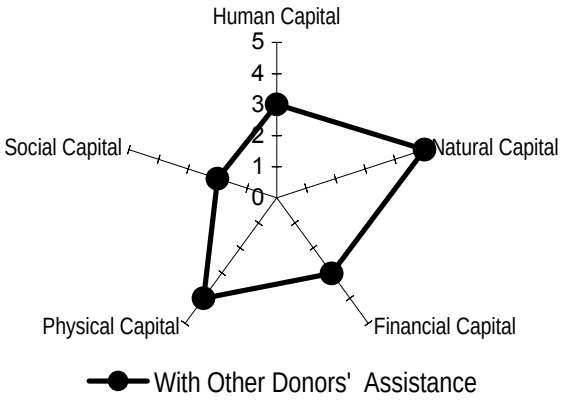


Figure 9.5 Recovery of Capitals from Assistance from Other Donors

(4) Camp Assistance by the JICA Pilot Project

Figure 9.6 shows the categories of assistance by the JICA Pilot Project.

1) Human Capital

The JICA Project support made considerable input for human resource development.

2) Natural Capital

The JICA Pilot Project made little contribution in this category.

3) Financial Capital

The JICA Pilot Project tried to establish a savings and micro-credit system in refugee camps, in collaboration with the Berendina Foundation, while other agencies (especially government agencies) delivered cash for food and for the rehabilitation of damaged accommodations.

4) Physical Capital

The JICA Project Team also enhanced the physical capital that had yet to sufficiently recover. This assistance was implemented after a careful needs assessment and repeated discussions with camp societies.

5) Social Capital

This was what the JICA Project Team placed high priority on. Camp societies have been organized and encouraged to make decisions on camp management, as well as to

negotiate with government agencies and NGOs. Since the Lordstar Company withdrew its management from the camps, camp societies had to undertake camp management by themselves. The JICA Project Team implemented assistance for other capitals as well, but with a view towards enhancing social capital in the end.

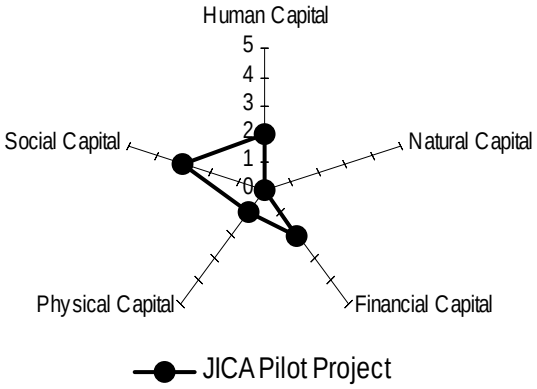


Figure 9.6 Assistance from JICA Pilot Project

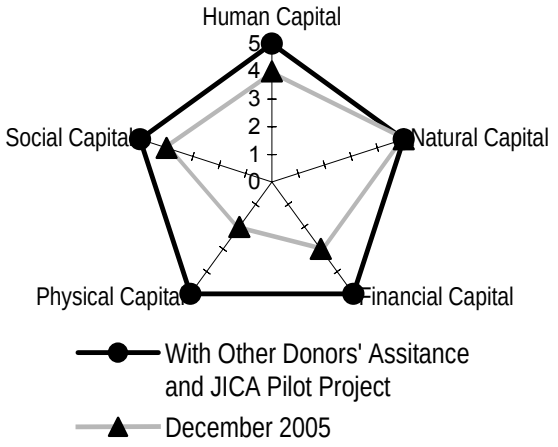


Figure 9.7 Five capitals after Culmination of Assistance

Figure 9.7 explains the status of the five capitals after all assistance was completed. This figure indicates that assistance from various organizations and the JICA Pilot Project complemented each other in recovering sufficient capitals for the sustainable livelihood.

As evaluation of the Pilot Project was conducted in December 2005, the Pilot Project is still in progress at the time of this writing and not all planned activities have been completed. As such, the effects of the Pilot Project cannot be evaluated for at least another several months after the completion of all planned activities. The line in Figure 9.7 (“December 2005”), shows the achievement of the Pilot Project at the time of evaluation. Physical capital will recover more once refugees move to permanent houses.

(5) Livelihood Capitals of FCSs before and after Tsunami

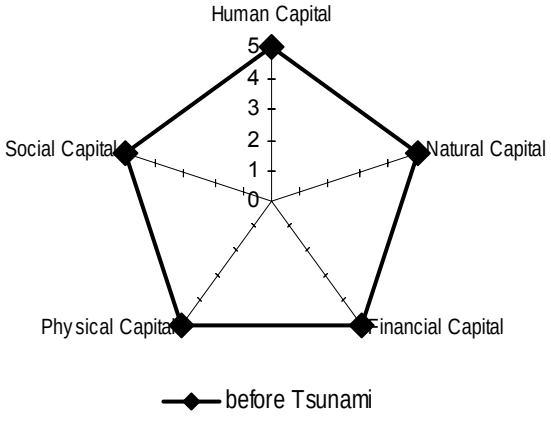


Figure 9.8 Five Livelihood Capitals before Tsunami

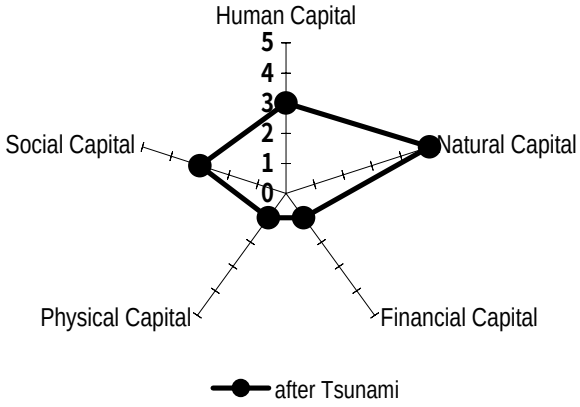


Figure 9.9 Five Livelihood Capitals after Tsunami

The JICA Project Team established the pre-tsunami situation as the rehabilitation benchmark and gave a rating of five to all capitals. Figure 9.8 shows the situation of the five capitals before the tsunami, while Figure 9.9 illustrates the five capitals after the tsunami disaster.

1) Human Capital

The score of this capital was reduced from five to three. Even though causalities were not so serious in these FCSs, survivors had no experience in this kind of disaster and did not know how to manage their life.

2) Natural Capital

Natural capital was not affected, as there were no reports of fishing resources having been significantly reduced by the tsunami.

3) Financial Capital

The score of this capital was reduced from five to one, as the Epitamulla and Dodampahara FCSs lost their office buildings, together with their micro-credit activity records. The FCSs had difficulty in maintaining micro-credit business operations, meaning that FCS members lost access to credit when they needed it most. Also, fishermen could not be engaged in fishing activities and lost their income.

4) Physical Capital

The score of this capital was reduced from five to one, as individual fishermen lost their boats and fishing gears, while FCSs lost their facilities such as office buildings and auction halls. For FCS members, these common facilities were essential infrastructure for their livelihoods.

5) Social Capital

The score of this capital was reduced from five to three, as the motivation of members was damaged significantly due to the institutional crisis of the FCSs.

(6) FCS Assistance from Other Donors

No other donors or government agencies focused on the FCSs with their tsunami rehabilitation programs. For each household of the fishery villages, various donors offered diverse support. Since almost all members of the Epitamulla FCS are refugees, they received considerable assistance, like those in the Gurubawilla and Pathegama Camps did (as noted in Chapter 4 of this report). Figure 9.11 illustrates the situation after interventions by other donors.

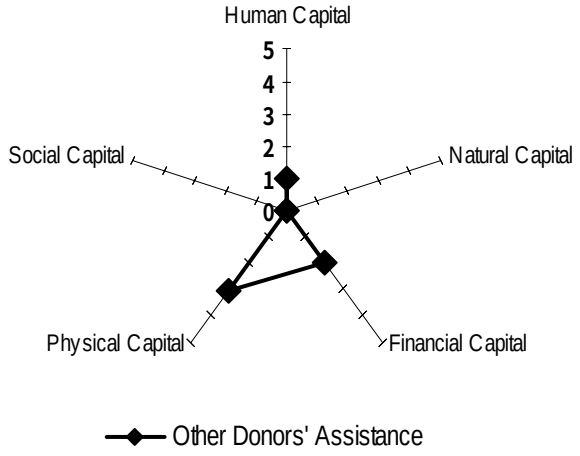


Figure 9.10 Assistance from Other Organizations

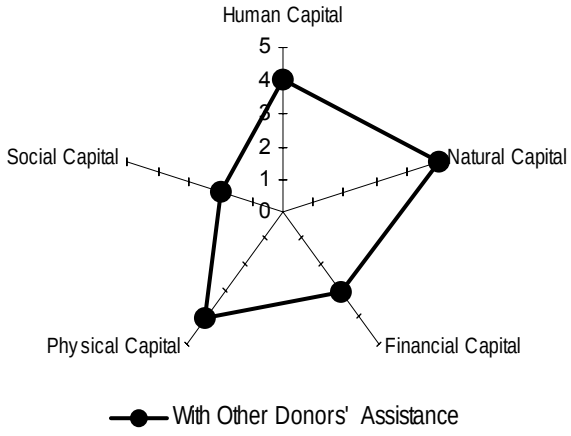


Figure 9.11 Recovery of Capitals from General Assistance

(7) FCS Assistance from the JICA Pilot Project

Figure 9.12 shows the categories of assistance provided by the JICA Pilot Project to the three FCSs.

1) Human Capital

Some training on positive thinking, business development, Maldives fish processing, and fishnet mending were conducted.

2) Natural Capital

Since there was no tsunami damage to natural capital, the JICA Project Team made no interventions.

3) Financial Capital

The JICA Pilot Project coordinated an enhancement in the micro-credit scheme. UNDP allocated a loan fund to the FCSs for a more business-oriented credit program that was prepared by each FCSs with assistance by the Pilot Project. Business development seminars and construction of an office building were also part of the effort.

4) Physical Capital

The JICA Pilot Project did not offer any capital to individual households. Instead, it supported the reconstruction of FCS common facilities such as office buildings, OBM lockers, auction halls, and meeting halls in order to enhance social capital and co-assistance.

5) Social Capital

The solidarity and motivation of FCS members has improved significantly during the Pilot Project. All FCSs significantly increased the number of members, amount of savings, and loan disbursement amounts.

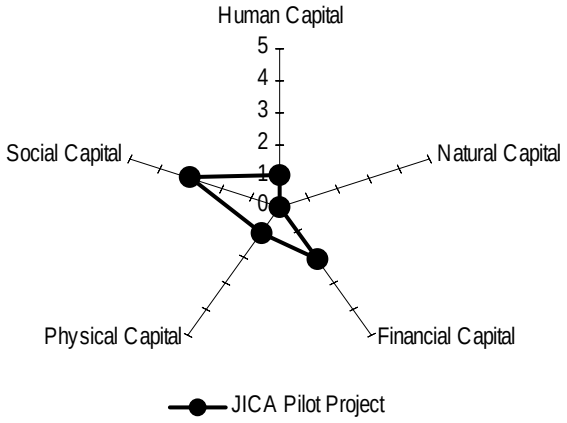


Figure 9.12 Assistance from JICA Pilot Project Pilot Project

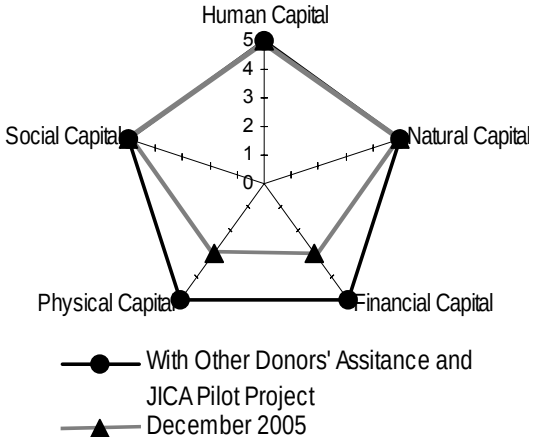


Figure 9.13 Five Capitals after Culmination of Assistance

Figure 9.13 indicates that planned status of the five capitals after all assistance is completed. This figure indicates that assistance from other donors and the JICA Pilot Project complemented each other and recovered to a sufficient level for a sustainable livelihood. In Figure 9.13, the line titled “December 2005” indicates the achievement of the Pilot Project at the time of evaluation.

(8) Capitals of Small Industries before and after Tsunami

1) Five Capitals before Tsunami

The JICA Project Team set the pre-tsunami situation as the rehabilitation benchmark, giving a full score of five to all capitals except social capital. Before the tsunami, there was no association of small industries, while limited communication and co-assistance were practiced only at the individual levels. Thus, Figure 9.14 shows the situation of the five capitals before the tsunami, while Figure 9.15 shows it after the tsunami. Enhancement of the social capital of small industry communities is a rather new development instead of rehabilitation from tsunami damage.

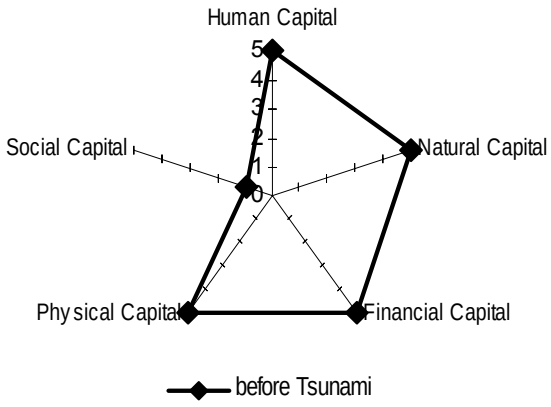


Figure 9.14 Five Livelihood Capitals before the Tsunami

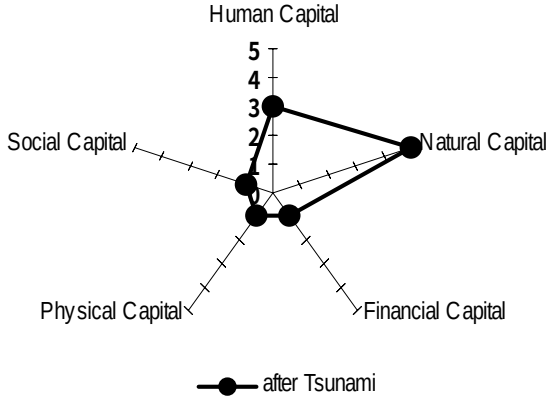


Figure 9.15 Five Livelihood Capitals after the Tsunami

2) Human Capital

The score for this capital was reduced from five to three, as even though causalities from the tsunami decreased this capital, skills of survivors did not decrease. It was found, however, that small enterprise owners did not know how to adapt their skills to the devastated situation after the tsunami.

3) Natural Capital

Natural capital did not change, as there were no reports that ornamental fish resources decreased. The food processing industry does not depend on natural resources.

4) Financial Capital

The score for this capital was reduced from five to one, as all members of the small industry associations lost their equipment and could not operate to earn a regular income as they did prior to the tsunami.

5) Physical Capital

The score for this capital was reduced from five to one, as business owners had their houses damaged and equipment lost. Business owners in the ornamental fish, food processing, as well as garage industries could not buy back the equipment by themselves.

6) Social Capital

This capital was unchanged and remained at a score of one, as no groups worked together.

(9) Small Industry Assistance from Other Organizations

No other organization focused on the two industries that the JICA Project Team selected as target groups of the Pilot Project. This was because the Industrial Development Board offered a list of tsunami-damaged industries and the JICA Project Team then selected target industries that had been given very little support. Figure 9.16 shows the assistance provided by organizations other than the JICA Pilot Project. Figure 9.17 shows the situation after general assistance interventions. Little recovery was observed.

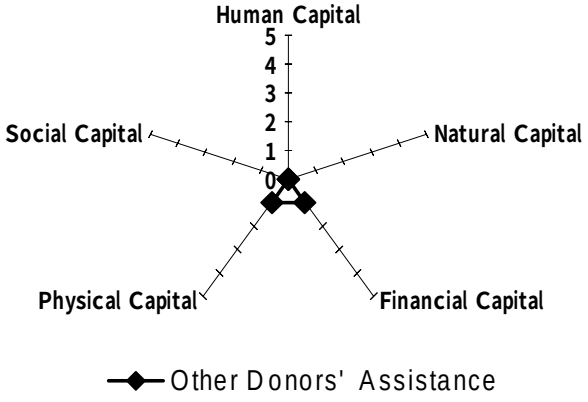


Figure 9.16 Assistance from Other Donors

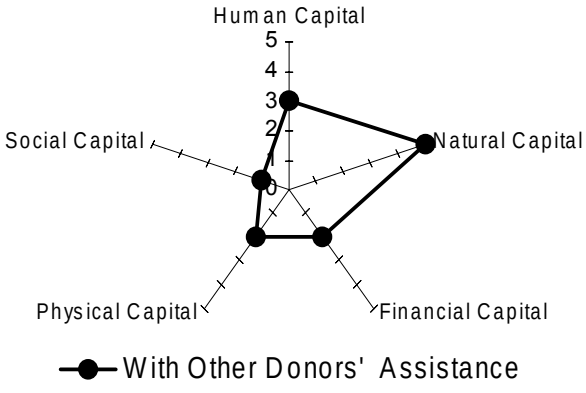


Figure 9.17 Recovered Capitals with Other Donor Assistance

(10) Small Industry Assistance from JICA Pilot Project

Figure 9.18 shows the categories of assistance provided to the selected small industries by the JICA Pilot Project.

1) Human Capital

Training was not completed by the time of evaluation. Some training (such as that concerning food processing, diving, and business development) is expected to be carried out soon. Even though the beneficiaries have considerable skills for their own business fields, training offered by the Pilot Project will further enhance their working and business capacities.

2) Natural Capital

The JICA Pilot Project made few contributions in this category, except for disaster awareness education through newsletters, meetings, and workshops.

3) Financial Capital

The JICA Pilot Project coordinated a micro-credit scheme for the target small industries. The Ruhunu Development Bank will manage the scheme with funds donated by UNDP, while the Enterprise Development Service Center (EDSC) will support the beneficiaries with business plan development.

4) Physical Capital

Even though the main objective of the Pilot Projects was to establish the co-assistance mechanism with small business owners, equipment procurement was essential to restart individual businesses. Equipment for food processing and diving was delivered to the associations and was lent to member beneficiaries. All recipients successfully revived their businesses and are now earning stable incomes.

5) Social Capital

Social capital is a new asset for the selected small industries. In [illegible]ion with IDB, the JICA Project Team organized business owners together, who later established the Food Processing Association and Ornamental Fish Association. Due to the delay of organized activities and training, social capital has not been fully developed (particularly in the Ornamental Fish Association).

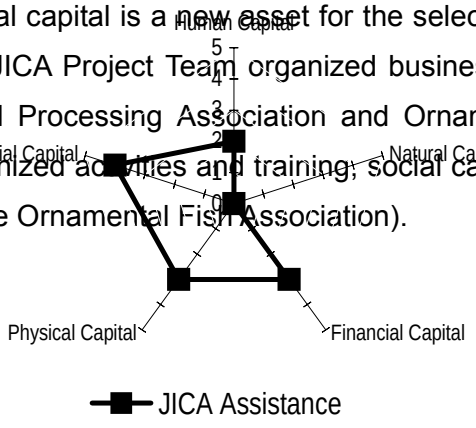


Figure 9.18 Assistance from JICA Pilot Projects

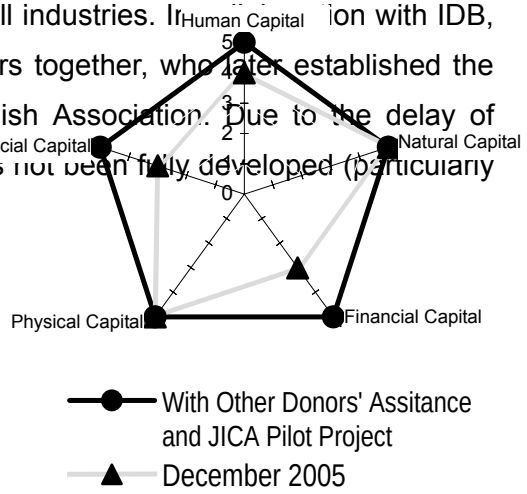


Figure 9.19 Five Capitals after Culmination of Assistance

Figure 9.19 indicates the planned status of the five capitals after the completion of assistance. This indicates that assistance from various organizations and the JICA Pilot Project complemented each other and accumulated sufficient capitals for sustainable livelihoods.

The evaluation workshop revealed that the Ornamental Fish Association may be unable to fully develop its social capital and may need to be reorganized (as suggested in Section 6.4.8.(3) “Institutional Governance).

9.3.4 Evaluation of Social Capital from a Perspective of Improving the Quality of Life

(1) Improvement of the Quality of Life through Enhanced Internal Bonding SC

1) Correct Understanding of Requirements/Needs in the Community

In the two camps, initial requests for common needs included utilities (such as a well and electricity supply). Over time, however, this changed due to many reasons. In one camp, they found that well water was unsuitable, while in another, it was found that a donor was going to build a well together with permanent housing. The request for electricity was also given up when residents realized that they would not be staying for too long in the transitional shelters.

Then, both camp societies identified revolving loan funds and small business/self-employment assistance as common needs. Micro-finance and revolving loan funds, together with savings, can act as a glue to keep societies cohesive, as they meet an important need of all members and committees, while also assisting a large number of members. Micro-finance also helps this, as there is an interest component, which can be used for society activity. This was relevant and appropriate and useful to most members. They were able to identify at more long-term relevant needs for the community, due to the regular meetings and increased internal bonding.

The Pathegama Camp also wanted a generator and sound system to generate income for future activities and sustainability of the society. This is a sound long-term decision by the Pathegama Camp Society, which is aware that donor assistance is only for a short time and that society must have its own sources of income.

In the fisheries co-operatives, a common understanding of the needs always existed. However due to the impetus given by the Project, the subsequent strengthening of the co-operatives, and the buildup of social capital, the horizons of people expanded and members of the Dodanpahala Fisheries Co-operative started focusing on broader needs such as road construction and the promotion of children's savings. In Sri Lanka, traditionally there are both single-activity community-based organizations (that for example will focus only on micro-finance or on death assistance) and also multi-activity societies (such as these co-operatives).

The small industry associations identified activities such as business management training, skills development, leadership training, food technology, food quality improvement, packaging, as well as new technology in vehicle painting, auto air conditioning, hydraulic system development, scientific diving course, and sustainable natural resource management. Except for ornamental fish collectors and divers societies, other needs were identified though participatory methods used in a workshop. The Project's use of participatory methods ensured a greater democratic platform for representative views and for all members to voice their views (unlike in the past when only "vocal" members or office bearer's views received attention).

2) Fair Opportunities for Assistance for All Members

At the Pathegama Camp, the leaders are very close to the people and communicate closely with them, providing assistance in an equitable manner. This is partly due to the fact that membership is small, limited to only 29 families, and that families came from the same village and were either related to or knew each other. The leaders, however, focused more on "society sustainability needs", rather than on member needs except for the revolving loan fund, which was a fair request benefiting all members.

On the other hand, at the Gurubibila Camp, people came from nine separate Grama Sevake Divisions, and did not know each other beforehand. Hence, there is less community spirit. This was worsened by the fact that the outside camp manager was authoritative and did not even support the formation of the society. Overall, there was a greater focus on individual needs. In the end, however, the leaders also recognized the need for small business and self-employment assistance (in particular needs for capital in the form of a revolving loan fund).

All fisheries associations showed high responsiveness to member needs due to the fact that they are both old existing societies living in a very close and cohesive community. They also went further into the general community need such as new roads. The small industry association members are too dispersed throughout the district, while some (such as the ornamental fish collector/divers) are too large to become cohesive in such a short time (i.e., during seven months since the Project formed these associations). Furthermore, the members were struggling to restart their own businesses and were less worried about giving fair opportunities to fellow members.

In summary, it is considered that Community Based Organizations generally contributed to promote fair opportunity for assistance, although there were some difficulties for new organizations.

3) Relationship of Mutual Trust with Other Members

Mutual trust was considered to be high in the three fisheries co-operatives, due to the fact that they were old existing societies. Relationships were also good in the Pahathgama Camp society, as members originated from the same village.

In the Food Processing Society, members have already started assisting fellow members in technology. For example, one established yogurt producer is assisting another member, who was earlier only transporting yogurt to commence production, through technology transfers. As the older producer is from Dikwella and the other from Polhene in Matara, they do not think of themselves as competitors. Another decision taken by food producers was that when a member receives a large order which he/she cannot handle, then the order would be shared with another producer who operates in the same line of business.

In another case, a garage owner from Thotamune in Matara, whose building was damaged, was assisted by the Project with materials, while fellow members of the Garage Owners society provided the labor. This is a building made from metal sheets and galvanized pipes. This kind of relationship of trust is evolving in other societies, but will take more time.

4) Communication with Other Members of the Community

The regularity of meetings and seminars assisted by the Project has improved communication between members. This was very important for trade associations as

members were dispersed around the entire district. Over time, communication and trust improved to such an extent, that members would talk of assisting other's businesses in many different ways.

(2) Improvement of the Quality of Life through Enhanced Bridging SC

1) Enhancement of External Network

The formation of a camp society and subsequent buildup of social capital assisted the camp residents to coordinate and obtain external assistance. The biggest such assistance came from the linkage with UNDP, as facilitated by the Project, which procured additional funding for loan capital to all three fisheries co-operatives (this was a significant sum totaling Rs.7.5 m (US$75,000)). UNDP also provided Rs.2.9 million as credit to members of the three trade associations. In addition to loan funds, UNDP also gave another grant of Rs.4.5 million to purchase office furniture for the three Fisheries Societies. Meanwhile, the Project linked with Berendina Development Services (BDS), a Dutch-funded local NGO, to provide Rs.2 million worth of equipment to 50 garage owners and diving equipment worth Rs.595,000 to 85 divers. BDS is also planning to work with the two camp societies to develop a revolving loan fund of up to Rs.600,000.

In another example, the Project was able to link the Pathagama Camp society leadership with a French NGO, TFS Academy, to provide computer training classes to camp children. In addition, BDS is also providing funds for the training of society members in camps and the training of garage staff. This work is to start in January 2006.

Thus amazingly, the Project was able to link societies to assistance worth over Rs.20 million (when its own total local management cost and assistance to beneficiaries excluding consultancy costs was Rs.16 million). Such considerable assistance from so many agencies was received by the societies because the project followed a co-assistance approach and insisted on the forming or strengthening of societies and developed the social capital of the group. In the evaluation, beneficiaries of the process followed by JICA acknowledged that assistance to form societies and strengthen them was the biggest contribution of the project, and not the material inputs (physical capital) provided by the Project.

2) Enhancement of External Negotiation

All the above linkages occurred due to the existence of a strong society, as well as to the Project catalyzing the linkages. However, more impressive were the linkages and work done by society itself, through its own efforts with little assistance from the Project.

In one such example, the Pathagama Camp Society was able to extend the services of the Loadstar Group in camp management by lobbying for this service, once the company decided to terminate its camp management services. In another more important instance of the impact of social capital, the Society (through letters and meetings) requested that the Loadstar Company provide housing for camp inmates who were not entitled to separate housing as they had been living in joint family houses. The company has now approved this request and has agreed to provide housing to 12 such families, subject to approval of the divisional secretary of the government. Now this request is with the government.

In another example of the effects of co-assistance, the society compiled a list of occupations/businesses of all beneficiaries with lost equipment and assets, and then sent this appeal to the Save the Children's Fund office asking for assistance. This is likely to be provided in 2006.

(3) Effect of Social Backgrounds and Characteristics in Sri Lanka Societies

In Sri Lanka, the experience of co-assistance over the last four decades has resulted in the formation of Community Based Organizations (CBOs), such as the "Co-operative Societies", which have provided the linkages to other organizations for partnerships. CBOs formed initially for micro-finance linked with donors that provided environmental, water and sanitation, or agriculture assistance. The existence of a cohesive CBO was a pre-requisite for other NGOs or projects to partner them in such work.

It should be noted that all societies formed or assisted by the Project are CBOs as opposed to NGOs. The difference being that NGOs are formed by well-meaning individuals or groups to assist others, while CBOs are beneficiary organizations owned, managed, and governed by beneficiaries. However, both forms of the organizations can be legally registered under the same Act of Parliament, namely the "Social Welfare Act".

In Sri Lanka, there are some strong and noted CBOs such as the Women's Development Foundation (WDF) in Hambantota, working in five divisions of the district. They have been able to link up with many donors such as USAID, which provided a building and training center. Currently, the World Bank is also providing considerable assistance in the form of grants. Such large CBOs are formed by federating smaller ones from the village level.

Despite the very high level of support the Project gave in other forms of capital, the evaluation of the beneficiaries showed that what they appreciated most was development of social capital in the form of the society or association. In this, they see a forum to work together and to lobby for further assistance on any issues they face.

The establishment of an institution makes them more visible to the government as well as to other agencies. They now have a letterhead and office bearers to represent them. They now feel they are not alone, a strong unified group to face the effects of the disaster. It was surprising to see this attitude, even in a newly formed group like the garage owners, which had members from different levels of society (micro-, small-, and medium-sized businesses) dispersed all over the district.

Of course, what is disappointing for them (especially for the small industry associations) is the fact that the Project and its support to strengthen society is so limited in time due to the short project duration. In other instances, the formation of trade associations under normal (not post-disaster) circumstances includes the Chamber of Commerce in Hambantota. The Chamber exists as a permanent entity and a link to support the trade associations formed. Though such a permanent body is not required, at least a two-year period of capacity building assistance would have been meaningful.

In following the strategy of co-assistance in a post-disaster situation, the Project was able to benefit from the traditional Sri Lanka rural societies desire to work in group situations. It was also able to capitalize on traditional Sri Lankan desires to serve others in the community, especially by those aspiring to leadership positions. Most leaders of such societies also enjoy the status and the power (in some cases) that comes from being a leader (although this is detrimental at times when leaders make decisions without consulting members).

However, the Project was able to avoid this as all three fisheries co-operatives, two camp societies, and two of the three trade associations held monthly member as well as committee meetings. This is extremely rare in Sri Lanka, as member meetings are held only once or twice a year and committee meetings only held every month, except in societies involving micro-finance.

In summary, the co-assistance approach adopted by the Project appears to be quite successful in that social capital was built up among beneficiaries and that such development in itself attracted the growth of other capitals in the community.

PART IV

MID-TERM REHABILITATION PLAN

Chapter 10 Suggestions for Regional Rehabilitation Plan

10.1 Introduction

Through implementation of the project and evaluation of the pilot projects as described in the previous chapters, the JICA Project Team learned many lessons. Based on these lessons, this chapter summarizes recommendations for a sustainable post-disaster rehabilitation plan.

In addition, disaster management is an essential factor in the rehabilitation plan to avoid serious damage from natural disasters in the future. There are some existing plans for public facilities and urban development, however, these plans have not sufficiently been prepared from the viewpoint of disaster management so far. In this chapter, the JICA Project Team summarizes various kinds of measures on disaster management plan for the Matara urban area, including preparation of a hazard map and implementation of awareness programs.

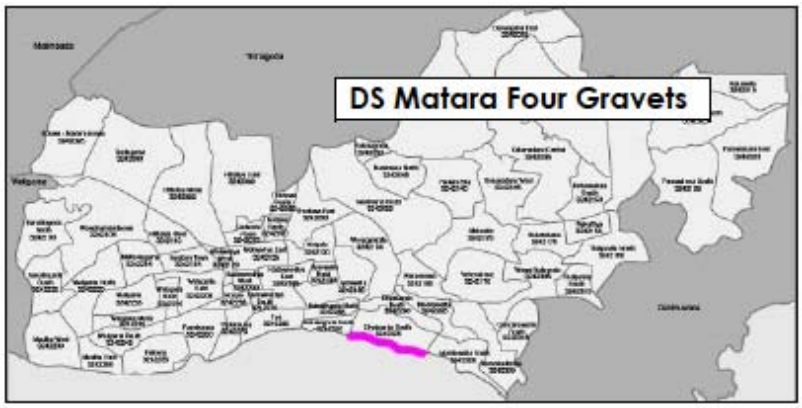
10.2 Review of Existing Urban Plans in Matara Urban Area

(1) 100 m Buffer Zone

After the tsunami, the Sri Lanka Government designated a 100 m buffer zone along the coast, which regulates buildings in the area within 100 m of the shoreline. The regulation in the buffer zone is summarized as follows:

- Rebuilding of damaged residential houses is prohibited;
- People whose houses were damaged are to be given new land and houses by the Government; and
- Buildings for tourism, fishery, and religion, infrastructure, and historical structure are exempted from the above regulations.

The Government did, however, relax regulations in some coastal areas, notably in Eliyakanda GN, Matara Division, where the buffer zone width was reduced to 25 m as it was a hilly area (as shown in the Figure 10.1).



Source: Humanitarian Information Center Sri Lanka

Figure 10.1 Relaxed Buffer Zone Area

(2) Institutional Setting for Disaster Management

Regarding the national level of disaster management, the National Disaster Management Center (NDMC), established under the Ministry of Women's Empowerment and Social Welfare, has been working on disaster management measures for more than 20 years with assistance from UNDP. However, after the tsunami, the Disaster Management Council and the Disaster Management Center (DMC) were established in the President's Office. The Disaster Management Council is expected to work on policy decisions, while the Disaster Management Center is an implementation body. Although they are still at a beginning stage and their roles have not been clearly identified, there is no doubt that they are the key organizations for disaster management.

In the Matara District, the national level NDMC and UNDP jointly have a district office in the Matara District Office. Also, DMC has a separate district office in the district office, with a district disaster management coordinator assigned to the office by the army of Sri Lanka.

As mentioned above, there are two organizations in parallel for disaster management; NDMC and the new DMC. According to an interview survey, it is presently expected that the DMC will be the main organization for disaster management (some say that the NDMC is going to integrate the DMC, although there is no official integration plan so far).

(3) Institutional Setting for Urban Planning

The Matara District Secretary (or government agent) coordinates various government agencies and their plans. Each agency such as the UDA, National Electric Board, National Road Authority, Sri Lanka Telecom, and National Water Board, has branch offices implementing their own projects. The District Secretary is to coordinate their activities and mitigate conflicts and inconsistencies. According to the Planning Department of the Matara District Secretariat, there is no integrated development plan at the district level.

On the other hand, the district office of the Urban Development Authority (UDA) provides urban development plans for each of the municipal/town councils under the authorization of the Ministry of Urban Development. In the Matara District, UDA has developed town plans for Matara city, Weligama town, Mirissa town, Kamburugamuwa, Devinuwara, and Dikwella.

The Matara Municipal Council has a regular committee to grant building permissions, as jurisdiction was recently handed over by the UDA. Every new building within the municipality must receive approval from this committee.

(4) Matara City Renewal Action Program (McRAP)

- Outline

The McRAP (Matara City Renewal Action Program) is the only township program being prepared for post-disaster Matara. Objectives of this program include avoiding ad hoc land use in the face of the relocation of tsunami-affected families, improving infrastructure and public facilities in the process, and building a disaster-free new urban center, assembling currently-scattered public services and economic institutions in a designated area.

The Government of Sri Lanka formed a special task force for McRAP in January 2005 under an initiative by the Minister of Ports and Civil Aviation (also a member of the Parliament of Matara District). After various surveys and studies, such as an impact assessment survey and a benchmark survey, this task force issued its first report named “McRAP” in June 2005. The Urban Development Authority, the Port Authority, the three universities, and other organizations have supported the task force. The Matara GA Office participated in the task force as an observer. McRAP is about to be finalized and authorized officially.

- Concept of Matara New Urban Center

One of the main concepts of the McRAP is the Matara new urban center, planned in the hilly area in the northwest of the center of Matara. The new center may include an administrative complex, a court complex, a new hospital, a commercial area, residential areas, industrial areas, and a national park as shown in the Figure 10.2.

- Road Network Development

The McRAP also proposed access roads connecting the new development area and Godagama, which is located 4 km north of the center of Matara and is the terminal point of the now under-construction motorway (connecting Colombo and Matara - in under one and a half hours).

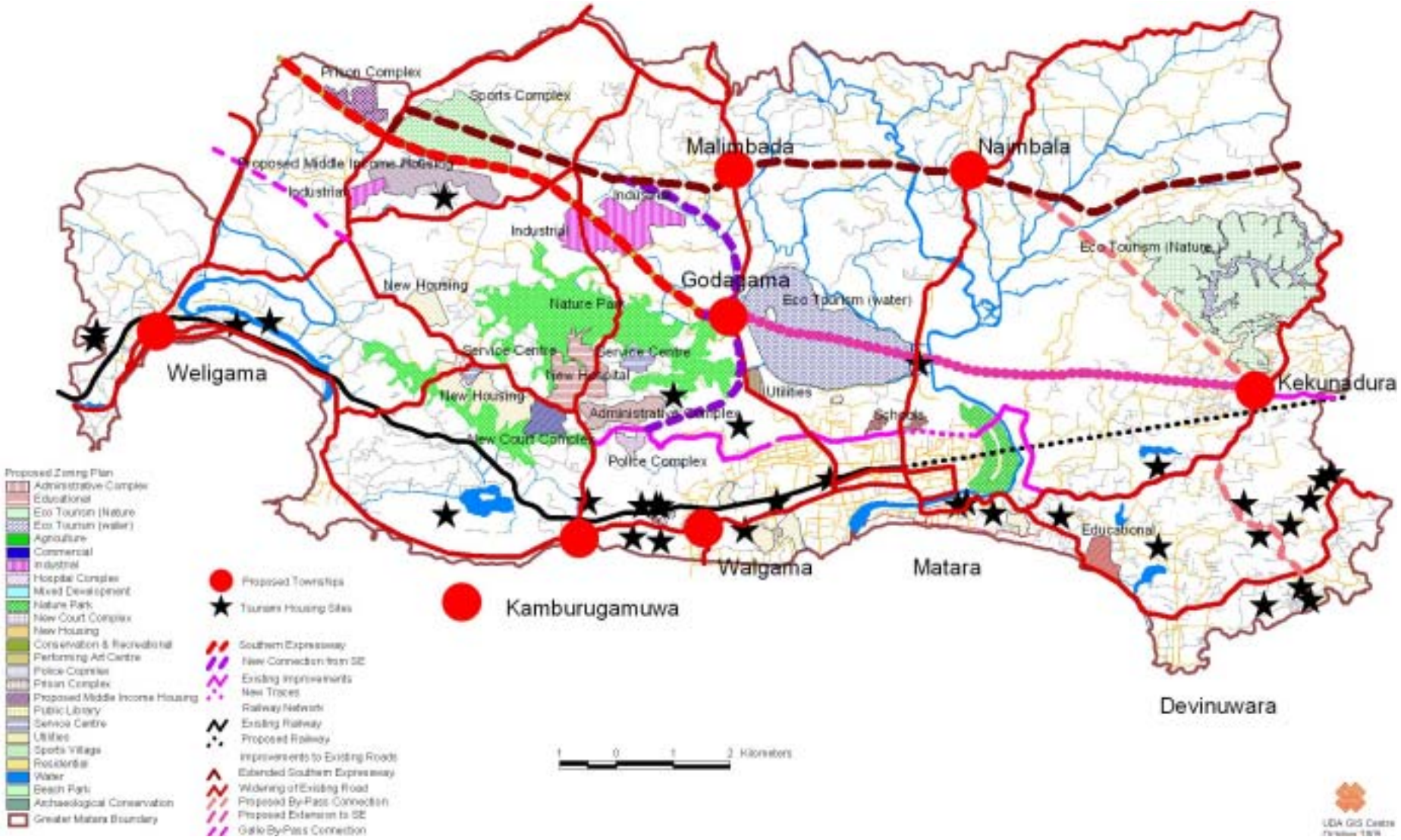
New bridges over the Nilwala River have been proposed. One is the reconstruction and expansion of Nilwala Bridge, the existing bridge in the center of Matara, while the other is the construction of the Naimana Bridge, located in the northeast of the city center. The former is expected to be constructed by RDA and the latter by the assistance from the Korean Government, respectively.

- Other Urban Development Plans

The McRAP report has some aspects related to city planning such as:

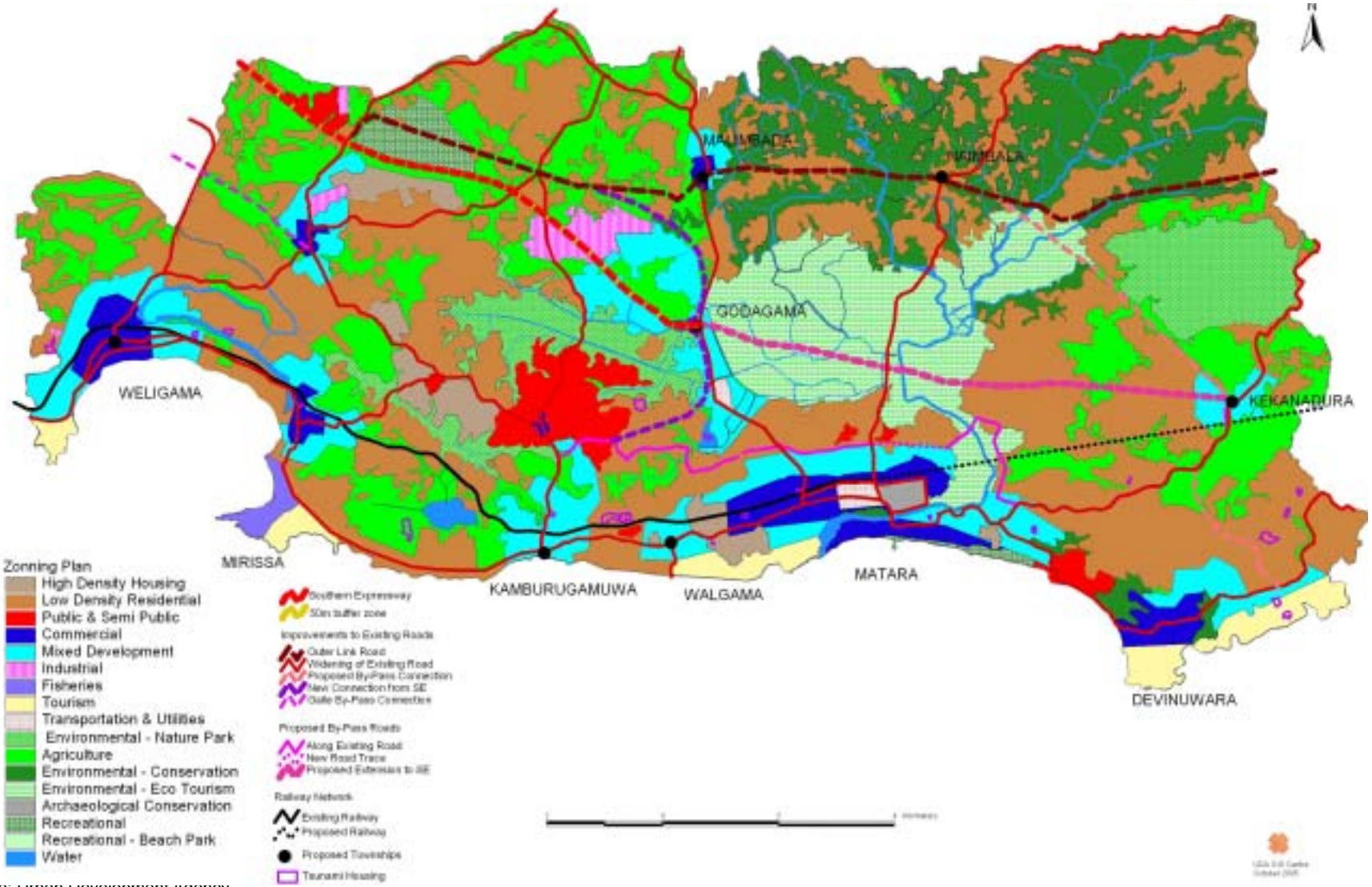
1) Development of an information technology park at Kamburupitiya;
2) Development of special infrastructure (electricity & telecommunication) projects;
3) Replacement of the Nilwala Bridge;
4) Conservation of the Matara Main Fort;
5) Conservation of the Star Fort;
6) Historic preservation of traditional houses; and
7) Development of an urban park project at Uyanwatta Stadium.

Other urban development plans are shown in Annex 10-1.



Source: Urban Development Agency

Figure 10.2 Concept of the New Urban Center for Matara and Satellite Towns



Source: Urban Development Agency

Figure 10.3 Proposed Land Use Plan in Matara

10.3 Suggestions for the Regional Rehabilitation Plan

10.3.1 Issues on the Existing Rehabilitation Plan

As described in the previous section, there are existing plans for rehabilitation. However, there are some issues as follows:

- There is no rehabilitation plan at the community level. To recovery the quality of life and livelihoods, it is very important to assist community activities by adopting the co-assistance concept, as shown in the previous chapter;
- As a result of the evaluation in the previous chapter, it is found that preparation of learned lessons from disasters and using them to prevent future ones is very important. However, no such study or research exists at present;
- Since the city of Matara and its vicinity are prone to not only tsunamis, but also floods, heavy rains, and high tides, these areas are often inundated with subsequent damage to people and properties. As such, a comprehensive disaster-mitigation plan is necessary. Existing plans are limited to physical urban development plans at present. The cross-sectoral disaster management plan is considered to be highly necessary; and
- In addition, the existing plans do not give enough consideration (from the perspective of community activities) for disaster management. Post-tsunami rehabilitation is a good opportunity to consider counter-measures against such natural disasters at the community level as well.

Considering the above issues, the JICA Project Team summarized the suggestions for the regional rehabilitation plan as follows.

10.3.2 Identification of Bottlenecks

1) Use of the List

The list of possible bottlenecks adapted from the list prepared in Japan after the great Hanshin-Awaji Earthquake proved useful as shown in the preceding chapter. This kind of exercise can be made in anticipation of a disaster, while measures to counter identified bottlenecks should be integrated into the rehabilitation plan.

2) Adaptation of the List

Some individual checkpoints in the list adopted in this Project were found to be ill-suited to the realities in Sri Lanka. It is therefore strongly recommended that the list be modified by planners of the regional rehabilitation plan to reflect the actual circumstances in Sri Lanka.

Some of the points that should be taken into consideration in the preparation of such an adapted list may include the following:

- The dual structure of local administration, as represented by the strong presence of the Central Government and by the rather weak functions of the Municipal Council, should be explicitly dealt with through a clear demarcation of roles in disaster management;
- Involvement of a large number of donors and NGOs (both domestic and foreign) should occur in such an event (at least in the near future). Coordination of their activities proved to be extremely difficult. As such, a dedicated office with sufficient resources should be established immediately after such an event and its roles must be clear to all;
- The co-assistance approach proved quite effective, partially due to the tradition of small societies in Sri Lanka. Immediate formation of such co-assistance societies among victims should also be explicitly clarified in the list;
- Availability of land for evacuees turned out to be crucial. Land ownership and decision-making in land utilization are very much country- or even area-specific. Concrete measures for quickly resolving this issue should be integrated in the list;
- In post-disaster planning, the roles of the Urban Development Authority, the Provincial Government, and the Municipality should be clearly defined and coordination among them should be specifically mandated;
- Reflecting the needs and opinions of victims themselves was found to be crucial in the smooth implementation and effectiveness of such measures. Explicit mechanisms to achieve such goals should also be integrated; and
- Reviving small-scale industries tended to be bypassed during such occasions, as attention first goes to rescuing individuals. It is essential and indeed important to revive the regional economy in Sri Lanka. This issue should also be clearly stated in the list.

3) Expansion of the Time Horizon

Due to the fact that the Project commenced three months after the tsunami, it was not meant to cover the emergency rescue and evacuation phases. Issues prominent in the first two phases such as public health and education were not included in the Project. A post-disaster rehabilitation plan should include measures for the issues anticipated during the first two stages. Therefore, the list should be expanded to include them.

10.3.3 Co-Assistance

The co-assistance approach proved to be quite effective in post-disaster management as evaluated in the preceding chapter. There are a number of points that have emerged in the course of implementing the Pilot Projects, which, if properly done, would make the approach even more effective.

1) Composition of Membership

Members of a newly formed society should, as much as possible, be of a similar background. In the refugee camps, if residents of a camp were drawn from a previously existing community, the society would work more quickly and more smoothly than if they were not (this was evident by comparing residents in the Pathagama and Grubewila Camps). The ornamental fish association has had cohesion problems and as a consequence in its general direction, due to the differences in interest between suppliers and divers.

2) External Negotiation

Societies that the Project dealt with seemed to have strengthened their internal bonding, and consequently effectiveness, when confronted with an opportunity to negotiate with external organizations. Societies should be given such opportunities to the extent possible.

3) Meetings

One reason the Pilot Project achieved considerable success in the co-assistance approach is that the JICA Team constantly urged association members to hold meetings. It is common in Sri Lanka that association meetings are held only once or twice a year, leading to the feeling of unfairness among the rank and file. Meetings should be held as frequently as possible.

4) Micro-finance

In Sri Lanka, micro-finance societies are quite common and the practice is well-accepted. It is a good to maintain a cohesive society as it gives an impetus for regular meetings of all members and committees, as well as a sense of a common goal. Interest payment can be used for the society's own activities. As for the associations assisted by the Project, members themselves requested the establishment of such a scheme as they were familiar with this already. This situation should be taken advantage of.

5) Training

Various training opportunities provided by the JICA Pilot Projects were popular among beneficiaries. Such training not only enhances individual participants, but also enhances the standing of the society to individuals, a mutually reinforcing cycle.

6) Linkage to External Resources

Formation of internally-cohesive and outwardly-oriented societies enables them to link up with existing organizations to enlarge their scope. This is again a mutually-reinforcing

relationship in that existing organizations such as IDB, UNDP, and donors themselves are often in search of good subjects for their activities. Here, it is important that some third party acts as a go-between for both the beneficiary association and the assisting organization. The JICA Team was able to assist in the procurement of assistance of well over Rs.20 million, when its own total local management cost and assistance to beneficiaries was Rs.16 million.

10.4 Recommendations on Disaster Management in the Matara Urban Area

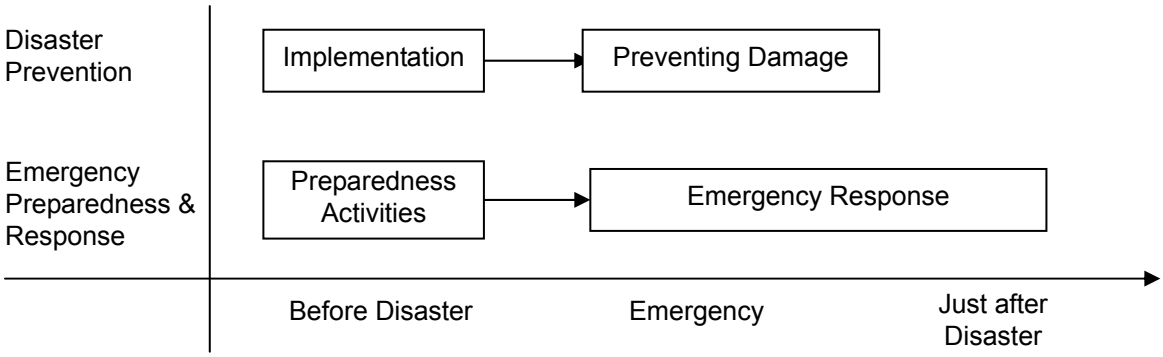
10.4.1 Framework for a Disaster Management Plan in the Matara Urban Area

The JICA Project Team recommends some measures on disaster management in Matara. Although these recommendations are mainly focused on the existing urban area in Matara including the fort, coastal areas, as well as the riverside of the Nilwala River, some recommended measures are applicable to the entire Matara provincial area as well. As mentioned earlier, tsunamis and floods are selected as the targeted types of disasters for this Project.

Disaster management generally consists of cross-sectoral measures, such as infrastructure development, urban planning, public awareness community enhancement, education, etc. In this section, such measures are classified by function into the following two types: disaster prevention and emergency preparedness/response.

Disaster prevention measures are expected to prevent/reduce physical disaster damage directly, through the construction of riverbanks, breakwaters, strong buildings in dangerous areas, and the relocation of buildings to safe area. These kinds of measures need to be completed before a disaster. On the other hand, emergency preparedness and response measures are necessary to plan and prepare emergency activities, as well as to prepare early warning systems and emergency evacuation areas/routes. Also, this includes disaster awareness measures aiming to encourage people to have proper awareness and preparation knowledge for future disasters. The important point is that government authorities need to implement both kinds of countermeasures in a balanced manner, as neither of them can adequately prevent disaster alone.

In line with this classification, the following sections summarize recommendations on the disaster management plan. Some measures that are closely related to other measures (such as hazard maps) are described in several parts.



Source: Project Team

Figure 10.4 Characteristics of Disaster Management Measures

10.4.2 Disaster Prevention Measures

(1) Urban Planning

1) Building Codes in Hazard Areas

Restrictions on construction in tsunami- or flood-prone areas are one of the most basic and effective measures for avoiding physical damage. As mentioned before, the Government of Sri Lanka established a buffer zone after the tsunami in order to control building construction. In the buffer zone, a residential building, which was destroyed by the tsunami, cannot be rebuilt, with the Government promising to provide substitute land for people living in the zone. However, the regulation is murky as there are some unresolved issues such as the lack of available substitute land and the destruction of communities, as well as potential political entanglements. Consequently, some people are still staying in tents next to their destroyed houses illegally. It is conceivable that the prohibition of rebuilding will not be a permanent measure. Although it is ideal to prohibit rebuilding in dangerous zones, something that can completely prevent the loss of life from tsunamis, it is more essential to implement feasible and sustainable measures in terms of the real reduction of disaster damage. Considering the conditions, it is recommended that residential buildings that can protect lives and properties from tsunami and floods be permitted. The following summarizes the recommendations for building codes.

- Buildings that Can Survive Tsunamis

To reduce tsunami damage, it is necessary to construct strong buildings that can resist destructive tsunami forces. Although there is no proven scientific data, it is generally

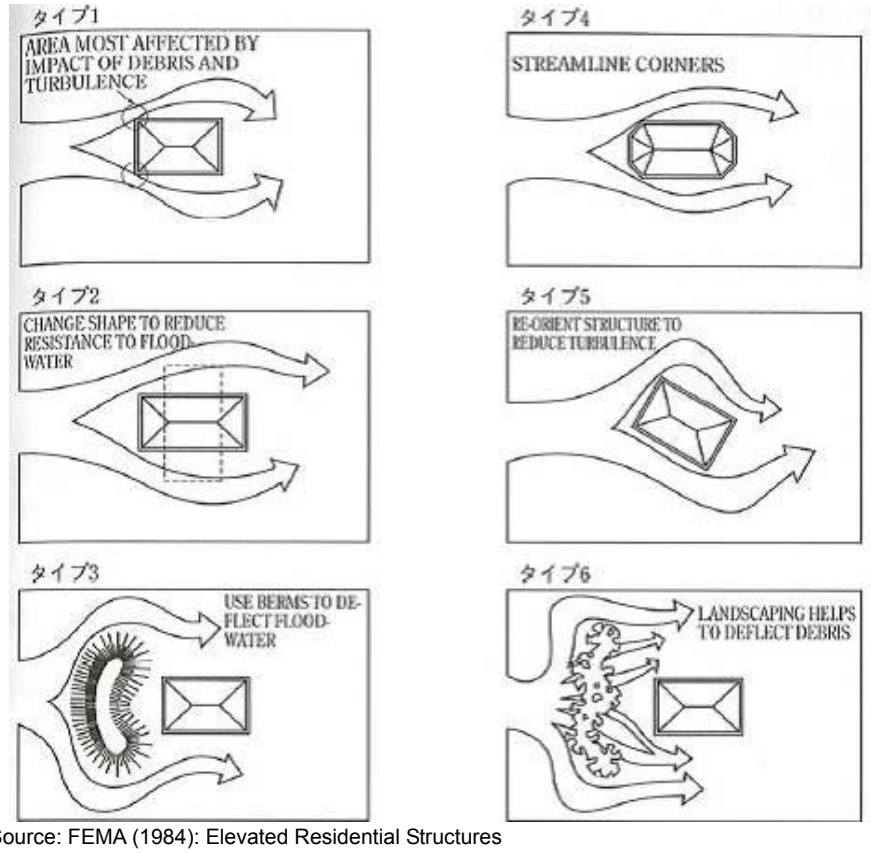
believed that buildings with reinforced concrete are sufficiently strong. It is therefore preferable to permit only those buildings with reinforced concrete or equivalent materials into dangerous areas.

- Prohibition of Buildings Lower than the Highwater Tsunami Level

In the Matara urban area, the highwater level of the previous tsunami along the coastline was around 3 m at most. If a residential building had two stories, people could run upstairs, escaping from the tsunami. Presently, some affected people are rebuilding two-storied houses outside of the buffer zone on their own initiative.

- Building Layout to Reduce Damage

Since the tsunami wave generally comes from one direction and is perpendicular to the coastal line, it is possible to reduce resistance to tsunami waves by change building layouts. As shown in the following figure, the reduction of the amount of wall area that is parallel to the shore, such as setting buildings diagonally to the wave direction, would ease the resulting wave force and increase the chance the building will not collapse. Recommended types of house layout are shown in Figure 10.5.



Source: FEMA (1984): Elevated Residential Structures

Figure 10.5 Recommended House Layouts to Reduce Wave Forces

However, enforcement of these layouts would impinge upon a private person's rights for their own properties. As such, public authorities should not force these designs on people, but encourage them to apply such designs when they construct a building. For example, if a house in a dangerous zone satisfies conditions that reduce damage, the Government can provide some financial assistance.

Target areas for these measures need to be identified according to the degree of disaster risk. A hazard map, which shows the risk of disasters, can be used for identifying the areas. The details of a hazard map are described in the next section.

2) Relocation of Public Facilities

A great many public facilities in the coastal areas in the Matara urban area, such as government offices and schools, were damaged by the tsunami. As these public authorities must coordinate and undertake important emergency activities, these facilities must be protected from disasters to the extent possible. Ultimately, the transfer of these public facilities to a safer area is ideal. As mentioned above, the McRAP includes a plan to transfer government offices to inland areas. Also, most schools along the coastal line have plans to move to safer places with the aid of specific donors.

3) Emergency Road Network

In an emergency situation, the road network plays two important functions: evacuating people and transporting emergency supplies. These functions are extremely essential for reducing disaster damage in emergency situations. Even though the road network cannot reduce and prevent disasters directly, this is one of the most important issues in urban planning. The details are found in the section on emergency preparedness and response.

(2) Infrastructure

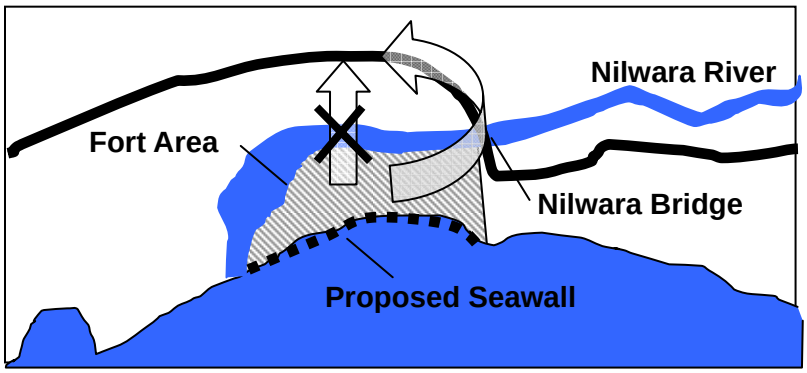
1) Infrastructure to Prevent Tsunami Inundation

- Seawall

The most general type of infrastructure for preventing tsunami inundation is a seawall. Theoretically, a seawall can protect from tsunami inundation completely, if it is higher than the produced highwater. However, a seawall often costs considerable money as it is a large structure and can also cause other problems in terms of land acquisition, landscaping, and obstruction of fishery activities.

There are some existing seawalls in Matara as mentioned in Section 10.4. However, it is not sufficiently high for preventing tsunamis. There is no plan to construct a new seawall so far. Although it is obviously not reasonable to develop a seawall along the entire coastline in Matara, a seawall along a limited area can be quite effective. For example, the fort area, which was seriously damaged by the last tsunami, is the center of administrative buildings in Matara. Although there are many office workers and visitors in the area in the daytime, it is difficult to evacuate to the hinterland quickly, as the area is surrounded by the sea and the Nilwala River. Thus, the only way to evacuate to safe areas is to go over the Nilwala Bridge. There are few suitable buildings for emergency evacuation in the area.

In addition, there are historic and cultural buildings such as churches in the area, which the McRAP recommends to conserve. Considering the noted situation, a seawall is recommended for construction along the coastline in the fort area. Since the McRAP plans to build a park in the coastal area of the fort, it is recommended to include a seawall in the park as shown in Figure 10.6. It should be noted that further detailed designs of the seawall are required for implementation.

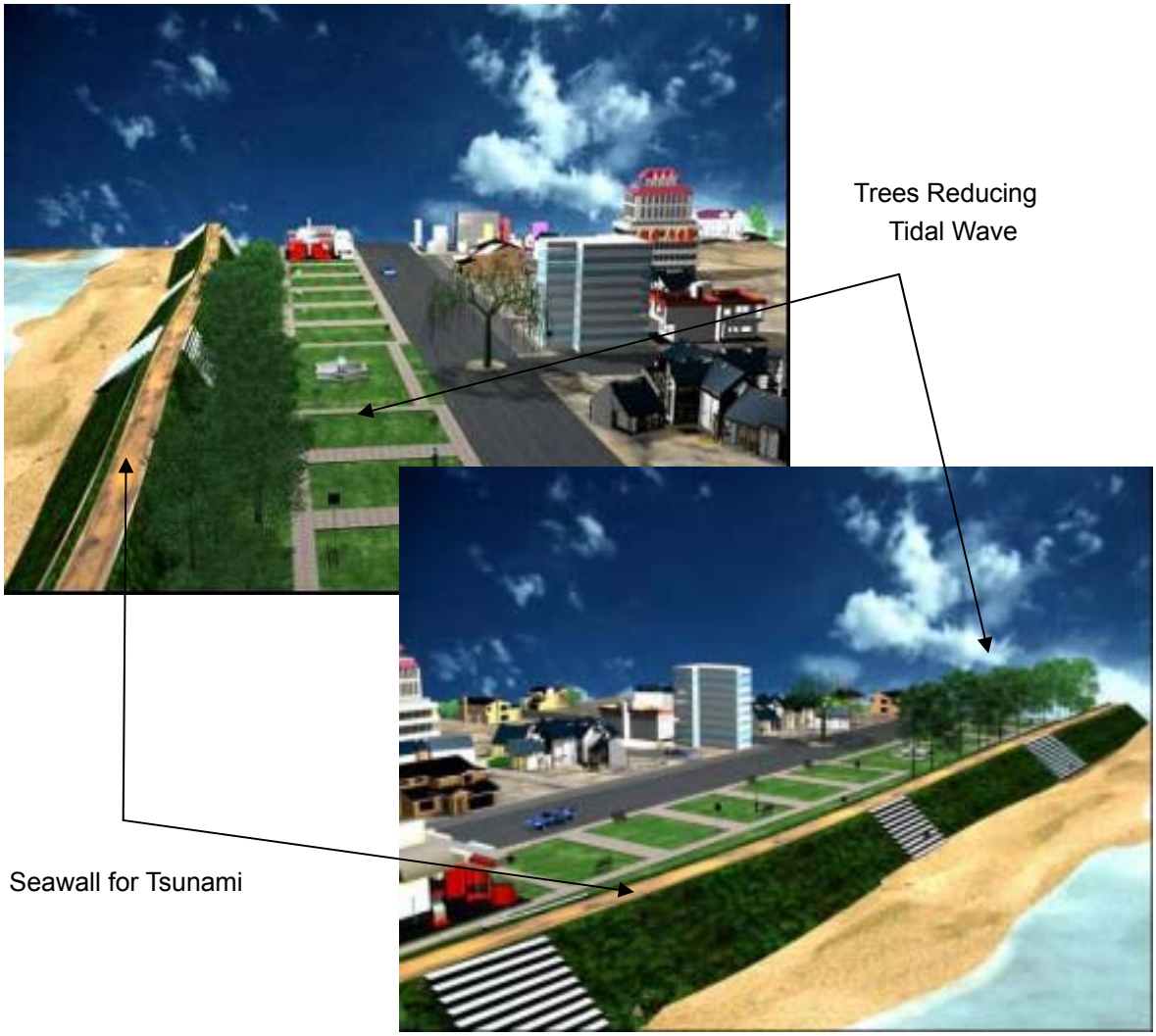


Source: Project Team

Figure 10.6 Proposed Seawall in the Fort Area

- Trees for Reducing Tidal Waves

Trees along the coastline play an important role in reducing the tsunami force. Dense trees can ease the tidal flows, prevent floating articles from going inland, and prevent castaways from swept away. There are many coconut trees along the coastlines in Matara. Even where they were not dense enough to dissipate the tides, it was reported that some people hung from trees and were able to survive the tsunami. It is recommended that existing trees are conserved and additional trees be planted in open space or parks along the coastline.



Source: Project Team

Figure 10.7 Preliminary Landscape for Seaside Park with Seawall and Trees to Reduce Tidal Waves

2) Infrastructure Preventing Flood Inundation

Although there are riverbanks along the Nilwala River, many people still live inside of the riverbanks illegally. Although floods usually do not overrun the riverbank, the water spilled out upstream of the Nilwala River in 2003 due to intentional destruction of the riverbank. The water came into wetlands north of Matara city and then went into the Matara urban area, resulting in serious damage.

At present, some problems remain including subsidence of the riverbank upstream and broken pumps for drawing water in the wetlands. The following measures are considered to prevent further flood damage:

- Repairing the pumps;
- Elevating the riverbank; and
- Constructing a bank between Matara city and the wetland.

For the best solution, however, it is necessary to conduct further engineering studies to cover factors affecting flooding and the dredging capacity, as well as to implement integrated flood control measures throughout the entire area.

10.4.3 Emergency Preparedness and Response

Since it is impossible to prevent disasters and resulting damage from physical means, it is absolutely imperative to enhance emergency preparedness and the response of local authorities and residents for minimizing disaster damage. The most basic concept for reducing tsunami and flood disasters is evacuation. Most people can survive tsunamis or floods if they can evacuate properly with enough preparedness and early response (as there is some lag time before the disaster impacts upon Matara).

(1) Early Warning System

It is obviously imperative to establish an early warning system for preventing both tsunami and flood damage.

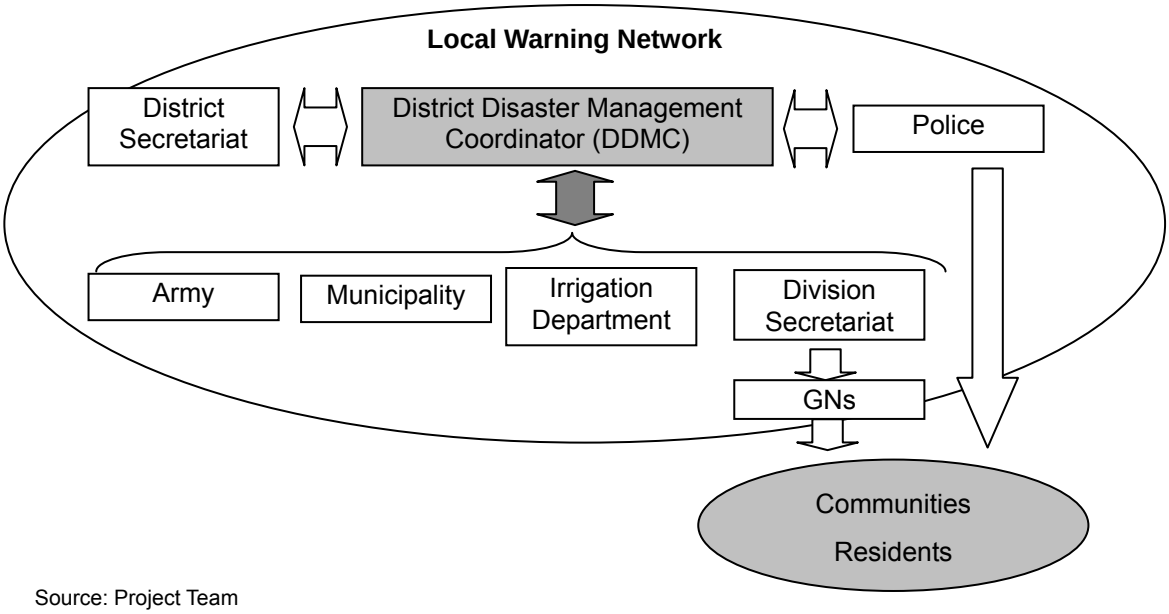
- Early Warning System of Local Government Authorities

It is urgently necessary to clarify communications procedures for emergency information and establish the agencies or organizations that can collect and distribute necessary information from/to relevant organizations and residents properly. Although early warning system should be developed at both the national level and the local level, the Project focused on the local level in Matara area in line with the purpose of the Project.

At present, there is no official early warning system at the local government level in Matara . The police presently take charge of issuing such warnings. Although the police in Matara is the only agency that can issue warnings to people around the clock, they do not have enough equipment such as loudspeakers by themselves. They have an agreement to borrow vehicles with loudspeakers from private companies in emergency situations. Regarding flood warnings, there is no system for the Department of Irrigation Matara to warn Matara GA offices or the police if a river reaches dangerous levels.

With the assistance of UNDP, the National Disaster Management Center (NDMC) has prepared a "District Disaster Preparedness and Response Plan, Matara", including institutional arrangements and operational procedures for emergency situations. However, it focuses on floods mainly and gave less consideration to tsunami disaster.

From the point of view of an early warning system for the Matara area, it is recommended that the Matara District Disaster Management Coordinator (DDMC) take charge of coordinating a local warning network that connects DDMC and related local authorities such as the district secretariat, army, municipality, irrigation department, division secretariat, and GN. While the police mainly are in charge of warning residents, the GNs are also expected to deliver warnings to them through the communities. The DDMC needs to cooperate closely with the police and avoid congestion and rumors of warning information as much as possible. It is recommended that the local warning network be developed among local authorities through an initiative of the DDMC.



Source: Project Team

Figure 10.8 Proposed Warning Network for Local Government Authorities

As well as institutional settings, it is also necessary to prepare a concrete procedure for communicating warnings as follows:

- Role of each authority for early warning;
- Local standard of judgment for issuing disaster warning in Matara;
- Information or data to be delivered from each authority to DDMC (e.g., the water level of the Nilwala River);

- Type and scope of information to be delivered from DDMC to each authority (e.g., the tsunami arrival time);
- Identification of divisions, GNs, and communities that require early warnings;
- Communication tree among DDMC, divisions, GN, and communities; and
- Actions in the warning of communities (e.g. routes of warning vehicles).

It is highly recommended that an emergency drill be conducted with all related authorities annually. This drill would require full coverage of activities including early warning, evacuation, and emergency assistance.

- Early Warning System at the Community Level

Besides at the government authority level, the community level also needs a warning system urgently. The communication of warnings is considered as one of the main tasks in community disaster management activities. Although the DMC is planning to issue warnings through the mass media or police, it is difficult to deliver information quickly and correctly to all people in the community.

It is important to establish a communication route for warning in every community in order to make sure that the warning can be delivered to all community members as well as to prevent scare and rumor-mongering. The following measures are recommended:

- Communication for warning needs to be enhanced between government authorities and communities. As the government authority at the lowest level, GNs needs to serve as the contact between the government authorities and communities and be responsible for issuing warning to the communities;
- A person responsible for emergency needs to be appointed in each community. He/she will be in charge of receiving warnings from GN, and informing the community members. A community leader can be responsible for this;
- Means to communicate warnings need to be discussed and decided by each community; and
- It is possible to use a siren or a bell at a temple, if they are available.

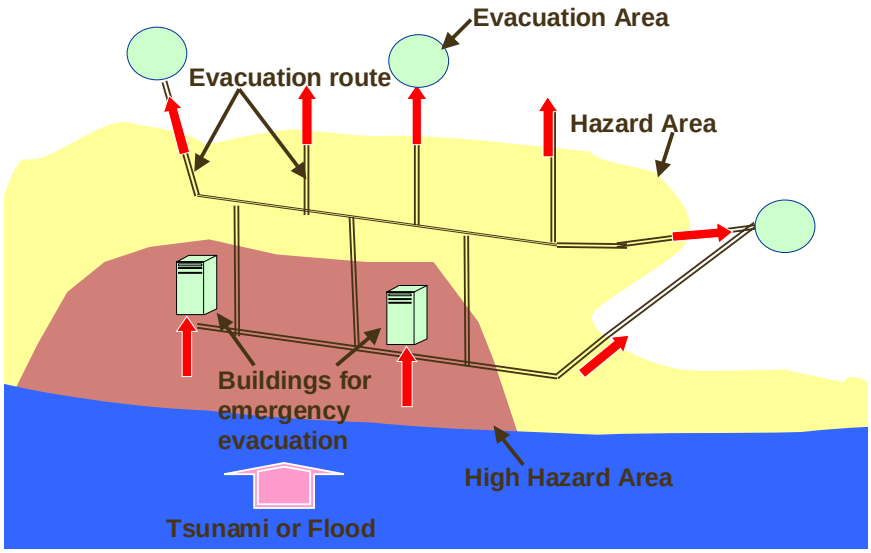
(2) Emergency Evacuation and Assistance

For smooth evacuation, it is necessary to prepare a detailed and concrete action plan on emergency evacuation and assistance. The plan needs to include the following contents:

- Areas where people need to evacuate;
- Emergency evacuation routes and areas;

- Locations of road blockades; and
- Mobilization of the police and/or army.

The concept of evacuation from a tsunami is shown in Figure 10.9. The most basic principle is to let people in the hazard area (predicted inundation areas) evacuate to outside of the area. Evacuation routes and emergency evacuation areas are to be designated according to the area as well. If an area is considered to be high hazard area (e.g., areas requiring significant travel time to leave the predicted inundation zone), then emergency evacuation area such as buildings inside of these areas must be prepared. In Matara, the bus terminal in the center of the city is suitable as an evacuation area.



Source: Project Team

Figure 10.9 Basic Concept of Emergency Evacuation

1) Identification of Hazard Areas

A hazard area is equivalent to a predicted inundation area. Even though there is little possibility to incur a more serious disaster than the last tsunami or the 2003 flood, it is reasonable to consider that a hazard area will be the same as the inundation area of these two disasters. The JICA Project Team preparedinundation maps (disaster maps) for tsunamis and floods, as well as a preliminary tsunami hazard map. Local authorities have been recommended to designate hazard areas after studying these maps.

As mentioned in Section 10.3.2, the fort area is considered to be an area that may have difficulties in evacuation, thus this area needs special consideration for evacuation.

2) Emergency Evacuation Areas

An emergency evacuation area is a place for evacuation just after a tsunami/flood warning. In Japan, this is usually a school, park, or town hall that has sufficient structural strength and is located in a safe area. These are identified as emergency evacuation areas by the local government. As mentioned earlier in the hazard map section of this report, a so-called "avoidance map" shows safe areas for tsunamis and floods, although an inundation zone was not considered.

It is necessary to identify the emergency evacuation area through the following steps:

- Estimate the number of people in the dangerous area, including not only residents but also workers, visitors, and tourists;
- Estimate the capacity of candidate emergency evacuation areas assuming an occupancy of one person per square meter[1];
- Assess if there is enough capacity in each of the evacuation areas, compared to the number who need to evacuate; and
- Check if there are areas in which people would need to travel a long way to reach evacuation areas.

3) Emergency Evacuation Route

The evacuation route is important for smooth evacuation in emergency situations. In the Matara urban area, there is only one bridge over the Nilwala River. When people evacuate from coastal area to the north inland areas, they have no other option but to cross the bridge. Since many people would rush onto the bridge, it is expected that they may panic. According to the Road Development Authority, the Nilwala Bridge is planned for expansion in the near future.

Roads that run inland from the coastal area also need to be considered as evacuation routes. The following are recommended for safe and smooth evacuation:

- Clear garbage or debris for easy and unimpeded walking;
- Place enough lights for safe walking at night; and
- Place signs showing the evacuation direction and areas.

During the previous tsunami, it was found that some roads became paths of the tsunami wave. While some people drowned while running on such roads, others survived by using side roads. It was also noted that people could not escape along roads that were

[1] Source: Guideline for Buildings for Emergency Evacuation, 2005, Japan

surrounded by walls on both sides. As such, evacuation routes that can possibly become water paths, are recommended to have side roads or other facilities to weaken the tsunami wave.

4) Emergency Transportation Route

There is no doubt that the expressway between Colombo and Matara, which is now under construction, will play a crucial role for emergency transportation. However, some sections of the access road connecting the expressway and Matara city center were inundated during the 2003 flood. It is urgently necessary to prevent the road from inundation through adopting countermeasures such as elevating the road or constructing banks along the road.

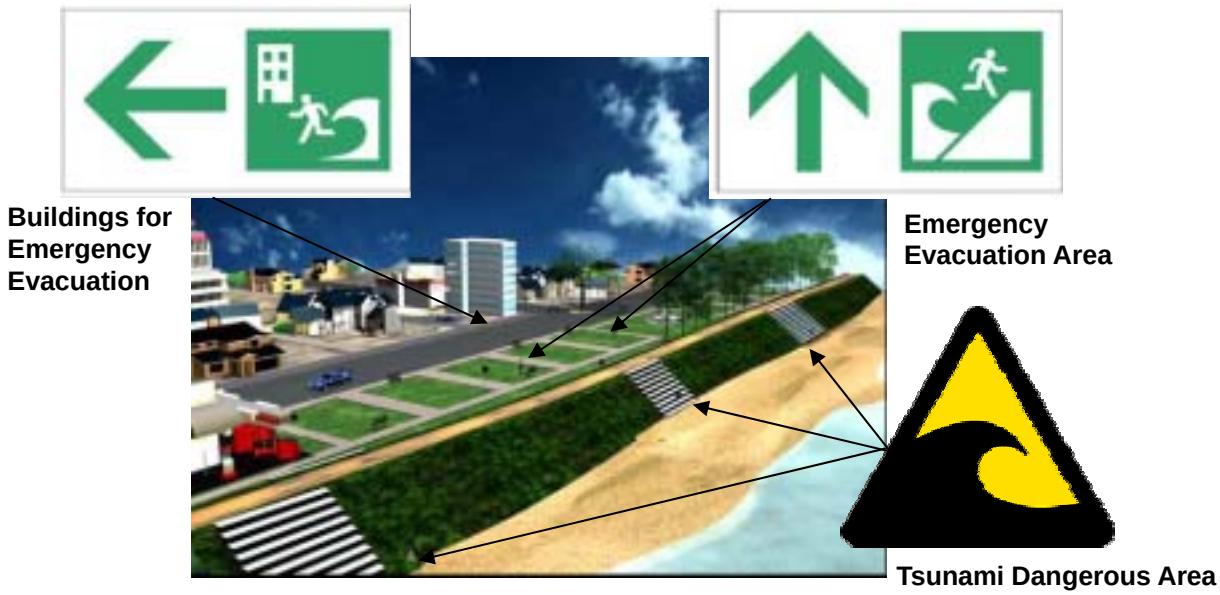
5) Evacuation Information

It is also necessary to provide information on emergency evacuation routes and areas. Some ways to provide information to the public are as follows:

- Distribution of a hazard map with emergency evacuation routes and areas; and
- Placement of signboards along evacuation routes and in evacuation areas.

The hazard map can show dangerous or safe areas visually as mentioned before. For example, a tsunami hazard map in Kesennuma City in Japan includes emergency evacuation areas such as parks, schools, and city halls, thus helping people to understand where to evacuate.

The signboards are also useful to let people know where safe areas is and where they should evacuate to. The Japanese Government recently decided to use the following three kinds of signboards showing tsunami danger area and the directions to safety. The Japanese Government is also proposing the adoption of these signs to the International Standard Organization (ISO); hopefully, these signs will become the international standard. It is recommended that Sri Lanka also use them so that everyone, even foreigners, can easily find a way to a safe place.



Source: Project Team

Figure 10.10 Proposed Signboards for Tsunami Evacuation

(3) Hazard Map and Disaster Map

A hazard map and a disaster map are very useful tools for disaster management. The hazard map explains the degree of risks for disaster damage and the disaster map shows the damaged area by the past disaster. These maps can be used as a guide for preparing counter-disaster planning measures by both local authorities and residents. This section summarizes recommendations of measures with the hazard map or the disaster map for disaster management.

The JICA Project Team is preparing a preliminary tsunami hazard map and tsunami/flood disaster map in the Matara Division. A detailed explanation is found in Section 10.4 of the report.

1) Measures for Local Authorities

Local authorities can use these maps for identifying target areas of the disaster management plan. Hazard areas are practically the same as target areas for planning disaster management measures. Local authorities are recommended to officially designate the hazard area by referring to the hazard or disaster map, with this area to be reflected in all related measures as follows:

- Regulated areas for building codes;
- Target areas for emergency evacuation and assistance;

- Designation of evacuation routes and areas;
- Designation of emergency transport routes;
- Target divisions, GNs, and communities for early warning; and
- Areas for emergency warning and assistance activities by the police and army.

2) Measures for Communities

The hazard map and the disaster map can be used for preparedness and awareness for communities. The following activities with these maps are considered to be effective for disaster preparedness and awareness.

- Distribution of the Hazard Map and Disaster Map

In Japan, there was an argument whether government authorities should distribute the hazard map to residents or not because they were afraid that people would overreact to the map and be confused. However, this was proven to be incorrect as people took the map literally and recognized the risk of disaster. Now, government authorities are making a positive effort to publish the map to people.

It is recommended that local authorities distribute these maps with the evacuation areas, which are included in the emergency evacuation plan prepared by local authorities. Also, it is recommended that the hazard map be distributed to not only people in the hazard area ,but also those in the entire Matara District because many people come to the center of Matara often for working or shopping, and everyone needs to share the knowledge where the hazard and safe areas are, as well as the evacuation areas.

The hazard map needs to be kept in each house or community properly and to be visible as soon as an emergency situation happens. However, in fact, it is usually very difficult to keep it for a long time as people will lose it anyway. One idea was to put a hazard map on the back of the telephone directory.

- Community Activities with the Hazard Map and Disaster Map

It is useful to have a meeting in each community and discuss the following with reference to the hazard map and the disaster map:

- Check where the hazard areas and the safe areas are around the community; and
- Evacuation routes and areas in emergency situation.

It is recommended that local authorities conduct seminars or workshops for the community and encourage the community to discuss these topics together with other aspects such as early warning communication and first aid as mentioned before.

(4) Emergency Preparedness and Response for Local Authorities

Quick response by local authorities is a key for reducing disaster damage. Local authorities are always required for the preparation for the emergency response on disaster.

UNDP has conducted workshops on disaster preparedness for officers of divisions in the Matara District. Although they focused on flood-affected areas before, they are going to have a similar program for tsunami-affected areas as well. During the workshop, the attendants prepared a disaster preparedness plan and identified necessary activities and equipment. Also, UNDP is planning to conduct workshops for the GN level.

In addition to these workshops, it is recommended to hold annual emergency drills for early warning, evacuation, and emergency assistance. Based on actual procedures of the early warning system and emergency evacuation/assistance plan, all related authorities are required to join the drill.

Related to this measure, the JICA Project Team carried out a JICA-Net seminar on disaster management for local public administrations in December 2005 and held seminars on disaster management in March 2006. The details are found in Section 10.5 in the report.

(5) Disaster Preparedness for Residents

1) Community Activities on Disaster Preparedness

As mentioned in Chapter 2, the importance of community activities in emergency situations is widely recognized. Community activities are expected to strongly support early warning, emergency evacuation, and emergency assistance. It is no exaggeration to say that the degree of disaster damage depends on the degree of community activities for disaster mitigation.

Presently, DDMC and UNDP place importance on assisting community activities on disaster management. DDMC is now working on the following activities:

- Recruiting volunteers from communities and appointing them as watchmen to guard properties against a thief in the area where people have evacuated;

- Urging families to prepare articles for emergency evacuation and assistance such as first aid kits;
- Selecting some persons for assistance of the disabled and evacuation of the elderly; and
- Conducting first aid demonstrations and preparing stretchers.

UNDP has a plan to recruit volunteers for disaster mitigation, to train them on first aid, to provide transportation equipment, and to provide financial assistance. However, they are still short of financial and physical assistance from other donors or NGOs.

Since the concept of co-assistance is quite an important factor for realizing sustainable rehabilitation in communities as mentioned in the previous chapters, it is recommended that activities for disaster management also be based on co-assistance to make these activities sustainable. Considering this situation, the following activities are recommended.

- Communication Route for Warning

It is recommended that a warning communication route be discussed in each community and prepared. A person, who receives warning from a government authority and informs the community members, needs to decide the appropriate route, while methods of communicating these warnings to members also must be prepared.

- Emergency Evacuation Route and Area

It is recommended that emergency evacuation routes and areas be discussed in each community and decided upon. For those who cannot evacuate quickly, such as the disabled or the elderly, assistants for evacuation need to be appointed in the community. They can refer to the hazard map for clarifying where they should evacuate.

- Stocking for Emergency

There are two kinds of stocking for emergency situation. One is for the family, while the other is for the community. The stocking for family is recommended to include the following items:

- Emergency food and water;
- Candles and matches;
- Flashlights with batteries;
- Cotton gloves;
- Towels;
- Plastic bags;

- Tissue papers;
- Plastic sheets;
- Can openers for emergency food;
- First aid kits (scissor, band-aid, gauze, and bandage);
- Medicine necessary for family members;
- Ropes;
- Masks; and
- Whistles for calling for help.

Regarding stocking for the community, it is good to store the following in evacuation areas, such as schools or temples:

- Emergency food and water;
- Flashlights with batteries;
- Plastic cases;
- Gasoline;
- Ladders;
- Chairs and tables;
- Buckets;
- Pans for cooking for refugees;
- Tents;
- Stretchers;
- Jacks;
- Generators;
- First aid kits;
- Ropes; and
- Blankets.

- Drill for Emergency Evacuation and Assistance

It is strongly recommended that a drill for emergency evacuation/assistance be regularly conducted in each community. First aid demonstrations with the assistance of DDMC are also effective.

- Disaster Awareness

Disaster awareness at the community level is also effective in making people remember the terror of disaster and prepare for disaster. The details of awareness activities are described in the next section. A community can implement effective awareness activities as follows:

- Have a meeting on the disaster, and share the experience of the disaster; and

- Make a song or a poem for handing down the experience and terror of the disaster to the next generation.

- Enhancement of Community Activities

Local authorities need to encourage each community to carry out activities on disaster management as mentioned above. It is considered that authorities can hold workshops in each community with the assistance of donors or NGOs.

As a part of the assistance of community activities, the JICA Project Team carried out a JICA-Net seminar on community initiatives in disaster management in December 2005 and held seminars on disaster management in March 2006. The details are found in Section 10.5 of the report.

2) Disaster Awareness

Understand a disaster and its resulting terror correctly is quite important for encouraging people to prepare for disasters and preventing further damage. People in Sri Lanka, in fact, did not know about tsunamis at all and they did not recognize the danger of a tidal wave during the last tsunami. There is no doubt that much less physical damage would have been sustained if people knew about tsunami. Even though most of people know the existence of tsunamis now, many do not seem to know how tsunami occurs[2]. The following measures will contribute to enhance people's understanding of the disaster.

- Public Relations on General Disaster Awareness

Continuous public awareness activities are necessary to let people be aware of the danger of the disaster. It is recommended that local authorities continue to explain the basic mechanisms of the disaster and to remind the public of dangers through advertisements, seminars, and media. It would be effective to implement these activities together with the announcement of emergency preparations as mentioned in the previous section.

- Memorial Dedicated to the Disaster

Development of a memorial is also an effective way to let people remember the disaster. According to McRAP, there is a plan to construct a memorial museum in the fort area. It will also be effective to construct a monument or signboard to show the disaster terrors. For example in Japan, as shown in the left-hand photo in Figure 10.11, white signboards on the cliff show the water levels of past tsunami disasters. In the right-hand photo in Figure 10.11,

[2] At the JICA Net Seminar on 13th December 2005, some participants from a community asked the question about the cause of tsunami.

the signboard on the telegraph pole shows the actual water level of a past tsunami, which reached 38.2 m about 100 years ago, with a message that, “Tsunami will come when people forget it”.

Source: http://www.bo-sai.co.jp/tunamihyoujiban.htm

Figure 10.11 Memorial Signboards Showing the Past Water Levels of Tsunamis

- Disaster Awareness Program in School

The disaster awareness program in schools is quite effective for raising awareness, not only for children, but also for all community members, because children are expected to discuss disasters with their families or communities after the program.

There is no common disaster awareness program so far. Some agencies or donors have been trying to implement programs for awareness. DDMC gives first aid demonstrations at several schools. One of schools on the Matara coastline, St. Mary’s, is carrying out a training program for teachers with the assistance of an Italian NGO. They are learning how to teach general safety issues such as fire, traffic accident, and etc, however, tsunamis are not included. Also, other donors have plans to hold disaster prevention classes for students.

Since all children need to learn about disasters, it is necessary to place disaster awareness into the compulsory education program. The following is recommended for program inclusion:

- Classes on the basic mechanisms of tsunami and flood generation;
- Demonstrations of first aid; and
- Emergency evacuation drills.

In Matara, the provincial education department and GA are the responsible agencies for planning and implementing the program. DDMC and the police can assist in

demonstrations of evacuation and first aid continuously. It should be noted that some children are still in psychologically unstable states, therefore, these programs need to be planned and implemented with consideration of the physiological implication on children.

10.4.4 Proposed Implementation Scheme

(1) Institutional Arrangement for Implementation

It should be noted that none of the measures alone can prevent disaster damage. The disaster damage can be prevented effectively only after the cross-sectoral measures are implemented. Therefore, it is difficult to manage disaster management measures through a single authority. Strong coordination is key for successful disaster management. Therefore, it is recommended to establish a disaster management committee in the Matara District, which will coordinate among related local authorities in Matara.

The committee needs to cover all related authorities to disaster management measures. The UNDP Report also proposed such a committee and referred to committee members. The following list shows the recommended members of the committee. The secretariat of the committee can be the GA office, which is responsible for coordination among government authorities.

- District Office in Matara (GA);
- Division secretariats in tsunami/flood affected area;
- District disaster management coordinator Matara, DMC;
- Matara District staff of NDMC;
- Department of Irrigation, Matara;
- Police;
- Army;
- Matara Municipality;
- Education Department, Matara;
- Costal Conservation Agency;
- Urban Development Agency, Matara; and
- Road Development Agency, Matara.

It is recommended that the committee hold regular meetings on various measures and discuss the following topics, which require coordination among authorities:

- Early warning systems in Matara;
- Emergency evacuation and assistance plans;
- Disaster awareness programs;

- Emergency preparedness and response for local authorities;
- Disaster preparedness for residents;
- Urban planning on disaster management; and
- Infrastructure development plans for preventing disaster.

(2) Suggestion for Implementation Schedule

The implementation schedule for disaster management measures, as mentioned above, was examined by considering the feasibility of each measure and the implementing agencies. According to the feasibility and prioritization, each measure was classified into two categories: short-term and medium-/long-term measures.

1) Short-term Measures

Short-term measures include ones that are to be implemented in one or two years. It is urgently needed to establish a disaster management committee in the Matara District as mentioned above, which coordinates and promotes various measures on disaster management. Under committee coordination, the following measures are recommended to be implemented in the short-term (the proposed implementation agency is shown in parentheses).

- Measures on Disaster Prevention:
  - Designation of tsunami/flood hazard areas (GA, Municipality);
  - Establishment of building codes in the hazard area (UDA, Municipality, CCA); and
  - Planning of infrastructure development for preventing tsunamis/floods (McRAP, UDA, Irrigation Department, GA, Municipality).
- Measures on Emergency Preparedness and Response:
  - Establishment of an early warning system in Matara (DDMC);
  - Preparation of an emergency evacuation and assistance plan (DDMC);
  - Provision of evacuation information such as the distribution of hazard maps and provision of signboards (DDMC, GA, Municipality);
  - Enhancement of emergency preparedness and response of local authorities (DDMC, GA, Municipality, Police, Army, Irrigation Department);
  - Enhancement of community activities on disaster preparedness (DDMC, GA, DS, GNs, communities); and
  - Planning and implementation of a disaster awareness program such as public relations and school programs (DDMC, GA, municipality).

Before examining short-term measures, it is recommended that consistency with existing measures be considered as short-term measures should not be duplicated or in conflict. As mentioned in Section 10.4, there are existing measures such as the 100 m buffer zone, and McRAP (new town, road network and etc.).

2) Medium- and Long-term Measures

As for the medium- and long-term, it is recommended to implement the following measures:

- Construct infrastructure for preventing tsunamis/floods;
- Develop infrastructure and equipment for emergency evacuation and assistance (evacuation areas, routes, etc.);
- Construct memorial facilities for the disaster;
- Relocate public facilities;
- Develop new town; and
- Develop the road network for evacuation and emergency transport.

Table 10.1 summarizes the proposed implement schedule of disaster management measures.

Table 10.1 Summary of Implementation Schedule for Disaster Management Measures

Fields	On-going Measures	Short-term Measures	Medium- and Long-term Measures
Institutional Setting		Establishment of Disaster Management Committees	
Measures on Disaster Prevention	100m Buffer zone	Designation of tsunami/flood hazard area	
		Establishment of building codes in the hazard area	
	McRAP	Planning of infrastructure development for preventing disaster	Relocation of public facilities Development of new town Construction of infrastructure for preventing tsunamis/floods
Measures on Emergency Evacuation and Response	Preparation of hazard map	Establishment of early warning system	
		Preparation of emergency evacuation and assistance plan	Development of infrastructure and equipment for emergency evacuation and assistance
		Provision of evacuation information	Development of road network for evacuation and emergency transport
	UNDP Disaster Preparedness Program	Enhancement of emergency preparedness and response of local authorities	
		Enhancement of community activities on disaster preparedness	
		Planning and Implementation of disaster awareness program	Construction of memorial facility of disaster

Source: Project Team

10.5 Preparation of Hazard Maps

10.5.1 Introduction

(1) Background

Matara city is located in a density populated area along the coast and the lower Nilwala River in southern Sri Lanka. As it has been seriously damaged by two significant water disasters, the 2004 tsunami and the 2003 flood, the geographical location of the present Matara city is highly vulnerable to water disasters. Under these conditions, implementation of a balance of both structural and non-structural measures is recommended to minimize the damage from water disasters as mentioned in the previous section. The preparation of a hazard map can be the first definitive step in disaster management and can be used as an essential item both for structural and for non-structural measures.

As far as the preparation of the hazard map in Matara city, the following comments should be made:

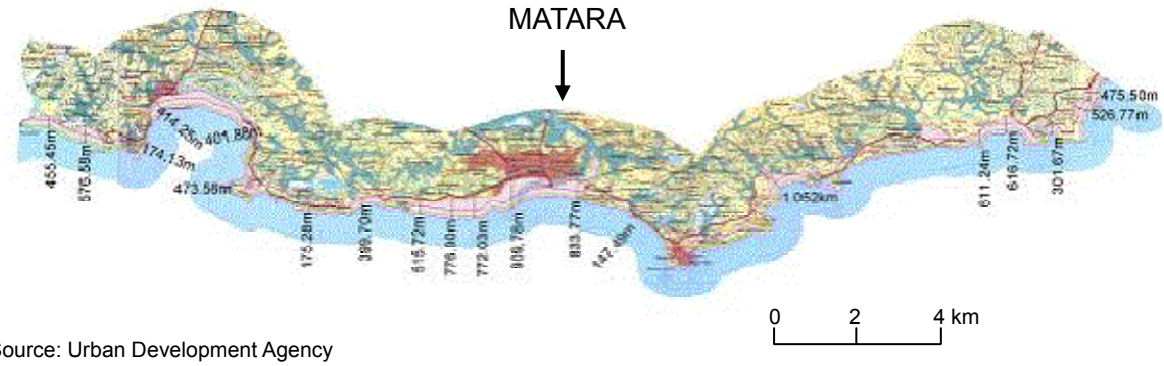
- The McRAP (Matara City Renewal Action Program) is to be prepared in coordination with the rehabilitation program of the tsunami disaster. The Government of Sri Lanka has formed a special task force for McRAP and is strongly aware of the necessity of a hazard map to prepare the township program for post-disaster; and
- No large earthquake sources are near/around southern Sri Lanka and flash floods have not occurred in Matara city in the recent past. When water levels rise slowly or a tsunami hits the area and a few hours pass, people living in the affected area have enough time to evacuate. Using the hazard map for evacuation can be one of the best ways to save lives in Matara city.

(2) Available Hazard Map

A hazard map is defined as a map that can accomplish the following: (i) identify the disaster-prone areas; (ii) classify the hazard level; and (iii) indicate information for disaster damage minimization activities such as evacuation routes/places and disaster reduction facilities. Even though there was not an official hazard map in Matara city, similar kinds of maps were collected from the concerned agency as shown next.

1) Tsunami-Affected Area (UDA GIS Division)

This map shows the 2004 tsunami-affected areas in southern Sri Lanka. The scale of the map is much wider than that of Matara city. In this map, necessary information about the hazard map, such as tsunami arrival time and inundation depth, are not indicated.

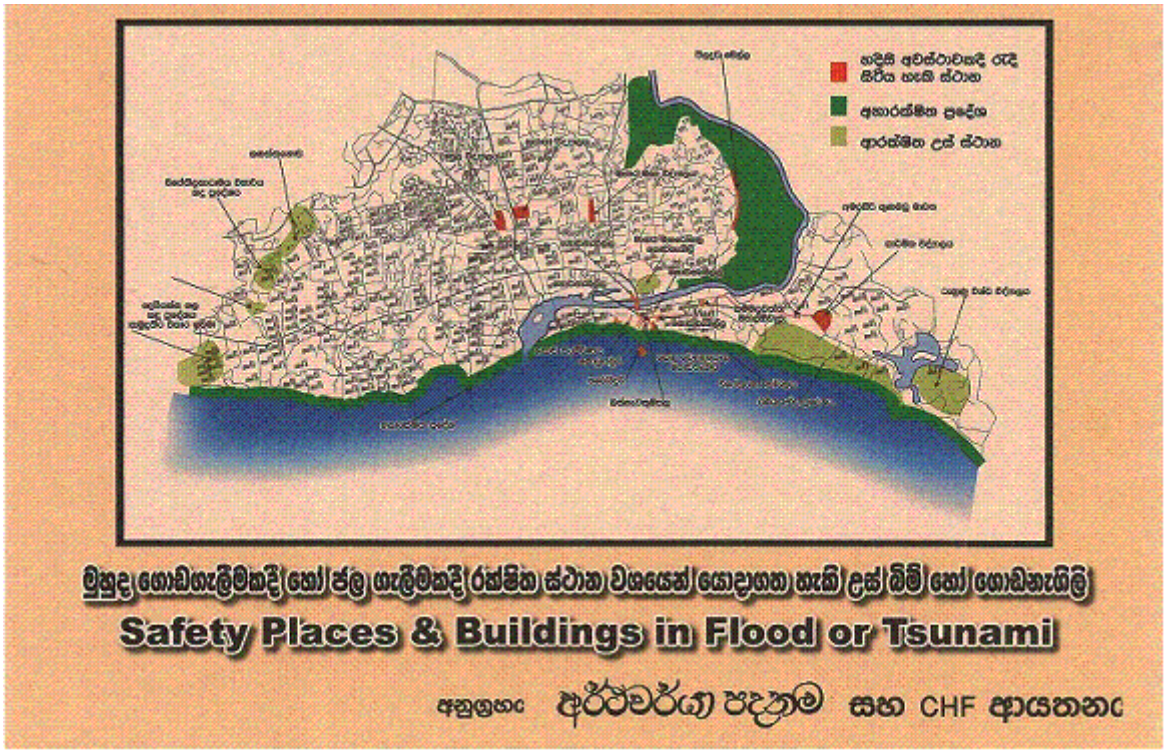


Source: Urban Development Agency

Figure 10.12 Tsunami-Affected Area

2) Avoidance Map (Matara Municipal Council)

This map shows both 2004 tsunami and 2003 flood affected areas, along with evacuation places and elevated places in Matara city. This map is displayed at the Matara bus terminal. It may, however, create confusion as the estimated inundation area was inaccurate (for example, the tsunami inundation area was defined by a parallel area to the coast or the flood inundation area was covered only on the left side of the rivers). The staff that prepared this map is aware of this problem and, as a result, the map has not been distributed to the residents.



Source: Matara Municipality Council

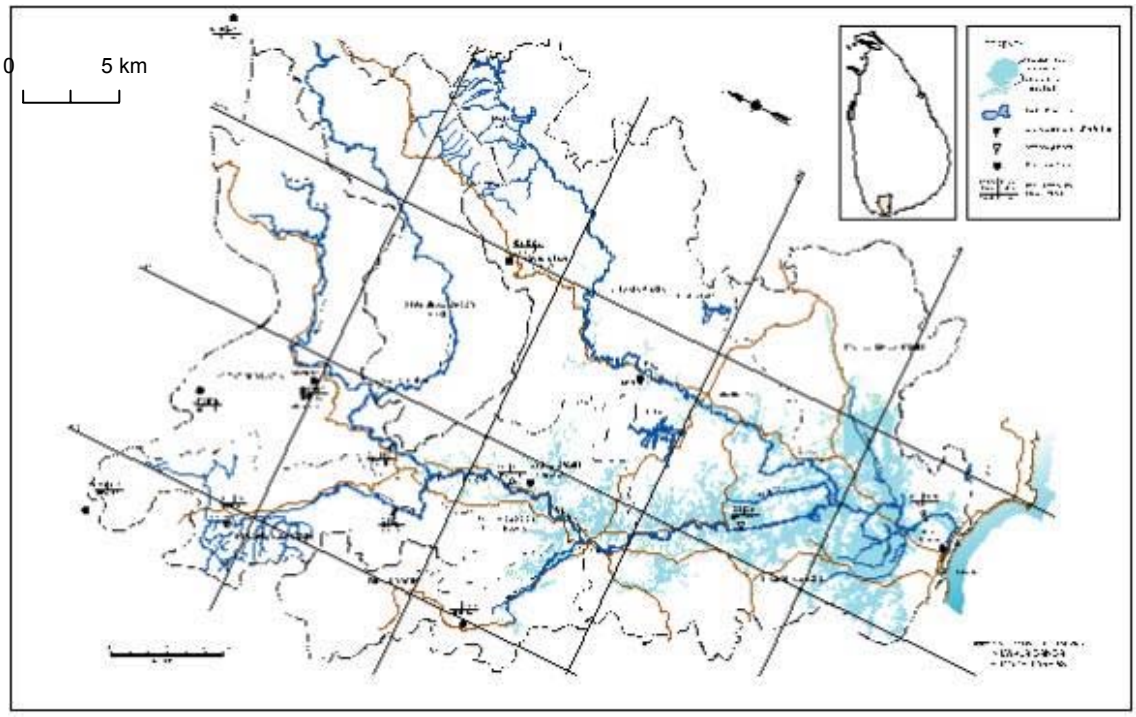
Figure 10.13 Avoidance Map

3) Nilwala Ganga Flood Area (Nilwala Ganga Flood Control Project Report)

This map shows the flood-affected area before implementation of the Nilwala River flood control project in the 1980s. The scale of the map is much wider than that of Matara city. Even though it was prepared decades ago, it was useful to roughly estimate the current flood area.

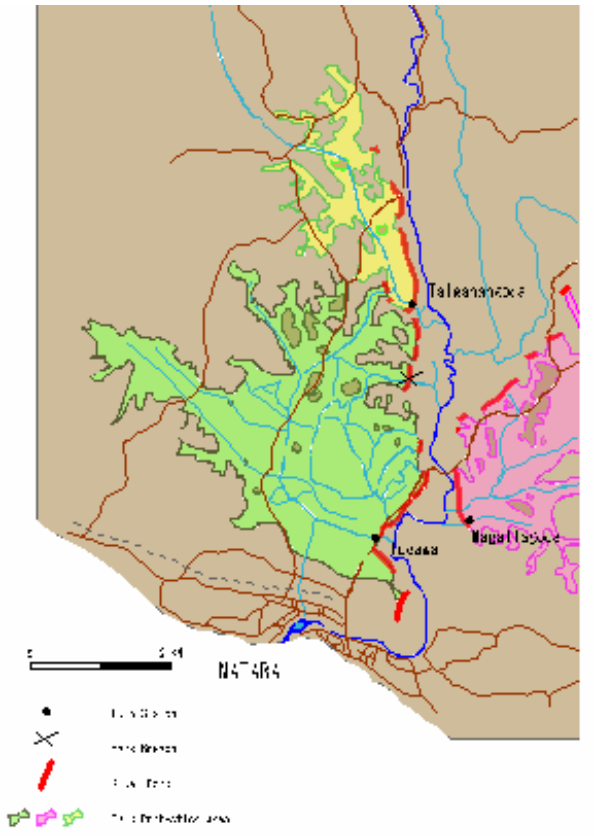
4) Bank Protected Area (Matara Irrigation Department)

This map shows the protected area along the riverbank of the lower Nilwala River. The bank protected area was almost the same as the above map. In the case of the 2003 flood, a large part of the protected area of the bank was inundated due to bank breaches and a poor drainage system in the basin.



Source: Nilwala Ganga Flood Control Project Report

Figure 10.14 Nilwala Ganga Flood Area

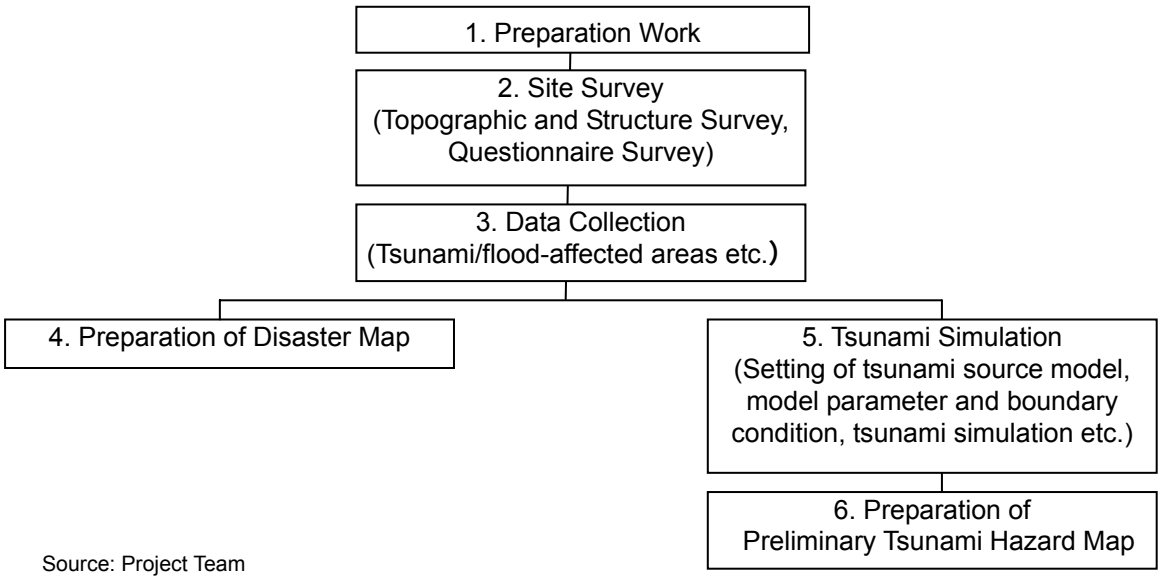


Source: Irrigation Department, Matara

Figure 10.15 Bank Protected Area

(3) Disaster Map and Preliminary Tsunami Hazard Map

Even though the above maps were useful for roughly estimating the disaster-prone area, they were not accurate enough to formulate the disaster management plan and to prevent disaster in Matara city. Therefore, aiming to prepare the basic and accurate information, a preliminary tsunami hazard map and disaster map were prepared by the JICA Project Team. Workflows are shown in Figure 10.16.



Source: Project Team

Figure 10.16 Workflow to Prepare Preliminary Hazard Map and Disaster Map

Information on the disaster map and preliminary tsunami hazard map is shown in Table 10.2.

Table 10.2 Information on Disaster Map and Preliminary Hazard Map

Information	Disaster Map	Preliminary Tsunami Hazard Map
Target disaster	2003 Flood, 2004 Tsunami	2004 Tsunami
i) Disaster-prone area	Past results	Simulation results
ii) Hazard level	Past results (inundation depth only)	Simulation results (Inundation depth, arrival time)
iii) Information for disaster mitigation activities	Past results (flow direction, evacuation direction)	Simulation results (flow direction and velocity*)

Note: *The evacuation information will be excluded in the preliminary tsunami hazard map because this information should be decided through discussions with the local government and residents.
Source: Project Team

The disaster maps are prepared for the 2003 flood and 2004 tsunami, respectively. For the disaster maps, prior records of inundation areas and depths are indicated, which are based on the results of the questionnaire survey.

The tsunami-affected area, inundation depth, tsunami arrival time, and preliminary hazard level in the case of the 2004 tsunami are indicated based on the tsunami simulation. The preliminary tsunami hazard map does not include information for disaster mitigation activities, as this information should be decided through discussions between the local government and residents. As such, the task of this Project was limited only to preparing a preliminary tsunami hazard map and making suggestions for next steps.

10.5.2 Site Survey

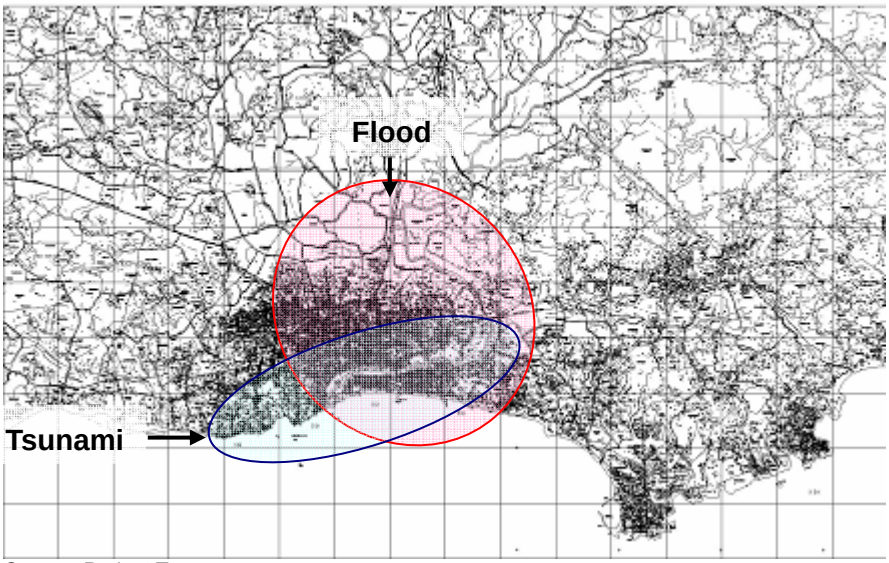
(1) Survey Area and Survey Items

The survey area covered the Matara Division, which was affected by the 2004 tsunami and the 2003 flood, as shown in Figure 10.17. Survey items and usage of results are shown in Table 10.3.

Table 10.3 Survey Items and Usage of Survey Results

Survey	Item	Usage of Survey Results	Remarks
Data Collection	Review of Report	Basic data for preparing hazard and disaster maps.	
	Data Collection	Base map (contour lines, land use, alignment of loads and main structure, etc.) Basic data for tsunami simulation (tsunami source, boundary conditions, etc.)	
Site Survey	Site Inspection for High Water Mark	Estimation of conditions and damages to tsunami/flood-affected areas Calibration data for tsunami simulation	
	Topographic Survey	Interpolation and improvement of topographic data	
	Structure Survey	Boundary condition of tsunami simulation	
	Questionnaire Survey	Preparation of tsunami/flood disaster map Calibration data for tsunami simulation	Section 10.4.3

Source: Project Team



Source: Project Team

Figure 10.17 Site Survey Area

(2) Data Collection and Review of Reports

The aim of the data collection and report review activities is shown in Table 10.4. A list of collected data in the Project is shown in Annex 10-1.

Table 10.4 Purpose of the Report Review and Data Collection

Purpose	Data and Reports to Be Collected
Collection of basic information	Maps of Matara Basic information of Matara city Preliminary information of damage in Matara City
Collection of basic data for disaster map	Reports of 2003 flood damage, etc. Water level records in Nilwala Ganga (pump station)
Collection of basic data for preliminary tsunami hazard map	Reports of 2004 tsunami damage, etc. Manuals for preparation of hazard map Topographic and chart data around Matara Reports for tsunami source model of 2004 tsunami

Source: Project Team

(3) Site Survey

1) Site Survey for 2004 Tsunami

a) Site Inspection

Site inspection is conducted to investigate the actual conditions and damage done to Matara city after the 2004 tsunami. The results of the site inspection are summarized in Figure 10.8 and Table 10.5. The Pholhena GS along the coast in the western Matara Division was seriously damaged by the tsunami. One of the main reasons is that many

houses were made of bricks or coral stones and that mortar lacked reinforced bars in the walls (as shown in Figure 10.18). Furthermore, the area lacked evacuation areas (such as elevated places), while many were not highly-reinforced concrete (RC) buildings.

Source: Project Team

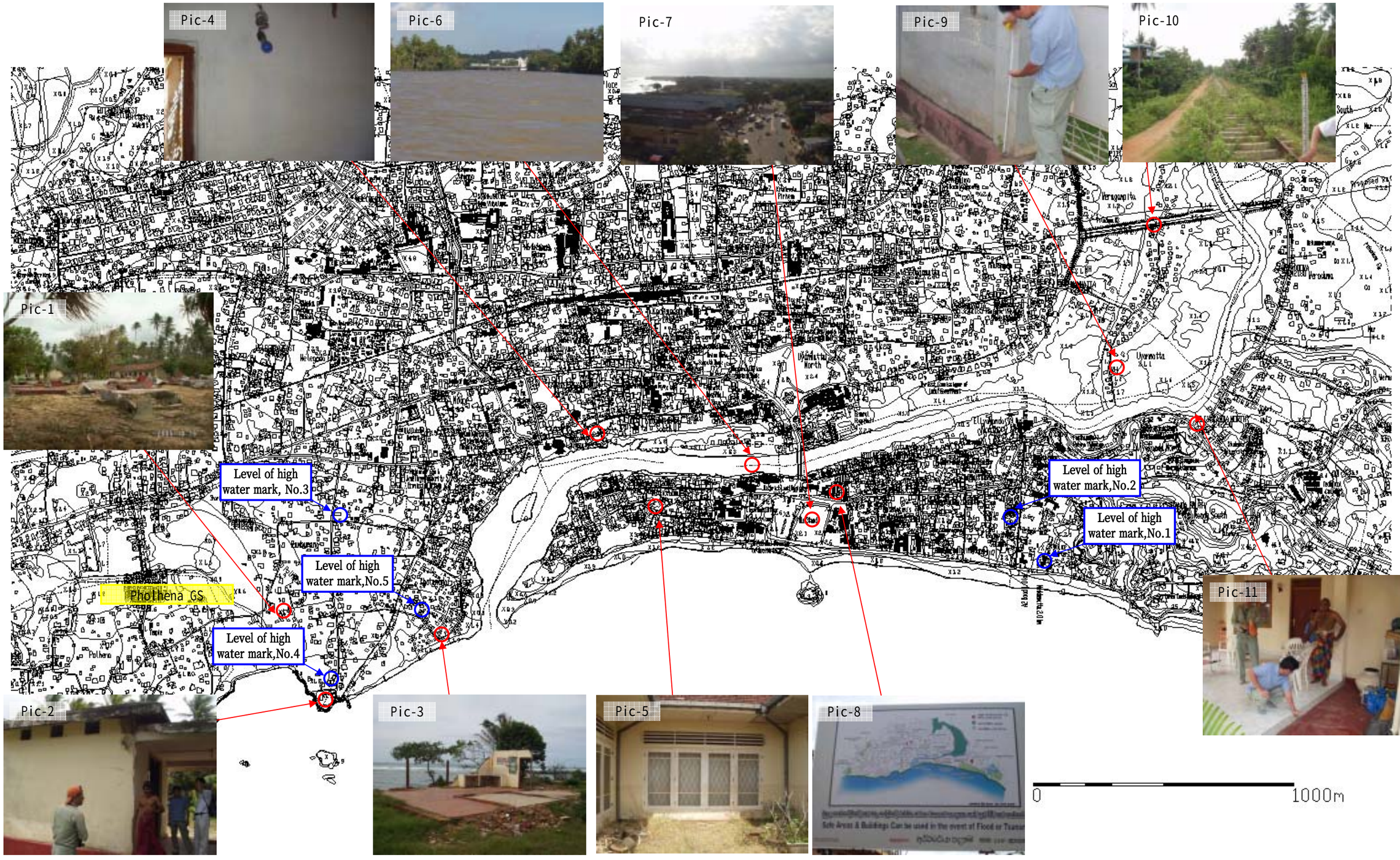
Figure 10.18 Section of a House Wall in the Polhena Area

(left : coral stone wall, right, brick wall)

Table 10.5 Results of Site Inspection for 2004 Tsunami

No.	Area	Condition
Pic-1	Polhena	Many houses near the coast were completely destroyed (except for the foundation).
Pic-2	Polhena	Damage to a temple was minor because it was an RC structure.
Pic-3	Polhena	A brick house in the coastal area was completely destroyed (except for its foundation and walls). Its walls stood in parallel to the direction of the tsunami wave.
Pic-4	Central of Matara city	The highest level that the water reached during the tsunami is marked on a house near the Nilwala River. This house was not damaged, but many riverside houses were completely destroyed.
Pic-5	Newtown of southern Matara	The highest level that the water reached during the tsunami is marked at 1 m from the ground (this still being clearly visible). The house was not damaged, but yard walls were destroyed. It may be inferred that yard walls reduced the power of the tsunami wave.
Pic-6	Nilwala River	Looking at the Nilwala River upstream from the bridge, little difference was observed between the Nilwala River water level and the ground level. Also since river banks were not fortified, the tsunami penetrated upstream along the river and caused floods.
Pic-7	Newtown of southern Matara	Many people climbed to the second story of the two-story bus terminal at the new town of southern Matara.
Pic-8	Newtown of southern Matara	An avoidance map is posted north of the bus terminal.
Pic-9	Suburban area of Matara city	During site inspection for tsunami penetrated along Nilwala River, it was found that the right side of the lower Nilwala River is in a lowland area and is highly vulnerable for tsunami and flood.
Pic-10	Suburban area of Matara city	Due to the railway embankment (construction has halted), the upstream area was protected from the tsunami.
Pic-11	Suburban area of Matara city	During site inspection for the tsunami along the left side of the Nilwala River, the inundation depth was around 10 cm (as the ground level of the left side is higher than that of the right side).

Source: Project Team



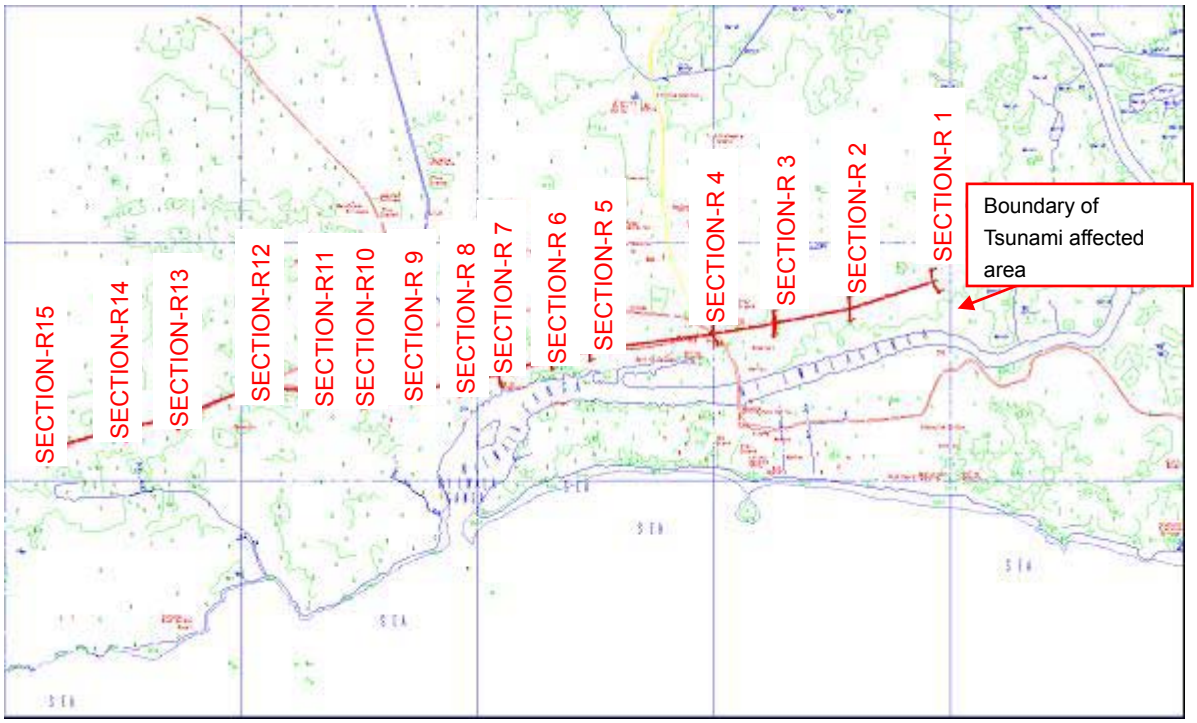
Source: Project Team

Figure 10.19 Location Map of Site Inspections

b) Topographic Survey

To simulate the tsunami movement on land, accurate topographic data was needed. In particular, topographic data around the boundary of the tsunami-affected area had a large impact on the results of the simulation. The location map of the topographic survey is shown in Figure 10.20.

Using the results of the topographic survey, topographic data on the grid of 50 m, which was collected from the Survey Department in Sri Lanka, was interpolated, with its accuracy also being improved.

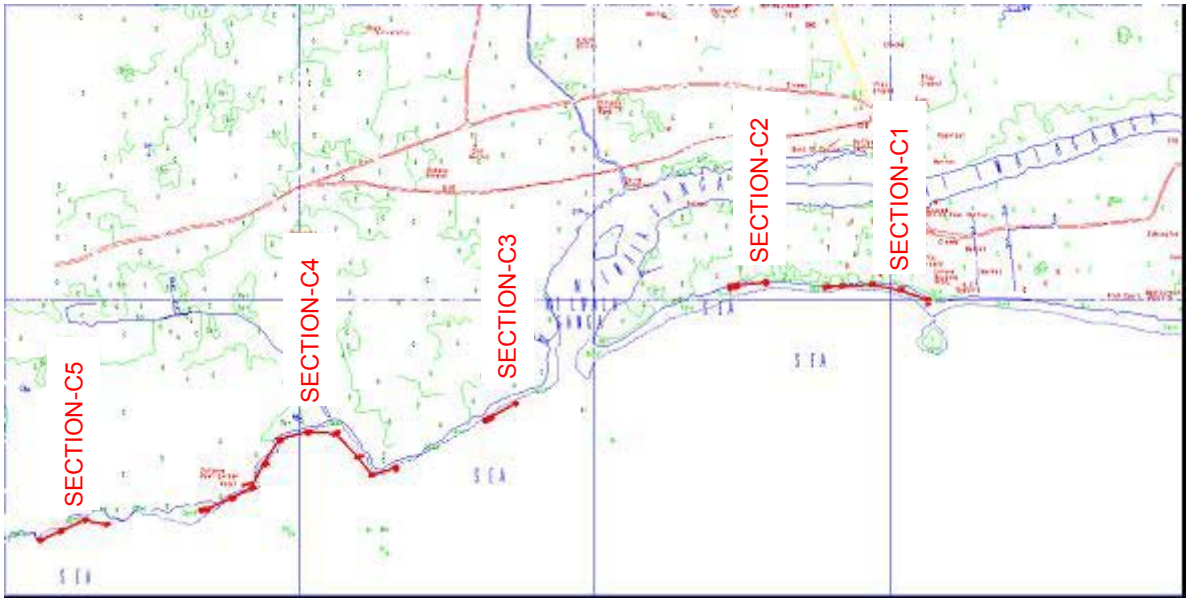


Source: Project Team

Figure 10.20 Location Map of Topographic Survey

c) Structural Survey

A structural survey was conducted to investigate the location, alignment, and height of coastal structures, and the larger size of reinforced concrete buildings and partition walls. It is considered that many seawalls had been constructed after the 2004 tsunami as shown in Figure 10.21, thus changing the way that a tsunami would hit land.



(a) Location Map of Seawalls

(b) Section 1

(c) Section 4

Source: Project Team

Figure 10.21 Location Map and Photos of Seawalls

2) Site Survey for 2003 Flood

Matara city in the lower Nilwala Basin experienced a major flood in May 2003. This flood was one of the largest observed in the recent past and inundated the entire northern area of Matara city causing excessive damage. The flood-affected area was wider and more complicated than the tsunami-affected area. The objectives of the site inspection for the 2003 flood were as follows:

i) Clearly mark the boundary of the flood-affected area before the beginning of the questionnaire survey;
ii) Collect accurate water level data at three pump stations in the basin; and
iii) Investigate the conditions of the bank breaches during the 2003 flood.

The results of the site inspection are summarized in Figure 10.22 and Table 10.6.

Even though the 2003 flood was directly caused by bank breaches upstream of the Nilwala River in northern Matara city, the following aspects should also be considered:

i) Reportedly a lower section (BR 4) of the bank was breached due to excessive seepage from bank settlement, while an upper section (BR 7) had been cut open and breached by residents; and
ii) Three pump stations, to deal with local drainage, were constructed on both sides of the river at Tudawa, Magallagoda and Talgahagoda in the 1980's, with a total of 24 pumps being installed (however, only half were working during this flood).

In order to bring about comprehensive disaster reduction after a flood has taken place, education and enlightenment in disaster awareness for local people and fundamental rehabilitation works are recommended for immediate implementation, as well as the preparation of the hazard map.

Table 10.6 Results of Site Inspection for the 2003 Flood

No.	Area	Condition
	Northern Matara	Flood high water marks were still remaining
Pic-1	Tributary in Northwestern Matara	The tributary runs through northwestern Matara city. The 2003 flood caused inland inundation from this tributary.
Pic-2	End Point of New Highway	The embankment for a new highway from Galle to Matara was under construction. The endpoint of the new highway was located in the 2003 flood affected area.
Pic-3	Canal in Western Matara	The canal runs through western Matara, from north to south.
Pic-4	Northern Matara	Gas stations along main roads were affected during the 2003 flood. The marks indicating the height that flood waters reached are still clearly remained visible, although were gradually disappearing.
Pic-5	Lower Nilwala River	Many houses were constructed on the riverside, without bank protection.
Pic-6	Bank in Northern Matara	Banks were constructed in order to create a buffer zone between houses and the river.
Pic-7	Northern Matara	A very wide floodplain spreads out from Northern Matara city.
Pic-8	Pump Station (SR1/SR2:Tudawa)	5.5 km upstream from the Nilwala River mouth, four out of eight pumps are out of water. Water level is monitored manually.
Pic-9	Bank Breach Section (BR4)	9.0 km upstream from the Nilwala River mouth, a bank breach was reported due to excessive seepage caused by settlement. After the flood, the bank was constructed.
Pic-10	Bank Breach Section (BR7)	10.0 km upstream from the Nilwala River mouth, a bank breach was reported due to cuts being opened by residents living in the unprotected area.
Pic-11	Bank (BR 8)	10.5 km upstream from the Nilwala River mouth, the top of the bank subsided due to settlement.
Pic-12	Pump	To deal with local drainage, 24 pumps were installed in the 1980s, although at present 10 of these are out of order. A few pumps are being repaired though.

Source: Project Team

Water level record

The maximum heights reached by water at the three pump stations during the 2003 flood are shown in Table 10.7. The water level gauge of the Tudawa Pump Station, which is located in northern Matara city, reached a maximum level of 3.45 m MSL on the 18th at 3:00 p.m. Thus, in northern Matara city, the floodwaters on the low plains elevated from 1.0 m MSL and 2.5 m MSL, meaning the inundation depth was estimated at around 1.0 m to 2.5 m in this area.

Table 10.7 2003 Flood Levels at Pump Stations

Pump Station	Tudawa	Magallagoda	Talgahagoda
Flood Level	3.45 m MSL	3.62 m MSL	4.27 m MSL
Peak Time	3:00 p.m. on May 18, 2003	3:00 a.m. on May 19, 2003	3:00 a.m. on May 19, 2003

Source: Project Team