

The Republic of the Union of Myanmar
Ministry of Environmental Conservation and Forestry

THE SECOND PREPARATORY SURVEY
ON
MANGROVE REHABILITATION PLAN
FOR ENHANCEMENT OF DISASTER PREVENTION
IN THE AYEYAWADY DELTA
IN THE REPUBLIC OF THE UNION OF MYANMAR

FINAL REPORT

January 2012

Japan International Cooperation Agency (JICA)
Kokusai Kogyo Co., Ltd.

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Preface

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Kokusai Kogyo Co., Ltd.

The survey team held a series of discussions with the officials concerned of the Government of Myanmar, and conducted a field investigation. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Myanmar for their close cooperation extended to the survey team.

January, 2012

Mr. Shinya Ejima
Director General,
Global Environment Department
Japan International Cooperation Agency

Summary

1. Outline of the Recipient County

(1) Land and Nature

The Republic of the union of Myanmar (hereinafter referred to as “Myanmar side”) is located between latitude 10° and 28° north, has an area of approximately 678,500km² (about 1.8 times that of Japan), and is characterised by a long landform stretching north and south. It has land borders with China, Thailand, India and Bangladesh, and the total length of these borders is approximately 4,600 km. It faces the Gulf of Martaban, Bay of Bengal and Indian Ocean, the total length of coastline is approximately 2,000km.

The project site is located in Ayeyawady Delta, a coastal region southwest of the largest city Yangon. The total area of Ayeyawady is 33,670 km². The south of this area is mostly flat, with the highest elevation being 3 m. Land of the project site is separated by rivers and creeks like a mesh. Rainy season is from around May to October. The average maximum temperature is around 30 C°. However, the average minimum temperature during the dry season is lower than 15 C°.

(2) Socioeconomics

In May 2008, a catastrophic cyclone, Nargis struck Myanmar, causing the loss of 140 thousand lives and 2.4 million people missing. Also in May 2008, soon after Nargis, Myanmar held a referendum on the adoption of a new constitution in accordance with democratisation road map. The new constitution was adopted with 98.12% voter turnout, and 92.48% voting in approval. Then in November 2011, a general election was held based on a new constitution after an interval of 20 years.

As for the macro economics of Myanmar, economic sanctions by the United States of America and the European Union among others have resulted in extremely undeveloped infrastructure and financial system. And also as a result of these situations, Myanmar has structural problems such as stagnation of foreign trade and investment. However, natural gas development and export are going well, with countries such as China, Thailand, Korea, India and Russia investing in these fields. In particular, foreign currency reserves have increased to 5 billion USD (as of the end of 2009), reflecting the favourable situation of natural gas exports to Thailand. Myanmar's main industry is agriculture, its GDP per capita is 462 USD (2009 IMF estimation), its economic growth rate is 7.9 % (2009 IMF estimation), and its inflation is also 7.9 % (2009 IMF estimation). Its trading partners, in order of value of exports, are: Thailand, India, China, Hong Kong, Singapore, and Japan; and in order of value of imports: China, Singapore, Thailand, Japan, India, Malaysia (2007).

2. Background and Outline of the Project

(1) Upper Plan

“Myanmar Action Plan on Disaster Risk Reduction 2009-2015” was drawn up in July 2009. The action plan shows 7 main policies including vegetation planting and construction of cyclone shelters. The goal of the action plan is “To Make Myanmar Safer and More Resilient Against Natural Hazards, thus Protecting Lives, Livelihood and Developmental Gains”. The “5-year Mangrove Rehabilitation Plan” outlines a plan to plant 88,000 ha of mangroves in Ayeyawady Delta, including the project site.

(2) Current Condition and Problems

Myanmar has one of the highest rates of forest loss among ASEAN countries; especially the Ayeyawady Delta has seen the worst devastation of mangrove forests. The Ayeyawady Delta has been managed as a conservation area since the beginning of the twentieth century. However, the mangrove forest cover has been decreasing due to lawless development (e.g. firewood, agricultural expansion and aquaculture). Recently, 44,000 ha of mangrove have vanished from 2001 to 2007.

On the other hand, Cyclone Nargis struck in May 2008, having a serious impact on resident's daily lives and livelihoods, with a huge death toll and missing persons. Although approximately 38,000 ha of Mangrove of coastal area was devastated by the cyclone, it also served to confirm the disaster prevention effectiveness of mangroves such as their role in alleviating seawater invasion by flood tide, prevention of erosion and drifting floating wreckage. However, the Myanmar side has a top priority to establish lifelines in the restoration and rehabilitation process. Budget allocation for mangrove rehabilitation is not enough and damage of mangrove forest is large scale. Therefore, it is difficult for Myanmar to implement early rehabilitation of mangrove forests on its own.

(3) Objective of the Project

The project is to plant mangroves in the Ayeyawady Delta, construct cyclone shelter with forest watch tower, and procure vehicles. Through these, the project aims to “Rehabilitate mangrove ecosystems in the Ayeyawady Delta and recover the function of disaster prevention and mitigation”.

(4) Related Project

JICA technical cooperation project, “the Integrated Mangrove Rehabilitation and Management Project through Community Participation in the Ayeyawady Delta (2007~2013)” has been underway in the project site since 2006. The increased capability and experience personnel have gained through this technical cooperation project shall be fully taken advantage of in this Grant Aid Project.

3. Summary of the Survey and Contents of the Project

(1) Summary of the Survey

From the background mentioned above, JICA conducted the First Preparatory Survey between May 31, 2010 and June 12, 2010. In this survey, a certain validity of implementation of the mangrove plantation project was evaluated. After this survey, JICA sent a survey team between January 10 and March 10, 2011, June 11 and July 10, October 23, 2011 and October 29, 2011 to Myanmar as the Second Preparatory Survey. The survey team conducted natural condition surveys (site reconnaissance, land survey, land use survey, tidal inundation, current mangrove species, soil condition and so on) and social condition survey at the project site in the Ayeyawady Delta.

The summarized result of field survey in Myanmar and analysis in Japan are mentioned below.

1) Mangrove Plantation

The original extent of the requested project from the Myanmar side covered Kadonkani Reserved Forest (RF), Kyakankwinpauk RF, and Pyinalan RF; a total area of 3,400 ha of mangrove plantation. Based on the original request, the survey team calculated the potential area of mangrove plantation by excluding existing cultivated areas, existing forest areas which canopy ratio is more than 50%, low lying areas, and so on by the field survey. Based on the result of calculation of potential area, Kadonkani RF was selected as the project site, and total plantation area of 1,154 ha was calculated in terms of disaster prevention effectiveness of the mangrove plantation, implementation and management as Grant Aid, and cost effectiveness of the forest project.

Two species of mangrove were selected based on elevation of the project site, and from the viewpoints of dominance, availability, survival rate, growth rate, site matching, and resiliency.

2) Cyclone shelter with forest watch tower

i) Site selection

Construction of cyclone shelter in Kyakankwinpauk RF and Pyinalan RF were excluded because these were excluded from mangrove plantation project site. Finally, construction site in Kadonkani RF was selected through a survey of location of existing shelters and so on, and the number of shelters to be constructed was set as one.

ii) Design standards

There are no existing standards that clearly show effective area per person for cyclone shelters. Therefore, the survey team adopted 0.45 m² / person taking into consideration the area where a man or woman can sit down, and the existing facilities. Seismic load and wind load for structural design were

adopted from Myanmar Engineering Society. Main purpose of the cyclone shelter is for emergency use. Therefore, in terms of simple management, there is no electrical installation. Simple water supply facility and toilets using roof water are installed for only emergency use.

3) Equipment procurement

Mainly boats are to be used for transporting to the project site. Therefore, the survey team judged there is no need to procure trucks for transportation of materials and construction equipment (heavy machinery). The survey team judged that vehicles and a boat are needed for management of the project and so on.

(2) Contents and Scale of the Project

1) Mangrove Plantation

Mangrove plantation plan of the project is as follows.

Table.1 Contents and Scale of mangrove plantation

Elevation	Elevation < 0.75 m (ha)	Elevation >= 0.75m (ha)
Mangrove Species	<i>Sonneratia caseolaris</i>	<i>Avicennia officinalis</i>
Plants number and Area		
Dense Brush Land	231,000 plants / 132 ha	418,250 plants / 239 ha
Sparse Brush Land	499,375 plants / 235 ha	499,375 plants / 235 ha
Grassland	367,500 plants / 147 ha	415,000 plants / 166 ha
Subtotal	1,097,875 plants / 514 ha	1,332,625 plants / 640 ha
Total	2,430,500 plants / 1,154 ha	
Average Density	2,139.5 plants / ha	2,082.2 plants / ha

2) Cyclone shelter with forest watch tower

Construction plan of cyclone shelter is as follows.

Table.2 Contents and Scale of cyclone shelter

	Specification
Site location and Construction number	Kadonkani RF (FC 55), 1 facility
Purpose	Emergency use, Surveillance from a watch tower
Capacity	150 persons
Architectural area	239.17m ²
Effective area (Shelter room)	67.5m ²
Toilet	4 toilets
Drinking water for Emergency	Stock of rain water
Electricity	Not planned
Structure	Reinforced concrete building

3) Equipment procurement

Equipment procurement of the project is as follows.

Table.3 Contents and Scale of Equipment procurement

Classification	Equipment	Purpose	Number
Operation and Management Equipment	Vehicle	Operation and management for the project and after the project	2 vehicles
	Passenger and cargo boat		1 boat

4) Soft component

The objective of the soft component is “the formulation of a mangrove forest management plan through community participation, the commencement of activities for continual conservation of mangrove forests, and deepening of the residents' understanding of the functions of the mangrove forest”. For the objective, formulate a mangrove forest management plan through discussion and deliberation between the Forest Department (FD) and the local residents, emergency drills including utilization of the shelter which will be constructed as the project, the aquatic life survey for estimation of effectiveness of mangrove plantation are implemented as the soft component activities.

(2) Project Cost

In order to implement the project, the project cost borne by Myanmar side is 45,253,000 Kyat.

5. Project Evaluation

(1) Validity

The Project implementation by Grant Aid is evaluated to be reasonable based on the result of this survey for the following reasons.

- Beneficiary population of the project is a considerable number, including those considered to be in the “worse off” category.
- “Myanmar Action Plan on Disaster Risk Reduction 2009-2015” was drawn up in July 2009, the action plan shows 7 main policies including plantation and construction of cyclone shelters. The goal of the action plan is “To make Myanmar Safer and more Resilient against Natural Hazards, thus Protecting Lives, Livelihood and Developmental Gains”, implementation of the project contributes to achievement of the goals of the action plan.
- Forest Department (FD), as the implementation agency, has experience and capacity for mangrove plantation and management, and has enough capability to implement mangrove operation and management after the project. And also, mangrove plantation and construction of the cyclone shelter are common in the project site so it does not require special techniques for construction and management.
- This project is a related project of Japan Aid Policy of Basic Human Needs that benefit to local residents directly
- This project is not a profit-earning project.
- Negative impact on the environment is not generated by the Project implementation according to the Environment Impact Assessment (EIA).
- The Project implementation by Japanese Grant Aid scheme is not particularly difficult.

(2) Project Impact

1) Quantitative Impact

Quantitative impact to be expected by implementation of this project is mentioned below.

Table.5 Quantitative Impact after implementation of the Project

Indicator	Baseline (2011)	Target value (2019)
Beneficiary local residents of wind breaking through mangrove plantation	0 people	Approx. 4,400 people
Beneficiary local residents of tide prevention through mangrove plantation	0 people	Approx. 210,000 people
Green house effect reduction	0 ton / year	Approx. 35,450 ton / year
Capacity of shelters in and near the project site	2,309 people	2,459 people

2) Qualitative Impact

Qualitative impact to be expected by implementation of the Project is mentioned below.

- Improvement of Forest management and preservation capacity of FD staff.
- Improvement of local resident awareness of disaster prevention and conservation of mangrove forest.
- Coastal ecosystems and biological diversity will be protected and conserved through proper management of mangrove forest, and contribution to water purification
- Local residents will benefit economically and environmentally due to biological diversity and utilization as firewood through pruning of branches.

From the above-mentioned contents, implementation of the project is assessed as reasonable and effective.

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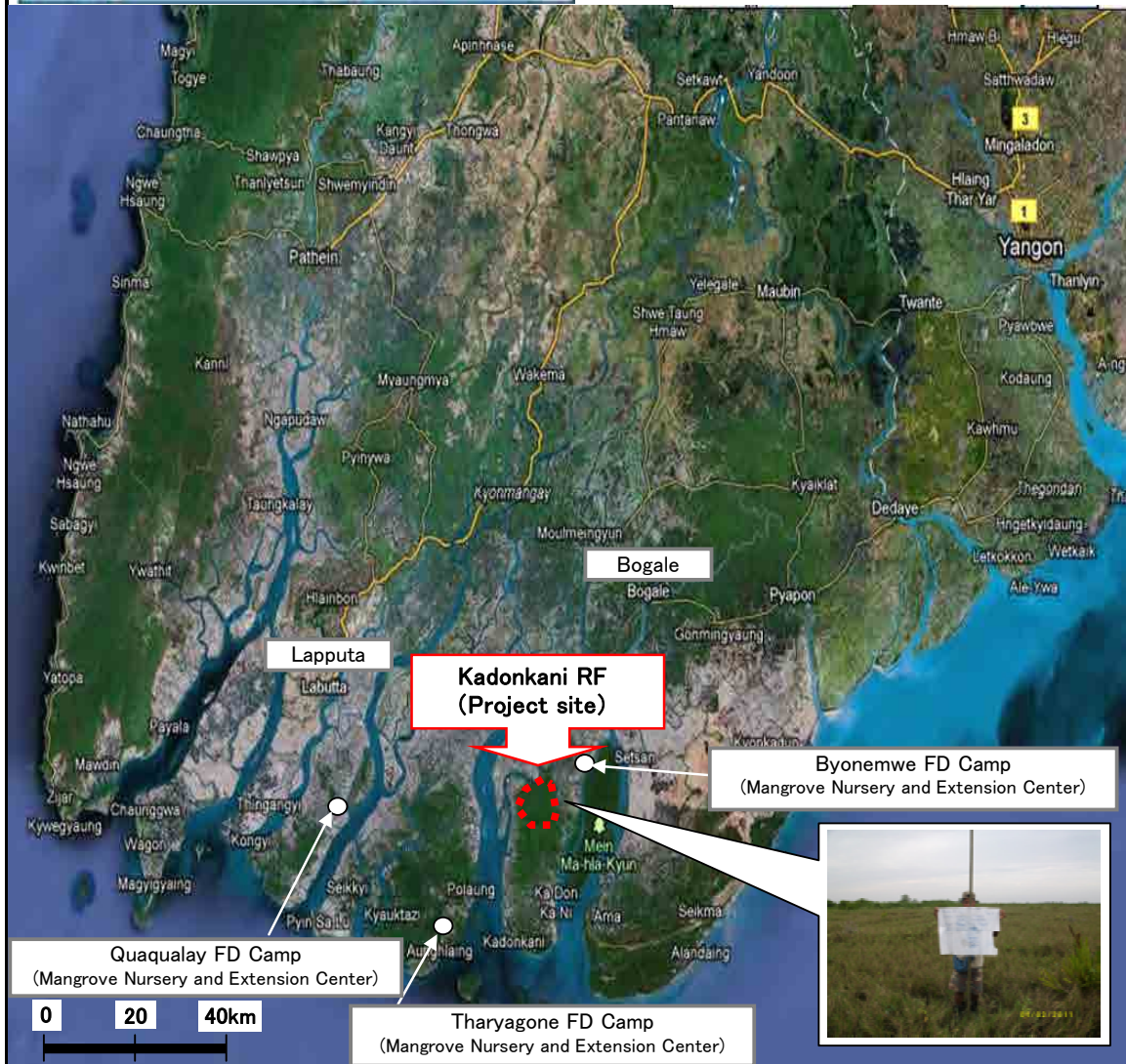
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Abbreviations

BANCA	Biodiversity and Nature Conservation Association
CF	Community Forest
CFUG	Community Forest User Group
ECCDI	Ecosystem Conservation and Community Development Initiative
ECLOF	National Ecumenical Church Fund Myanmar
E/N	Exchange of Notes
EU	European Union
FC	Forest Compartment
FD	Forest Department
FREDA	Forest Resource Environment Development and Conservation Association
G/A	Grant Agreement
GDP	Gross Domestic Product
GPS	Global Positioning System
IEE	Initial Environmental Examination
IMF	International Monetary Found
IPCC	Intergovernmental Panel on Climate Change
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
MAPDRR	Myanmar Action Plan on Disaster Risk Reduction
MECAF	Ministry of Environmental Conservation and Forestry
MERN	Mangrove and Environmental Rehabilitation Network
MES	Myanmar Engineering Society
NCEA	National Commission for Environmental Affairs
NGO	Non Government Organization
PDC	Peace and Development Council
RF	Reserved Forest
RTK	Real Time Kinematic
REDD+	Reducing Emissions from Deforestation and Forest Degradation
UNDP	United Nation Development Program

Chapter 1

Background of the Project

1. Background of the Project

1-1 Background of the Project

The Republic of the Union of Myanmar (hereinafter referred to as the “Myanmar side”) has one of the highest rates of forest loss among ASEAN countries; especially the Ayeyawady Delta has seen the worst devastation of mangrove forests. The Ayeyawady Delta has been managed as a conservation area since the beginning of the twentieth century. However, the mangrove forest cover has been decreasing due to lawless development (e.g. firewood, agricultural expansion and aquaculture).

JICA conducted a development study (2002~2005), then settled on the Integrated Mangrove Management Plan that aimed to improve resident's livelihoods and sustainably manage mangrove forests. The Ministry of Forestry has started to implement the above plan as a “5-year Mangrove Rehabilitation Plan”, however, both the government and residents did not have enough knowledge for forest management through community participation. Therefore, the Myanmar side requested technical Cooperation Assistance to the Government of Japan (hereinafter referred to as the “Japan side”); in response to the above request from the Myanmar side a Technical cooperation project, “the Integrated Mangrove Rehabilitation and Management Project through Community Participation in the Ayeyawady Delta (2007~2013)” (hereinafter referred to as “the technical cooperation project”), was formed and is currently being implemented.

In the midst of implementation of these projects, Cyclone Nargis struck in May 2008, having a serious impact on resident's daily lives and livelihoods, with a huge death toll and missing persons. Although approximately 38,000 ha of Mangrove of coastal area was devastated by the cyclone, it also served to confirm the disaster prevention effectiveness of mangroves such as their role in alleviating seawater invasion by flood tide, prevention of erosion and drifting floating wreckage. The Myanmar side has a top priority to establish lifelines in the restoration and rehabilitation process, and also has an intention for early rehabilitation of damaged mangrove forests. The Myanmar side decided that it would be difficult to implement early rehabilitation of mangrove forests on its own; therefore, it requested grant aid of the Government of Japan.

JICA conducted the First Preparatory Survey to grasp rationality with related policies, contents of request for the project (draft), implementation organization, current situation of selected area for the project, activity of related donors and so on, and then explained Japan’s Grant Aid Scheme. Finally, the Japan side and Myanmar side exchanged Minutes of Discussion about mutual consent.

The Second Preparatory Survey's aim is to formulate an appropriate project plan as Japan’s Grant Aid Scheme and implement an outline design and cost estimation of the project through the survey of confirmation of necessity, validity and urgency of the contents requested by the Myanmar side, and also to inspect social and natural conditions of the target site.

1-2 The Contents of the Requested Project based on the First Preparatory Survey

1-2-1 Mangrove Plantation

Candidate project sites confirmed through the first preparatory survey and discussion with the Myanmar side are the following reserved forests (RF). The forest department in Ayeyawady Delta has jurisdiction over these forests.

- (1) South-eastern part of Kyakankwinpauk RF (800 ha)
- (2) Southern coast of Pyinalan RF (200 ha)
- (3) Kadonkani RF (2,400 ha)

1-2-2 Facility

Construction of a cyclone shelter with forest watch tower

(Construction of a similar facility to those located in the area of the technical cooperation project, in the 3 target sites)

1-2-3 Equipment Procurement

- (1) Vehicles for management
- (2) Trucks for transportation of materials
- (3) Passenger and cargo boat
- (4) Construction equipment (heavy machinery) for plantation

1-3 Land Use Survey Result

The study areas are presented in Table 1-1: The Study Areas for Mangrove Plantation which covers the three (3) reserved forests (Kadonkani RF, Kyagankwimbauk RF and Pyinalan RF) in Bogale and Laputta Township in Ayeyarwaddy Division.

Table 1-1: The Study Areas for Mangrove Plantation

Survey target RF	Area
Kadonkani RF	3,020 ha
Kyagankwimbauk RF	1,636 ha
Pyinalan RF	414 ha

The description of the adjusted classification of land uses is presented in the table below.

Table 1-2: Classification and Description of Land Use

Classification		Description	Plantable?
1	Mangrove Forest	The density of the timber size trees (with 15 cm diameter at 1.3 m from the ground) is 750 trees per ha.	No
2	Brush land dense	The density of the wood and/or non-woody mangrove or associate species with a height of 2.0 m or greater than 2.0 m is more than 60% coverage in a hectare.	Yes
3	Brush land sparse	The density of the wood and/or non-woody mangrove or associate species with a height of 2.0 m or more than 2.0 m is less than 60 % and more than 20% coverage in a hectare.	Yes
4	Grass land	The density of the wood and/or non-woody mangrove or associate species with height of 2.0 m or more than 2.0 m is less than 20 % coverage in a hectare.	Yes
5	Cultivated Paddy	The area is subdivided into compartments with prominent embankment and currently cultivated into paddy.	No
6	Shrimp pond Clearings	The area is currently not being used as shrimp pond	Yes
7	Canal / Digging	The area has been excavated into canal or depression along the access road or paddy field.	No
8	Tidal-flat: Sandy Area	The dry sandy area along the shoreline is frequently inundated by tide water and by wave action (only Pyinalan RF).	No
9	Tidal-flat: Shallow Area	The wet sandy areas along shoreline are regularly inundated by tide water (only Pyinalan RF).	No
10	Sandy-Plantable Area	The elevated sandy area above the tidal flat is not inundated by either tidal, wave action or rain water which is potential for planting of beach forest species (only Pyinalan RF).	Yes
11	Mud-fad: Plantable Area	The mudflat along shoreline (only Pyinalan RF).	No
12	Mangrove Plantation	The mudflats along or adjacent to shoreline have been planted and maintained as mangrove plantation by either FD and/or villagers (only Pyinalan RF).	No
13	Oriza Plantation	The area adjacent to shoreline is planted and maintained as oriza plantation by the villagers, and was initiated by the NGO and serves as a shelterbelt area (only Pyinalan RF).	No
14	Water Pond	Elevated and enclosed embankments serve as rain water collector (only Pyinalan RF).	No
15	Village	The area inside the RF along the riverbank is used by villagers either for temporary or permanent settlement (only Pyinalan RF).	No

1-3-1 Kadonkani RF

The total aggregate area surveyed in Kadonkani RF was 3,020 ha. At Kadonkani RF Mangrove Forest, River-Creek and Stream-Canal were classified as Non-Potential Area; and Brush Land Dense, Brush Land Sparse and Grass Land as Potential Area for Mangrove Plantation (Table 1-3, Figure 1-1).

Table 1-3: Kadonkani RF Land Use Survey Result

FC No.	Total Survey Area (ha)	Non-Potential Area(ha)				Potential Area (ha)			
		Mangrove Forest (Open Canopy)	River-Creek	Stream-Canal	Sub-Total	Brush Land Dense	Brush Land Sparse	Grass Land	Sub-Total
38	494	86	87	9	182	94	127	91	312
39	210	12	47	3	62	52	45	51	148
40	205	41	12	5	58	38	53	56	147
43	347	34	72	8	114	53	98	82	233
44	614	107	30	16	153	172	200	89	461
45	506	82	52	9	143	140	171	52	363
52	644	11	151	9	171	281	167	25	473
Total	3,020	373	451	59	883	830	861	446	2,137

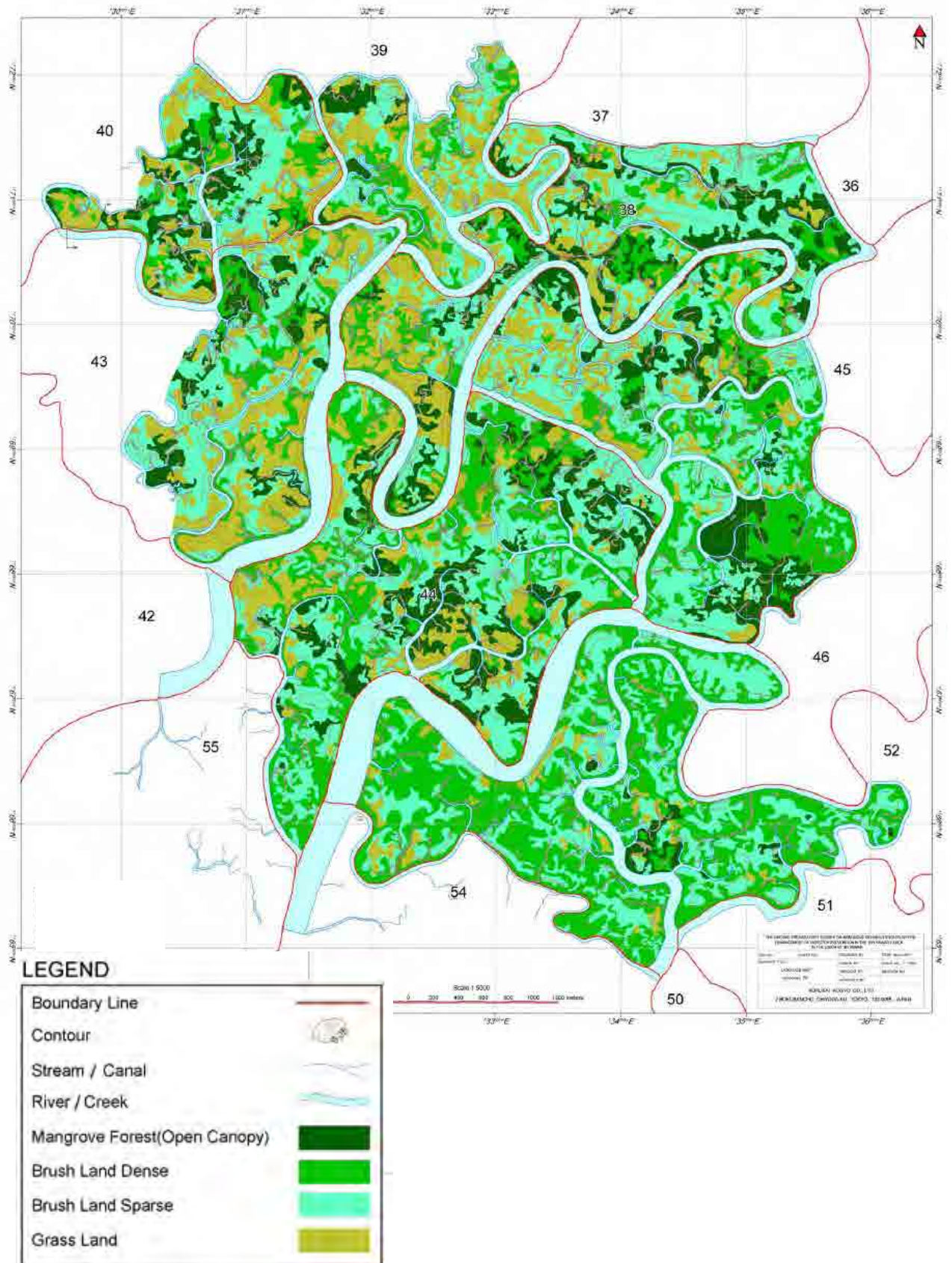


Figure 1-1: Kadonkani RF Land Use Map

1-3-2 Kyagankwimbauk RF

The total aggregate area surveyed in Kyagankwimbauk RF was approximately 1,600 ha. In Kyagankwimbauk RF Mangrove Forest, Cultivated Paddy and River-Creek were classified as Non-Potential Area; and Brush Land Dense, Brush Land Sparse, Grass Land and Shrimp Pond as Potential Area for Mangrove Plantation (Table 1-4, Figure 1-2).

Table 1-4: Kyagankwimpauk RF Land Use Survey Result

FC No.	Total Survey Area (ha)	Non-Potential Area(ha)					Potential Area (ha)				
		Mangrove Forest	Cultivated Paddy	River-Creek	Stream-Canal	Sub-Total	Brush land Dense	Brush land Sparse	Grass land	Shrimp Pond	Sub-Total
25	443	71	7	34	11	123	87	127	56	50	320
27	1,193	128	38	100	11	277	291	328	171	126	916
Total	1,636	199	45	134	22	400	378	455	227	176	1,236

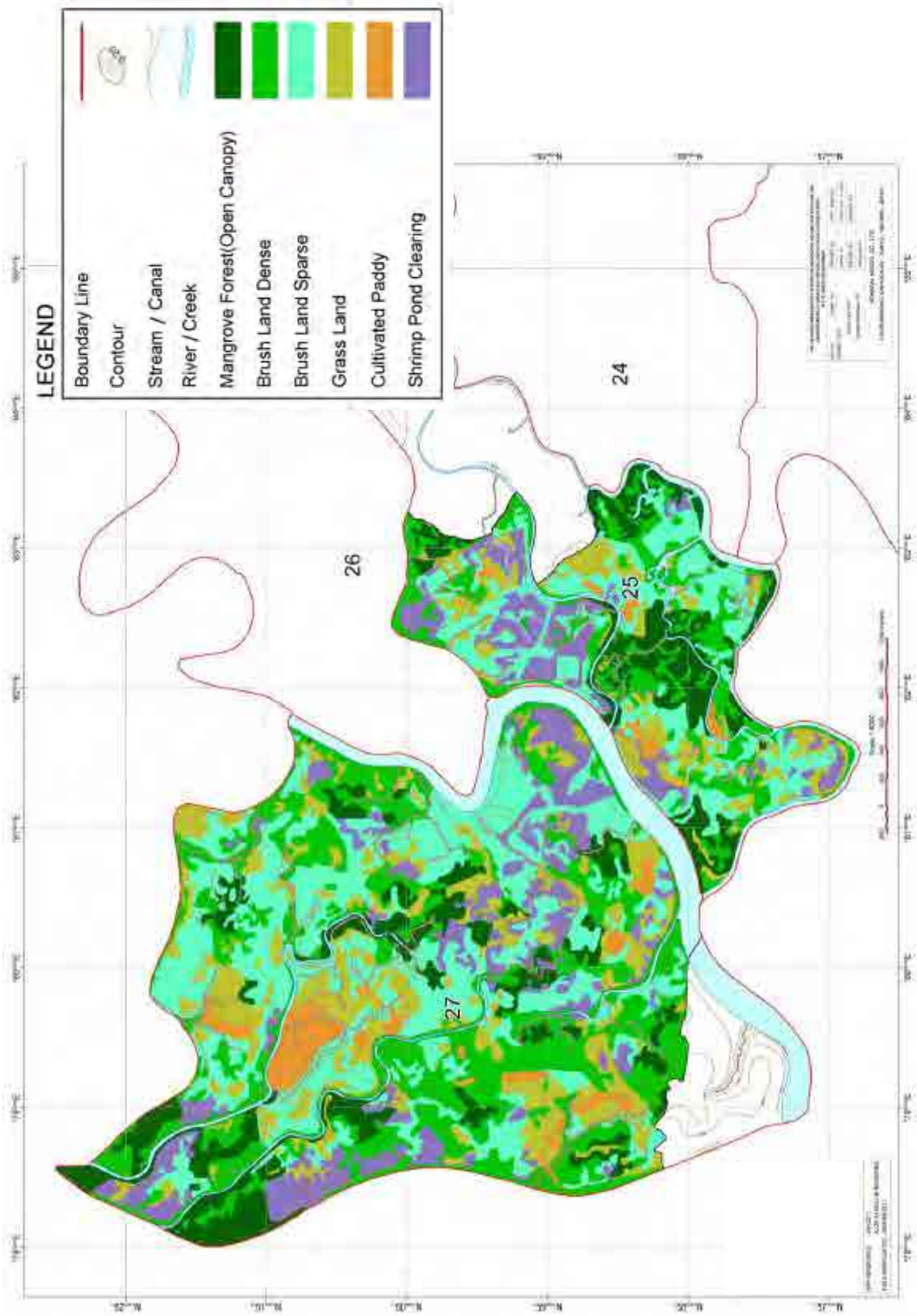


Figure 1-2: Kyagankwimpauk RF Land Use Map

1-3-3 Pyinalan RF

Since the target plantation area of 200 ha in Pyinalan RF is intended as a shelterbelt against tsunami and cyclone, the survey was limited to 200 m width of beach sandy area along the shoreline of FC 63 and 67. Out of the total surveyed area of 439 ha, only 39 ha was suitable for beach forest plantation. There is already existing shoreline plantation of 9.0 ha mangrove, which was established after Cyclone Nargis. The sandy plantable area is limited since villagers also use this area for paddy cultivation during rainy season (Table 1-5, Figure 1-3 and Figure 1-4).

Table 1-5: Pynalan RF Land Use Survey Result

FC No.	Total Survey Area (ha)	Non-potential Area (ha)										Potential Area (ha)				
		Mangrove Forest (Open Canopy)	Brush Land Dense	Brush Land Sparse	Grass land	Culti-vated Paddy	Shrimp Pond Clearing	Tidal flat (Sandy Coastline)	Tidal flat (Shallow Area)	Mud Flat Plantable Area	Mangrove Plantation	Water Pond	Village	Sub-Total	Sandy Plantable Area	Sub-Total
63	182	0	14	12	12	24	5	30	67	0	0	1	5	170	12	12
67	232	1	19	2	17	3	1	50	95	6	9	0	2	205	27	27
Total	414	1	33	14	29	27	6	80	162	6	9	1	7	375	39	39

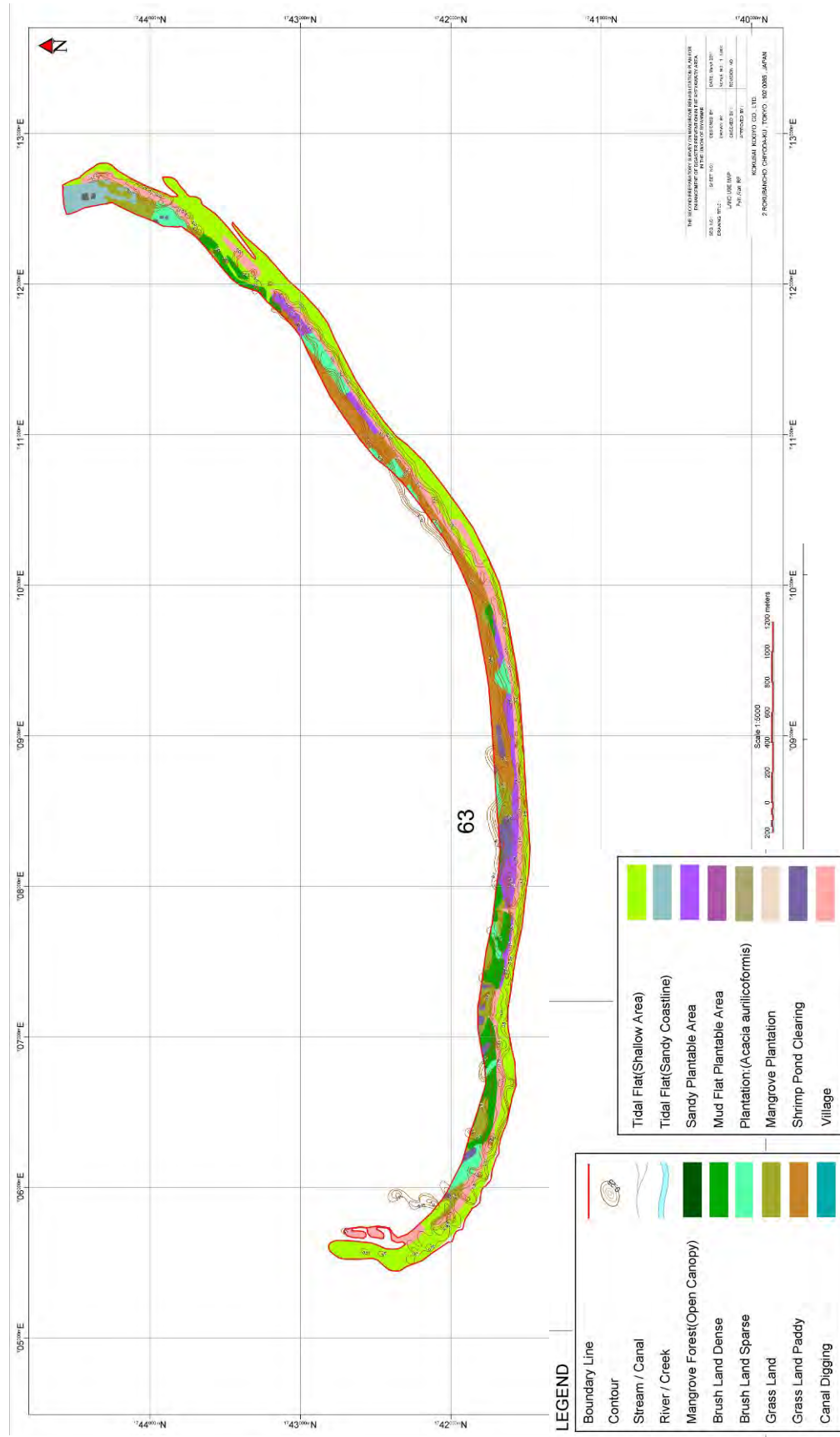


Figure 1-3: Pyinalan RF (FC No 63) Land Use Map

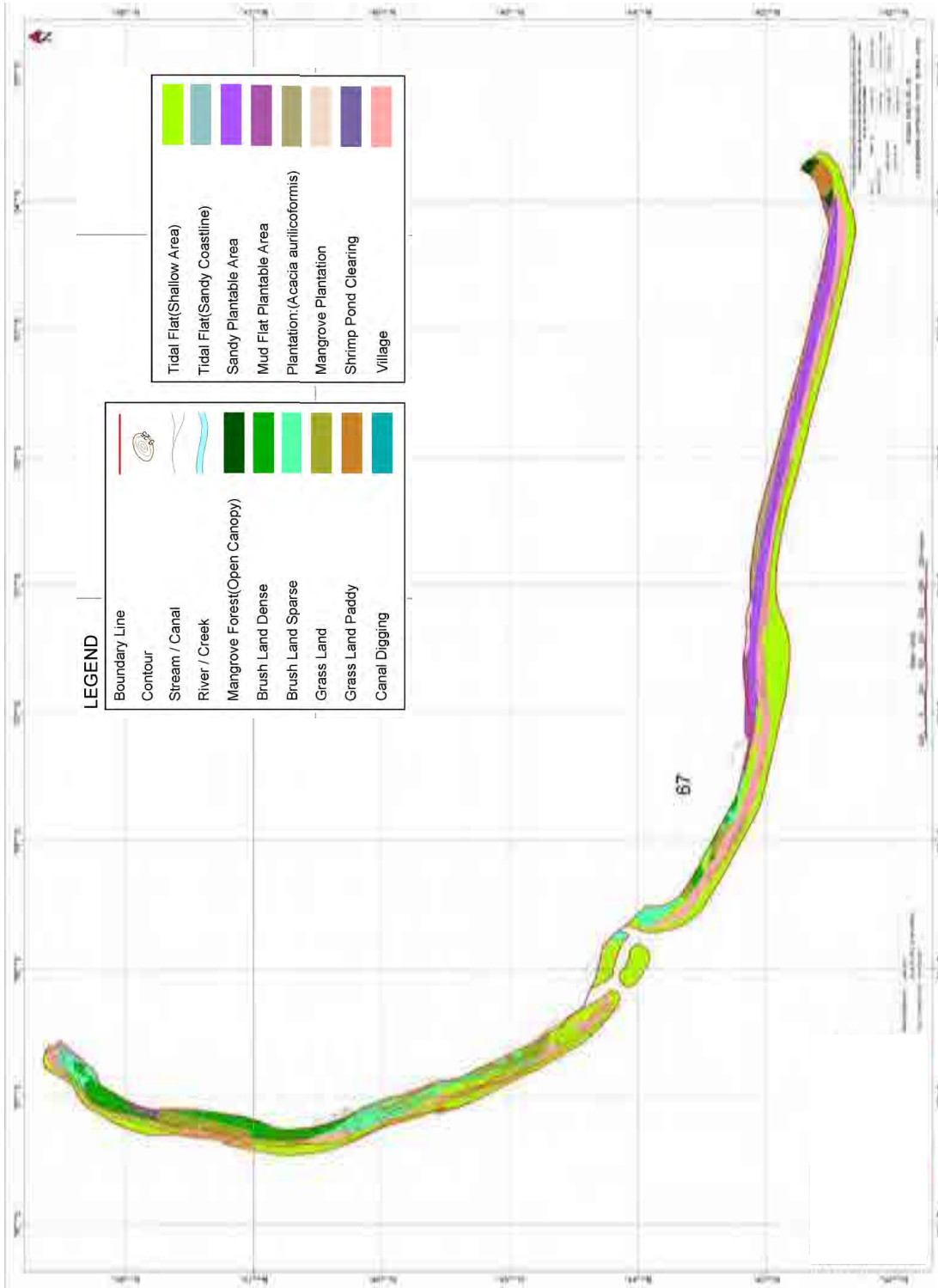
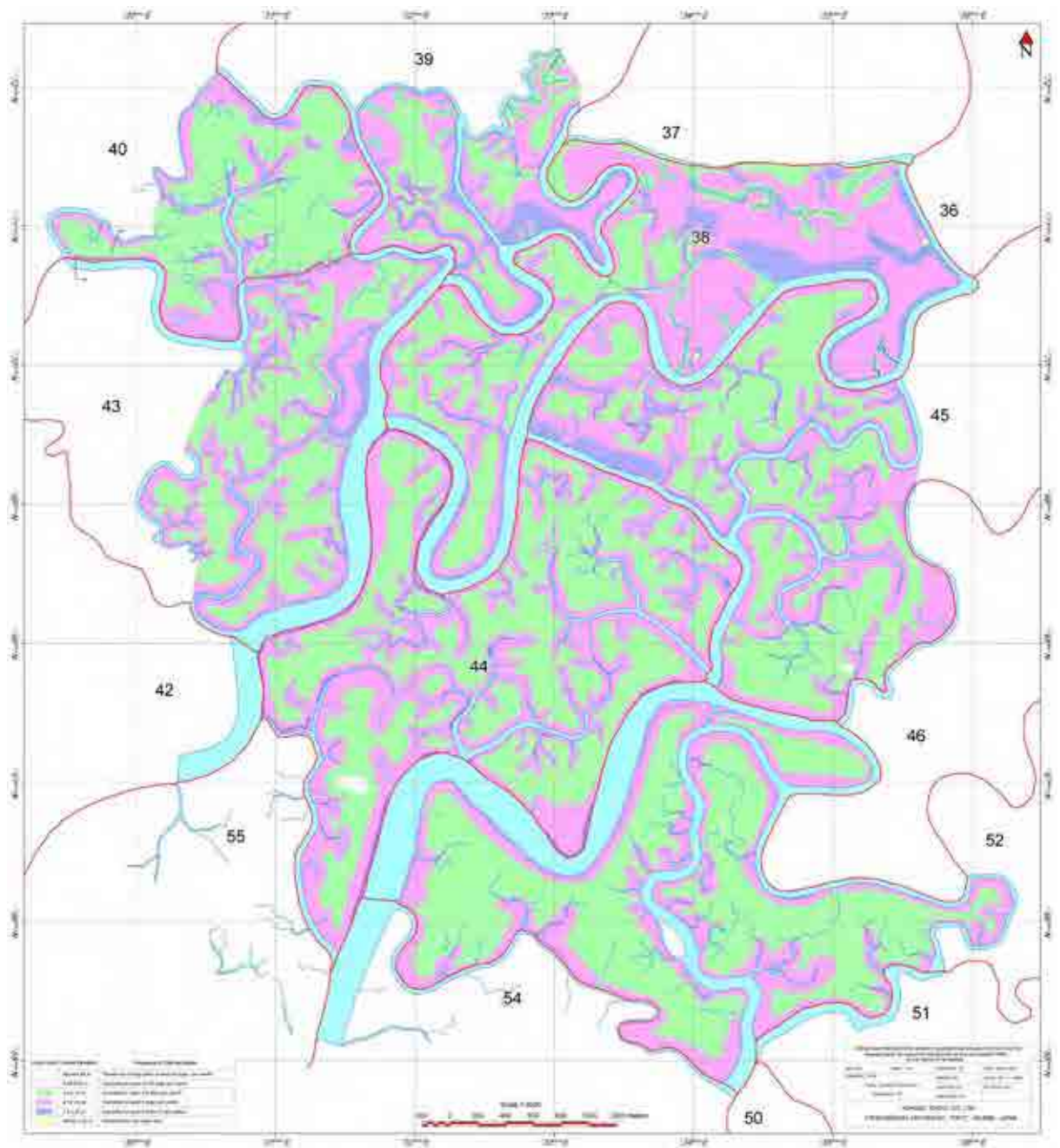


Figure 1-4: Pymalan RF (FC No 67) Land Use Map

1-4 Tidal Level and Inundation

Figure 1-5 (Kadonkani RF) and Figure 1-6 (Kyagankwimpauk RF) show the relation between elevation and Frequency of Tidal inundation. The map of Pyinalan RF is omitted because this site is regularly inundated due of its shoreline, and also this site was canceled as a candidate project site by the Myanmar side during the first field survey.



Color Code	Contour-Elevation	Frequency of Tidal Inundation
	Below 0.25 m	Flooded by all high tides at least 20 days per month
	0.25-0.50 m	Inundated at least 10-19 days per month
	0.5-0.75 m	Inundated at least 3-9 days per month
	0.75-1.0 m	Inundated at least 2 days per month
	1.0-1.25 m	Inundated at least 4 times in dry season
	Above 1.25 m	Inundated by rain water only

Figure 1-5: Tidal Inundation Map of Kadonkani RF

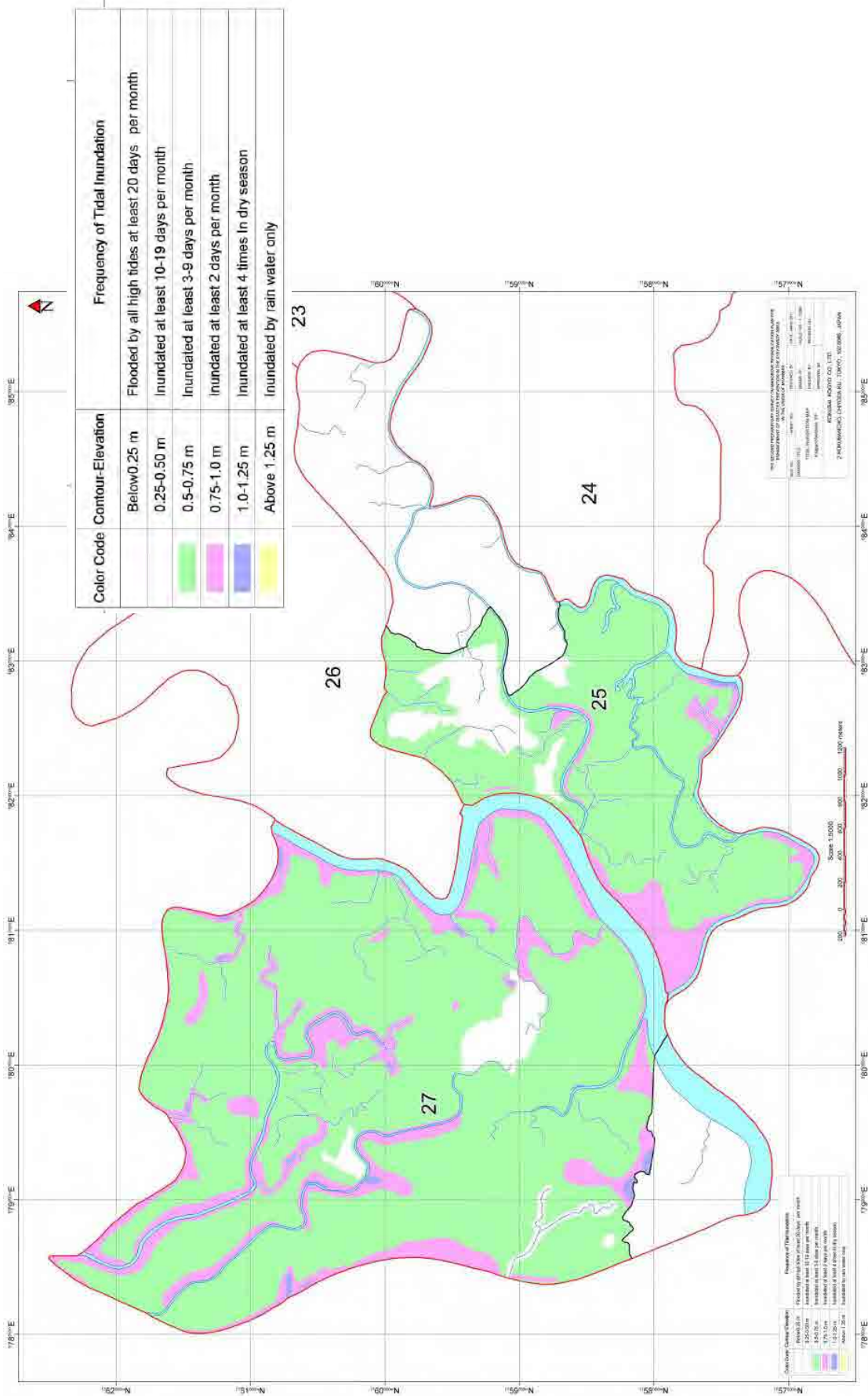


Figure 1-6: Tidal Inundation Map of Kyagankwimpauk RF

1-5 Existing Cyclone Shelter Survey Result

It was confirmed during the first field survey that many cyclone shelters were constructed after Cyclone Nargis. Outline of confirmed existing cyclone shelters during the first field survey is shown in the below table.

The effective area¹ and the design of cyclone shelters are different for each shelter. It is surmised that one of the reasons for these differences is because the basic design of shelters was decided by each donor.

It is expected that there are some cyclone shelters in the project site which the Myanmar side does not know exist in that location.

Table 1-6: Existing Cyclone Shelters

ID	Village	House holds	Population	Location	Capacity area (m ²)	Effective area (m ² per capita)
Kadonkani						
KA1	Khone Tan Pauk	150	500	738821 1766169	175	0.35
KA2	Atwin mayair	63	250	737365 1770049	84	0.34
KA3	Makyin Myein	90	290	736580 1773724	100	0.34
KA4	Kyein Chaung Gyi	520	2,100	734290 1775533	456	0.22
KA5	Tan Yaw Chaung	265	550	727844 1765152	162	0.29
KA6	Gway Chaung Gyi	219	750	738535 1763221	162	0.22
Pyinalan						
PY1	Mingalar Thaug Tan	245	1250	709949 1741968	150	0.12
PY2	Aunghlaing	453	2300	712467 1744424	200	0.09
PY3	Thit Poat	815	3900	711343 1745653	2600	0.63
PY4				711670 1746040	200	
PY5	Kwin Pauk	310	1250	703810 1742805	65	0.05
PY6	A Mat Gyi	138	700	701885 1744174	60	0.09
PY7	A Mat Ka Lay	150	600	699193 1746237	65	0.11
PY8	Yae Cho Kan	180	750	698019 1746483	60	0.08
PY9	Thaug Lay	173	600	697260 1748352	65	0.11
Kyagankwimpauk						
KY1	Kwin thone Sint	130	470	679068 1757892	120	0.26
KY2	Mie Chaung Ai	500	1960	676785 1757614	32	0.02
KY3	Sa Lu Seik	375	1550	683821 1755906	700	0.45
KY4	QuaQuaLay FD	-	-		78	-

¹ Effective area is a value which was calculated as dividing capacity area by village population where cyclone shelters exist. This value was calculated to grasp how much area one person can occupy in case of emergency. Capacity area was measured during the first field survey.



Figure 1-7: Location Map of Cyclone Shelters in Kadonkani RF

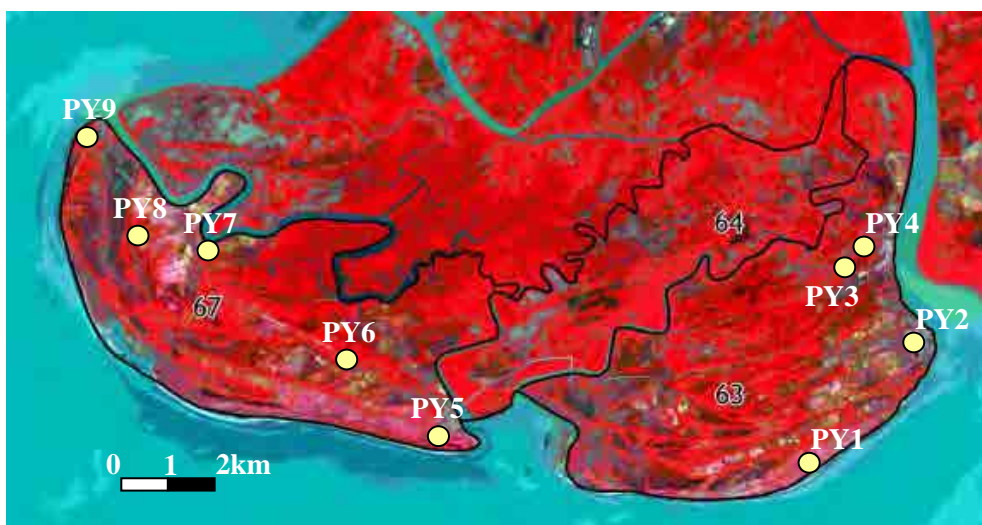


Figure 1-8: Location Map of Cyclone Shelters in Pyinalan RF

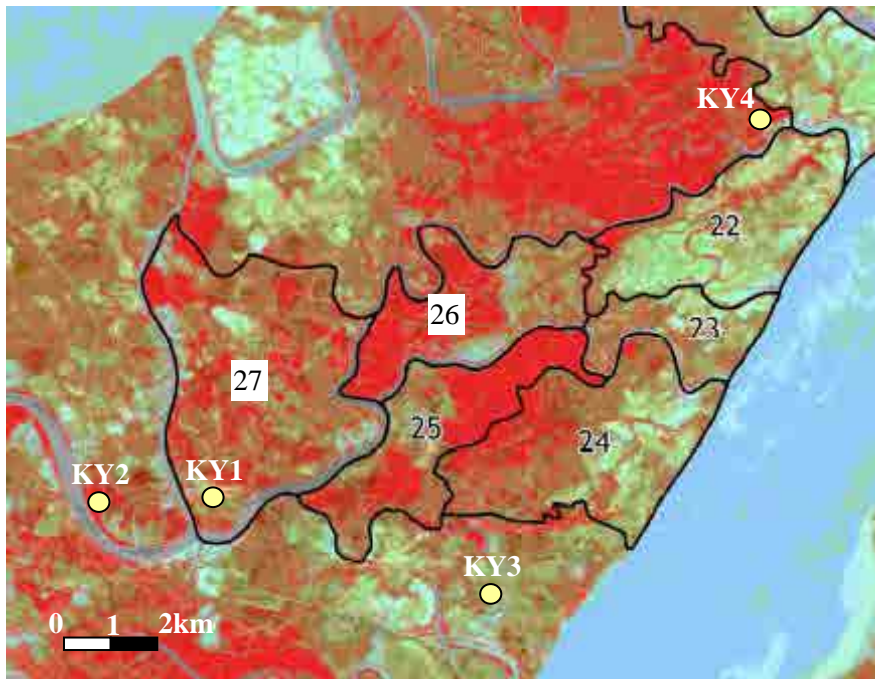


Figure 1-9: Location Map of Cyclone Shelters in Kyagankwimpauk RF

1-6 Social Survey Result

The results of the social survey is outlined in the table below (Details are in the process of finalization).

Items		Current Status
Natural Environment	Global warming	The people in/around the project area feel that the weather has become unusual due to the increased deforestation after Cyclone Nargis, and they expect that the plantation project will bring about improvement of weather.
Social consideration	Migration of people including involuntary resettlement	There are no settlements within the target site in Kadonkani Reserved Forest (hereafter, RF), and one village (Kwinthonesint) at the south-western end of the compartment No. 27 in Kyakankwinpauk RF.
	Local economy such as employment and livelihood	Fishery (mainly prawns and crabs), and agriculture (mainly monsoon paddy) are the major livelihood activities. No other industries to create opportunities for cash income.
	Land use and utilization of local resources	<p>The Ayeyawady Delta has been designated by the FD as a RF since 1901 for production of timber and fuel wood. Over time, due to increased population and encroachment, the forest has been converted to other land uses, especially paddy fields, home gardens, other cultivated land, and fish/ prawn/ crab ponds. In the surveyed area, there are remaining mangrove forests of only 12.2% in Kyakankwinpauk RF (2 compartments, 1644.30ha) and 11.9% of Kadonkani RF (9 compartments, 3326.68ha). On the other hand, currently cultivated farm land in Kyakankwinpauk RF target site is 2.8% only and no such land was found in Kadonkani RF.</p> <p>The abandoned farm land, which was covered with salt water when Cyclone Nargis hit, has become brush land.</p> <p>The Kwinthonesint, the only village within the plantation target site, depends of the surrounding forests as their fuel wood source.</p>
	Social institutions such as social infrastructure and local decision making institutions	Villages in Myanmar have Peace and Development Council (hereafter, PDC), and functions as the decision making body of a village. Other than this, fire fighting group, voluntary agriculture and fishery groups, women's group, and a group for rituals.
	Existing social infrastructures and services	<p>The targeted area has little land transportation and the villagers depend on water ways. There is no electricity or water supply. Mobile batteries are used for electricity, and wells and rainwater are used for daily water.</p> <p>Health and educational services in the targeted village are limited to a health volunteer trained by an NGO, and an elementary school. If any better social services are required, they need to travel to the closest larger village, Migyaungaing Village, or a township, Laputta Town, where the local government administration have their services including high schools and a governmental hospital.</p>
	Water Usage	The villagers use rainwater and groundwater, and do not use river water because it is salty.

Items		Current Status
	Vulnerable social groups such as the poor and indigenous peoples	GDP per capita (nominal) of Myanmar is estimated to be 702 US\$ (2010) ² . The average annual income of a household considered “poor” in Kwinthonesint is 700,000 Kyats (813.95US\$ ³) and 70% of the village households belong to this category. Even those considered “middle class” in the village have an average annual income of 1 million kyats (1164.79 US\$) and comprise 26.92% of the village. This means that 96.92% of the villagers live under the poverty line of 1US dollars per day (the average number of people per household is 3.29.) All villagers of Kwinthonesint are Burmese, the majority of Myanmar, and are all Buddhists, the major religion of the country.
	Gender	Females are actively involved in daily production activities and village events such as rituals, sharing work with males.

² JETRO country/regional information

³ Market rate (as of end of Jan, 2011) : US\$1=860kyat

1-7 Environmental and Social Considerations

Implementation of the Project of plantation may affect the ecosystem by selection of mangrove species and construction of facilities, and may cause involuntary resettlement. Therefore, it is rated as category B based on “JICA Guideline for Environmental and Social Consideration” (April 2002).

1-7-1 Legal Framework for Environmental and Social Consideration in Myanmar

In 1992, National Commission for Environmental Affairs (NCEA) was established under the Ministry of Foreign Affairs in Myanmar, and has conducted workshops, seminars and training courses, for the purpose of awareness creation for and encouraging participation in environmental conservation in general, and of education and dissemination of knowledge about environmental conservation. NCEA is preparing an Environment Law and an Environmental Impact Assessment Law, but they are yet to be enacted. In addition, NCEA has formulated Myanmar Agenda 21, which states the commitment of the government in sustainable development in line with the United Nations Conference on Environment and Development (UNCED) held in 1992.

There are two current forestry related laws and regulations, the Forest Law (enacted in 1992) and the Protection of Wildlife and Protected Areas Law (enacted in 1994). Based on these, while recognizing the traditional ownerships of forest land, and permitting the utilization of forest products for traditional medicines and customary necessary products, commercial development has been regulated in order to protect the forests. However, these regulations do not stipulate implementation of environmental impact assessment, and there is no other legal foundation to conduct environmental assessment in the Myanmar side. Therefore, the environmental impact assessment for the Project is to be implemented based on “JICA Guideline for Environmental and Social Consideration” (April 2002).

1-7-2 Scoping

The result of scoping is shown in the following table.

Table 1-7: Scoping result

	Items	Rating		Description
		Under construction	In service	
Pollution abatement	Air	B ⁻	D	Under construction: Operation of small heavy machinery for shelter might cause air pollution. In service: the risk of pollution is very low.
	Water	B ⁻	D	Under construction: Drain due to some works of construction of shelter might cause water pollution. In service: the risk of pollution is very low.
	Wastes	B ⁻	D	Under construction: Wastes dump and scrap wood will be discharged. In service: there is no discharge any waste.
	Soil	B ⁻	D	Under construction: There is a possibility of spillage of oil during construction of shelter, and then it might cause soil pollution. In service: the risk of pollution is very low.

	Noise and vibration	D	D	Some works during construction of shelter might cause noise and vibration but there are no villages near the site so noise and vibration do not causes any harm.
	Land subsidence	D	D	There is no works which cause land subsidence.
	Odor	D	D	There is no works which cause odor.
Natural Environment	Global warming	D	A ⁺	This project will recover the degraded forests, and thus even positive impact can be expected. Further, few greenhouse gases are anticipated in any process of the project.
	Ecosystem	D	B ⁺	The impact of the Project is considered positive for the mangrove species to be reforested are the species native to the project area, and the Project will recover and improve the mangrove forests from the current brush land, which may result in a more diverse ecosystem in the area.
	Protected Area	D	A ⁺	The project will be implemented within the protected area, but it is in line with the purpose of the protected area and aiming at the recovery of the forest devastated by Cyclone Nargis, with the native tree species.
Social Considerations	Migration of people including involuntary resettlement;	D	D	Within the target site in Kandonkani Reserved Forest (hereafter, RF), there are no settlements. The land currently utilized for livelihoods and farm is not selected as plantation area. Therefore, no involuntary resettlement is required.
	Local economy such as employment and livelihood;	B ⁺	D	Fishery (mainly prawn and crab) and agriculture (mainly monsoon paddy) is the main livelihood of the community in the target site. However, the plantation will be done in the area except for such utilized land, and vegetation on the water edge will not be touched by the Project. Therefore, no negative impact on their livelihood is anticipated. On the other hand, the target site is where no other industries to provide cash income opportunities exist, and the Project is expected to create employment in the planting process.
	Land use and utilization of local resources;	D	D	The Second Preparatory Survey excluded the land currently utilized for livelihood activities from the planned plantation area, so that no change in land use would be forced by the Project.
Social Considerations	Social institutions such as social infrastructure and local decision-making institutions;	D	D	The project will be implemented RF (Protected area by FD) therefore there is no affect to Social institution.
	Existing social infrastructures and services;	D	D	There are no roads in the project site hence mainly boat will be used for transportation. There are not so many boats traffic so the project does not disturb daily transportation of residents. There is no public services of electricity and water so there is no disturb these public service
	Water usage	D	D	There are no villages around the project SITE so there

				will be affection to current water usage.
	Accidents	D	D	No heavy machinery is planned to be used, and thus the risk of accidents is very low.
	Vulnerable social groups such as the poor and indigenous peoples;	D	D	The project will be implemented RF (Protected area by FD), so there are no any vulnerable social groups which is affected by the implementation of the project.
	Gender	B ⁺	D	Both the plantation and the soft component under the Project will provide sufficient opportunities to women to participate.
	Children's rights	D	D	The project will not disturb any rights of children.
	Cultural heritage	D	D	No cultural heritages are found in the project area, thus no harm will be caused.
	Infectious diseases such as HIV/AIDS	D	D	No negative impact is anticipated.
<p>Notes: A⁺: Large Positive / negative impact is expected B⁺: Positive / Negative impact is expected to some extent C: Not clear (Needs to be studied in IEE further) D: No impact is expected, and not to be included in IEE.</p>				

1-7-3 Result of Environmental and Social Considerations

Based on scoping, Environmental and Social considerations as to pollution abatement (Air, Water, Waste, and Soil) were assessed and the results shown in the below table.

Table 1-8: Result of Environmental and Social Consideration

Air pollution	Construction of the shelter is mainly implemented by human power without heavy machinery. Exhaust gas will be discharged by using concrete mixer (power resource is generator). However, size of generator is so small therefore no influence around the project site.
Water pollution	Although water will be used for concrete mixing in the site, there is no discharge of polluted water which might cause water pollution.
Wastes	Cement bag and scrap wood will be discharged.
Soil pollution	The project will be implemented by mainly human power. There is no works and no use of heavy machinery which will cause soil pollution. Therefore, the risk of soil pollution is very low.

1-7-4 Environmental Impact Assessment

Table 1-9: Result of Assessment of Impact

	Items	Rating as a result of scoping		Rating as a result of survey		Reason of Assessment
		Under construction	In service	Under construction	In service	
Pollution abatement	Air	B ⁻	D	D	D	Refer above table
	Water	B ⁻	D	D	D	Refer above table
	Wastes	B ⁻	D	B ⁻	D	Refer above table
	Soil	B ⁻	D	D	D	Refer above table
	Noise and vibration	D	D	N/A	N/A	
	Land subsidence	D	D	N/A	N/A	
	Odor	D	D	N/A	N/A	
Natural Environment	Global warming	D	A ⁺	D	A ⁺	
	Ecosystem	D	B ⁺	D	B ⁺	
	Protected Area	D	A ⁺	D	A ⁺	
Social Considerations	Migration of people including involuntary resettlement;	D	D	N/A	N/A	
	Local economy such as employment and livelihood;	B ⁺	D	B ⁺	D	
	Land use and utilization of local resources;	D	D	N/A	N/A	
	Social institutions such as social infrastructure and local decision-making institutions;	D	D	N/A	N/A	
	Existing social infrastructures and services;	D	D	N/A	N/A	
	Water usage	D	D	N/A	N/A	
	Accidents	D	D	N/A	N/A	
	Vulnerable social groups such as the poor and indigenous peoples;	D	D	N/A	N/A	
	Gender	B ⁺	D	B ⁺	D	
	Children's rights	D	D	N/A	N/A	
	Cultural heritage	D	D	N/A	N/A	
	Infectious diseases such as HIV/AIDS	D	D	N/A	N/A	

1-7-5 Mitigation plan and cost for implementation of mitigation plan

Construction will have no negative impact in general, except when construction waste is left at the site. This will be avoided through monitoring by the consultant, such as whether construction site is in order, construction is going smoothly, and waste is not abandoned in or around the site. Monitoring is part of and its cost included with that of construction supervision.

Chapter 2

Contents of the Project

2. Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Overall Goal

Establishment of disaster prevention structure in the cyclone affected area.

2-1-2 Objective of the Project

Rehabilitation of mangrove ecosystems in the Ayeyawady Delta and recover the function of disaster prevention and mitigation.

2-1-3 Outline of the Project

In order to achieve the objective of the project, a mangrove plantation (Kadonkani Reserve Forest, 1,154ha) will be planted and a cyclone shelter will be constructed in Kadonkani Reserve Forest (forest compartment (FC) 55), vehicles and passenger boats will be procured. In addition to this, support for establishment of a mangrove management plan for the project area will be implemented as a soft component activity.

The following outputs are expected as a result of implementing the above components;

- Land and river bank erosion and destruction caused by storms and floods will be mitigated,
- Preparedness and preventive plans will be formulated on the basis of experience and lessons learned from cyclones and storms,
- Coastal ecosystems and biological diversity will be protected and conserved through proper management of mangrove forests, and
- The local resident will benefit economically and environmentally

(1) Contents of the Request to Japan

- Mangrove Plantation 1,154 ha in Kadonkani Reserve Forest
- Construction of the cyclone shelter with forest watch tower in Kadonkani RF, compartment 55
- Procurement of 2 vehicles (4WD pick up D/C) for management
- Procurement of 1 boat with engine for management

(2) Planned Undertaking by the Myanmar side

- Secure of land for implementation
- Tax share
- Payment of bank commission fees
- Cooperation of supervision of implementation

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy (Mangrove Plantation, Cyclone Shelter and Procurement)

2-2-1-1 Design Policy for Mangrove plantation

(1) Basic Policy

1) Confirmation Policy for Plantation Area of Target Site

The following items were confirmed in the First Preparatory Survey which was implemented in June 2010. Therefore, it is judged as a suitable site for the project.

- a) Plantation for the target site is suitable in the point of view of the objective of the project (Rehabilitation of mangrove ecosystems in the Ayeyawady Delta and recover its role in disaster prevention and mitigation.)
- b) Each target site for the project is Reserved Forest which is under control of Forest Department (FD). According to FD, there is no illegal occupancy since Cyclone Nargis, and also consensus of plantation and preservation of mangrove forest has been obtained from local residents around the target site.
- c) From the technical aspect, it is possible for plantation in the target sites, and also FD has plantation technical skill to some extent.
- d) Plantation area in the target sites is enough area for fulfillment of multi-faceted function of mangrove forest including disaster prevention and mitigation. Besides, it is suitable for securing labor taking into consideration the area of plantations planted annually (approximately 1,500 ha) by FD around the target sites.
- f) There are similar sites and situation as mangrove plantation near and around the candidate sites, therefore implementation of the project will be a model project that is expected to have repercussions on similar sites. FD is expecting that kind of effect.

In the Second Preparatory Survey, moreover, the candidate site will be selected and judged based on below additional confirmation policy.

- g) Existing cultivated areas shall be excluded in accordance with the Minutes of Discussion signed on 20 January, 2011.
- h) The existing forest areas which canopy ratio is more than 50% shall be excluded, because natural generation is expected.
- i) The low land areas and the banks of rivers and creeks shall be excluded, because the areas are narrow and there are existing forests.

j) Areas which are not covered by vegetation shall be excluded, because the soil is not expected to be suitable for plantations.

2) Confirmation of Target RF and Area for the Project

Target RF and Area for Mangrove Plantation will be decided based on below figure.

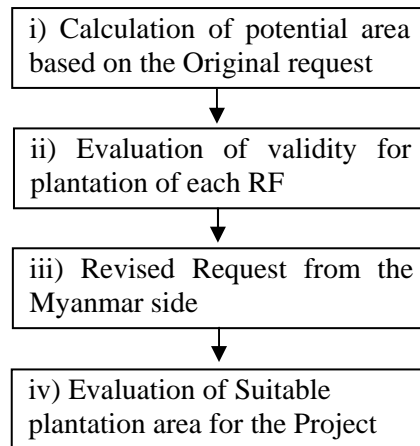


Figure 2-1: Confirmation flow of Target RF and Area for the Project

i) Calculation of potential area based on the Original request

Through the first field survey of the second preparatory survey, Potential area for mangrove plantation was calculated as in the following table.

Table 2-1: Original Requested Area and Potential Area for Mangrove Plantation

Reserved Forest	Original requested area	Potential area
Kadonkani RF	2,400 ha	2,137 ha
Pyinalan RF	200 ha	39 ha
Kyakankwinpauk RF	800 ha	1,236 ha
Total	3,400 ha	3,412 ha

ii) Evaluation of validity for plantation of each RF

Although the above figures were finally calculated after the first field survey, the team explained the current potential area for the project by using tentative figures to the Myanmar side because it was estimated that the potential area would differ from the original requested area during the first field survey. The team explained that potential area of Pyinalan RF was only approximately 40 ha compared to 200 ha of original requested area. Therefore, the team explained that it would be difficult to expect it to function effectively with regard to disaster prevention and mitigation, and also it would have a low P/C (Performance /Cost) compared to the other target sites (Kadonkani RF and Kyakankwinpauk RF). In addition, the team explained that approximately 1,100 ha would be the potential area in Kyakankwinpauk RF, and securing the original requested area of 2,400 ha in Kadonkani RF would be difficult.

iii) Revised Request from the Myanmar side

Myanmar side submitted a revised request area based on the above explanation by the team. The revised request was to omit Pyinalan RF from the candidate sites, then target sites were Kadonkani RF and Kyakankwinpauk RF with total request area of 3,400 ha, which was not changed (Below table).

Table 2-2: Original and Revised Request for Mangrove Plantation Area

Reserved Forest	Original requested area	Revised requested area
Kadonkani RF	2,400 ha	approximately 2,300 ha
Pyinalan RF	200 ha	0 ha
Kyakankwinpauk RF	800 ha	approximately 1,100 ha
Total	3,400 ha	3,400 ha

iv) Evaluation of Suitable Plantation Area as the Project

Based on Revised request from the Myanmar side, evaluate suitable Plantation Area and RF, then decide project components from the following viewpoints;

- Necessity area of mangrove plantation for disaster prevention effectiveness
- Population to benefit from disaster prevention effectiveness through mangrove plantation
- Validity of the project site (RF) and plantation area as Japan’s Grant Aid Scheme

3) Nursery specification design policy

It will be difficult to utilize nursery facilities constructed in the technical cooperation after the project because of reduced demand for and longer distance to transport plants. However, temporary nursery facilities constructed in the project will be suitable scale and specification based on existing facilities.

(2) Design Policy Regarding Natural Conditions

- It was confirmed that elevation of the target sites is approximately 0 ~ 1.5 meters. Areas below 50cm located near rivers and creeks in the target sites are excluded because natural generation is expected.
- Implementation schedule shall be prepared taking enough consideration of limited mangrove planting period (during rainy season, around May to September).
- Nursery work shall be operated and managed carefully in order to avoid unexpected influence of heavy rain during rainy season, inundation, strong sunlight during dry season, evaporation and so on.
- Mangrove species shall be selected based on tidal inundation, soil situation and survival rate of

species in the target sites.

(3) Design Policy Regarding Socioeconomic Conditions

It will be confirmed with the Myanmar side that lands found in surveys to be currently utilized, and those likely to be used by locals in future, will be excluded from the target sites.

For implementation of plantation, the following aspects will be taken into consideration;

- There is land scattered across the target area where people have settled and use the land for agriculture and fishery. Such land will be excluded from the targeted plantation area, in order to protect the livelihoods of such people and not force them to resettle.
- The area is in remote area and has little economic activities with limited opportunities for cash income. The Project will actively employ local resident for raising seedlings and planting works.
- Females in the area actively participate in production activities together with males. The project will employ local women, taking their physical capacity into consideration.

The following aspects will be taken into consideration for implementation of the soft component.

- The workshops and meetings required in the process of the soft component will be held, avoiding as much as possible the rainy season when agricultural and fishery activities are at their height.

(4) Design Policy Regarding Management and Operation

Management and operation policy are expected as follows for the proper and efficient implementation of the project.

- Planted area, constructed facilities and procured equipment in the project through Japanese Grant Aid, all belong to the FD.
- FD is in charge of operation and management of planted area, constructed facilities and procured equipment, then supervise management through enhancement of organization.
- FD allocates enough budget and staff for Bogale FD and Labutta FD, then prepares and arranges management and operation system.
- FD constantly makes an effort to maintain the planted area and constructed facilities in good condition, in order to keep the natural environment status and resources for livelihood in their local area.
- FD implements patrols and inspections mainly in the planted area, thereby gains an understanding of the local residents' activities and the current situation of the planted area, areas being deforested or degraded, area being burnt for farming, and so on.

(5) Design Policy Regarding Procurement and Project Schedule

- The project is expected to take approximately 4 years, therefore, total planting volume and planted area shall be divided suitable volume and area by each term (year).
- Construction and preparation facilities, for example nursery, and procurement of equipment shall be implement in the first term of the project.
- Planted area will be handed over to FD after post-planting care has been completed (weeding, survival counting and fire protection and so on).
- Each year plan of the project shall avoid putting much burden (budget and staff) on the FD.
- The project and plantation shall be completed based on the Japanese fiscal year (April to March).

2-2-1-2 Design Policy for the Cyclone Shelter with Forest Watch Tower

(1) Basic Policy

Cyclone shelters were requested in three sites, Kadonkani RF, Pyinalan RF and Kyakankwinpauk RF in the original request. However, details of construction sites and number of shelters to be constructed were not clarified in the original request. Therefore, the team surveyed location, size and so on about existing cyclone shelters in and around the target sites. The size, location and number of facilities to be constructed will be decided based on the result of the survey.

(2) Design Policy Regarding Natural Conditions

1) Weather Condition

- Construction period should be planned taking into due consideration difficult periods such as the rainy season.
- The roof will be made of reinforced concrete slabs taking into consideration the need to avoid damage by strong winds such as during cyclones. Structure of shelter also should have enough resistance to a cyclone.
- Timber doors and windows, which can be procured easily in the local market, will be used instead of glass doors and windows to avoid being broken by strong winds.

2) Wind Load and Seismic Load

- Wind load adopted will be 125 mph (55.9 m/sec) based on MES (Myanmar Engineering Society) standard.
- Seismic Load adopted will be 0.15g based on MES standard.

3) Flood and Tide Level

- Estimated surge height flood level is 6 ~ 12 feet (approximately 1.80 ~ 3.70m) in the target site based on MES. In addition, according to local residents, the flood level at the time of Cyclone Nargis was 1.5 ~ 6.5 feet (approximately 0.50 ~ 2.00m) in the target site. Based on these flood levels, the 1st floor, which will be the floor to evacuate to in the event of a storm surge or flood, will be GL + 15 feet (approximately +4.50m).
- It was confirmed that tide level during rainy season in the target site was around GL + 2 feet (+0.60m). Therefore, the height of the ground floor will be GL+3feet 4inch (approximately +1.0m) taking into consideration the tide level.

4) Soil Condition for Foundation of Shelter

- It is estimated that the soil condition is weak because the project site is located in the delta area. However, the facility is a shelter with a main purpose of emergency use, therefore, piling work or soil stabilization work, which will be expensive, will not be considered. The foundations of existing shelters confirmed during the field survey, are all spread

foundations according to local residents and existing drawings.

(3) Design Policy Regarding the Socioeconomic Conditions

The targeted area has little land transportation and the villagers depend on waterways. And also fishery (mainly prawn and crab) and agriculture (mainly monsoon paddy) is the main livelihood of the community in the target site, moreover their income is very low. In consideration of this situation of local residents who will use the cyclone shelter, Operation and Maintenance will be very easy and low cost (or almost no cost).

(4) Design Policy Regarding the Local Construction Industry and Local Materials

1) Policy Regarding the Local Construction Industry

Many cyclone shelters have been constructed since Cyclone Nargis struck in and around the target site so there are many construction companies in Yangon which have experience constructing cyclone shelters. Therefore, it will not be a problem to use local contractors which have construction skills and experience.

2) Policy Regarding the Local Materials

- In Myanmar, most building materials can be procured locally. The construction work under the project does not require procurement from Japan or a third country.
- Cement made in Myanmar or Thailand and reinforcing bars made in China will be used in the project. The team confirmed there is no problem regarding quality or supply of these reinforcing bars or cement.
- In the target site, pond or shallow groundwater is usually used to make concrete. However, high quality fresh water will be required for making concrete from the point of view of preventing salt damage. Therefore, water quality, namely salinity, will be inspected, and water which does not fulfill a certain quality with regard to salinity for making concrete will not be used.

(5) Design Policy Regarding Operation and Maintenance

- It will be requested that FD keep the cyclone shelter well maintained so that it can be used in the event of an emergency. In addition, the design of the cyclone shelter will take into due consideration the need for minimal operation and maintenance.

(6) Design Policy Regarding the Grade of the Facility

- The Grade of the cyclone shelter will be minimum grade which fulfills Myanmar design standard and required functions. The finishing specifications will be mortar plaster.

(7) Design Policy Regarding the Construction and Procurement Methods and Work Schedule

- Commencement time of the construction will take into consideration that at least foundation construction should be completed before the rainy season.

- Materials which are reasonably priced and easily procured locally will be used for the construction.
- The construction will be completed at an early stage of the project schedule.

2-2-1-3 Design policy for Equipment plan

Taking into consideration of mangrove plantation plan of the project, soft component activity, mangrove operation and management plan which was submitted from the Myanmar side, validity of procurement of equipment will be considered and evaluated.

2-2-2 Basic Plan (Plantation plan, Construction Plan, Equipment Plan)**2-2-2-1 Basic Plan for Mangrove Plantation Plan**

Kadonkani RF was selected and an area of 1,154 ha was decided for the mangrove plantation component taking into consideration the implementation and management as Japan's Grant Aid Scheme, disaster prevention effectiveness and P/C (Performance /Cost).

Table 2-3: Outline of plantation plan of Kadonkani RF

Elevation	Elevation < 0.75 m (ha)	Elevation >= 0.75m (ha)
Mangrove Species	<i>Sonneratia caseolaris</i>	<i>Avicennia officinalis</i>
Plants number and Area		
Dense Brush Land ⁴	231,000 plants / 132 ha	418,250 plants / 239 ha
Sparse Brush Land ⁵	499,375 plants / 235 ha	499,375 plants / 235 ha
Grassland ⁶	367,500 plants / 147 ha	415,000 plants / 166 ha
Subtotal	1,097,875 plants / 514 ha	1,332,625 plants / 640 ha
Total	2,430,500 plants / 1,154 ha	
Average Density	2,139.5 plants / ha	2,082.2 plants / ha

Remarks:

- 1) The primary objective of the project is to rehabilitate disaster prevention forests steadily and to manage them sustainably. Therefore, candidate mangrove species for each site elevation were narrowed down to those most likely to survive throughout the entire project period.
- 2) On selection of plantation species, hierarchical rankings among existing species were based on six criteria: dominancy, seed abundance and availability, survival rate, growth rate, site matching (compatibility between characterization of species and site conditions) and resiliency to cyclones. Next, consider the ranking of each criterion by assigning points and then overall points of each candidate species were obtained by summing up. On the basis of the overall points and several consultations with FD on a practical level, final decision of plantation species was made.

Here, the criteria were regarded as equivalent and any weighting coefficients were not applied. The same ranking was not put in the hierarchies because the candidate species were less than ten.
- 3) As to plantation number for each land use, standard number of 2,500 (100%) was planned for grassland, then sparse brush land was 2,125 (85%) and dense brush land was 1,750 (70%).

⁴ The density of the wood and/or non-woody mangrove or associate species with a height of 2.0 m or more is more than 60% per hectare.

⁵ The density of the wood and/or non-woody mangrove or associate species with a height of 2.0 m or more is between 60 % and 20% per hectare.

⁶ The density of the wood and/or non-woody mangrove or associate species with a height of 2.0 m or more is less than 20 % per hectare.

(1) Plantation Area of Target Site for mangrove plantation

Selection and calculation of plantation area of target sites for mangrove plantation was conducted according to the following procedure.

- a) Study and understanding about current situation (plantation, land use and so on) before field survey using satellite imagery from 2010 and 2011 (ALOS/AVNIR2).
- b) Making a land use map by GPS during the field survey with comparison of the imagery and current situation on the ground.
- c) Making a topographic map using RTK (advanced GPS) through leveling to obtain the elevation of the target sites.
- d) Through overlaying of the land use map and the geographical map, then select and calculate plantation area.

As already mentioned at “2-2-1-1Design Policy for Mangrove plantation”, plantation area of Kadonkani RF is 2,137 ha and Kyakankwinpauk RF is 1,236 ha. Plantation area specified by elevation and land use of both RF is shown in the below table.

Table 2-4: Details of Potential Area Kadonkani RF

FC No.	Total (ha)	Elevation < 0.75 m (ha)				Elevation >= 0.75m (ha)			
		Brush Land Dense	Brush Land Sparse	Grass Land	Sub-Total	Dense Brush Land	Sparse Brush Land	Grass-land	Sub-Total
38	312	23	47	32	102	71	80	59	210
39	148	15	18	19	52	37	27	32	96
40	147	20	37	34	91	18	16	22	56
43	233	16	54	46	116	37	44	36	117
44	461	78	116	50	244	94	84	39	217
45	363	65	97	29	191	75	74	23	172
52	473	159	120	13	292	122	47	12	181
Total	2,137	376	489	223	1,088	454	372	223	1,049

Table 2-5: Details of Potential Area Kyakankwinpauk RF

FC No.	Total (ha)	Elevation < 0.75 m (ha)				Elevation >= 0.75m (ha)			
		Dense Brush land	Sparse Brush land	Grass land/ Shrimp Pond	Sub-Total	Dense Brush land	Sparse Brush land	Grass land/ Shrimp Pond	Sub-Total
25	320	77	10	61	148	10	117	45	172
27	916	217	17	109	343	74	311	188	573
Total	1,236	294	27	170	491	84	428	233	745

(2) Confirmation of Target RF and Area for the Project

Based on “Design Policy for Mangrove plantation”, evaluate suitable Plantation Area and RF, then decide project sites and area.

Table 2-6: Revised Request and Potential Area for Mangrove Plantation Area

Reserved Forest	Revised requested area	Revised requested area
Kadonkani RF	approximately 2,300 ha	2,137 ha
Kyakankwinpauk RF	approximately 1,100 ha	1,236 ha
Total	3,400 ha	3,373 ha

1) Mangrove plantation area necessary to be effective for disaster prevention

Main direct disaster prevention effectiveness of mangrove forest will be wind breaking and tide prevention as bellow table.

Table 2-7: Effectiveness of Mangrove Plantation

Effect	Outline of effectiveness	Area of effectiveness
Wind breaking	Reduction of damage of house holds and agricultural land caused by strong wind	Area where wind is reduced will be limited to near the mangrove forest
Tide prevention	Reduction of damage caused by Tsunami and high wave	Damage will be reduced in hinterland, and not be limited to near the mangrove forest.

For example, tide prevention by mangrove plantation is to lessen the destructive power of waves by reducing wave energy when they pass through the mangrove forest. In addition to this, catching floating wreckage such as fishing boats within the mangrove forest to prevent it hitting to people and houses, and also prevent cars, furniture and households goods flowing into the sea by tide flow (there were many survivors who caught hold of mangrove trees during storm surges caused by Cyclone Nargis).

Disaster prevention effectiveness of mangrove plantation is not in proportion to the area of plantation. Even if the area of plantation is small, it can be expected to be effective in preventing disasters to some extent. It is difficult to clearly define a plantation area that will be functional preventing disasters. Therefore, approximately 1,000 ha mangrove plantation is required for the project taking into consideration the requested area of Kyakankwinpauk RF (approximately 1,000ha).

2) Population to benefit from disaster prevention in Kadonkani / Kyakankwinpauk RF

In this section the population to benefit from disaster prevention in Kadonkani and Kyakankwinpauk RF is estimated.

a) Population benefiting from wind breaking

Wind breaking effect will be expected in the villages located near the mangrove plantation sites. Existence of 6 villages in the target site of Kadonkani RF, and 4 villages in the target site of Kyakankwinpauk RF were confirmed already. Population benefiting from wind breaking is estimated according to the following table.

Table 2-8: Estimated Beneficiary local residents by wind breaking⁷

RF	Villages locating near the target site	Beneficiary Local residents
Kadonkani	6 villages	4,400 persons
Kyakankwinpauk	4 villages	3,980 persons

b) Population benefiting from tide prevention

Not only near the area of mangrove plantation site but also the hinterland will benefit from tide prevention as mitigation of tsunami and high tides/waves, catching floating wreckage, preventing persons being carried away to the sea in case of high tides and waves. The hinterland which will benefit from the mangrove plantation is estimated roughly as in the below figure. A large area is expected to benefit due to tide prevention.

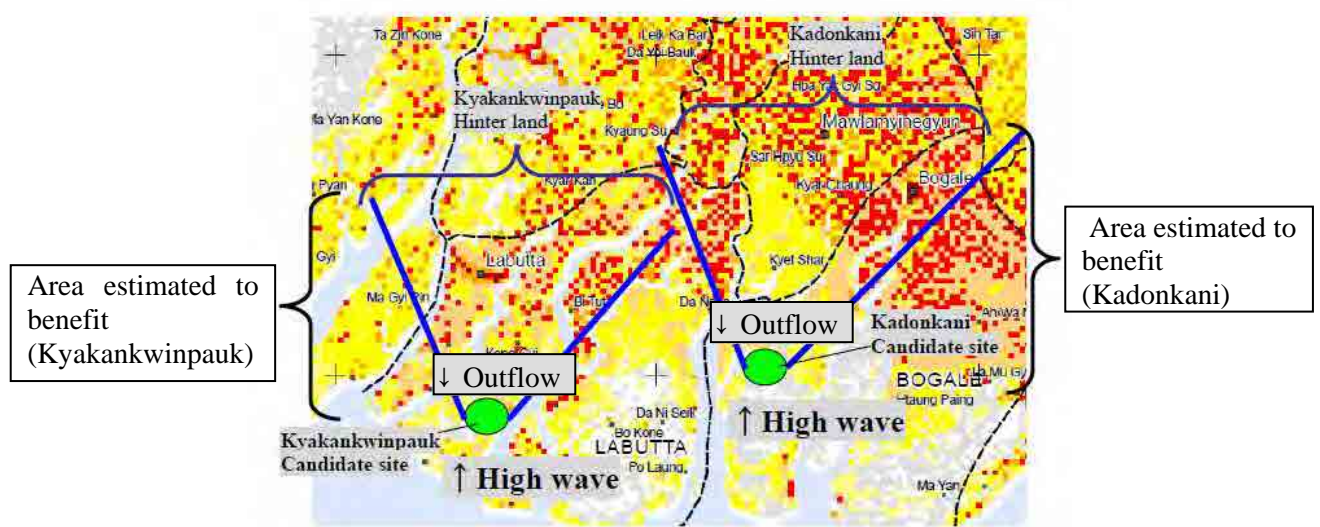


Figure 2-2: Estimated area of tide prevention⁸

Benefit population of tide prevention will be calculated based on the above Figure.

⁷ Source: Field survey

⁸ Myanmar Cyclone NARGIS Population Density 2005, MIMU

Table 2-9: Rough estimate of local residents to benefit by tide prevention

RF	Beneficially local residents
Kadonkani	Approximate 210,000 persons
Kyakankwinpauk	Approximate 100,000 persons

3) Population trend in Bogale and Lapputa townships

Below table shows existing village location in Bogale and Lapputa townships and area near the target site in Kadonkani and Kyakankwinpauk. Villages are dispersed near the candidate sites.

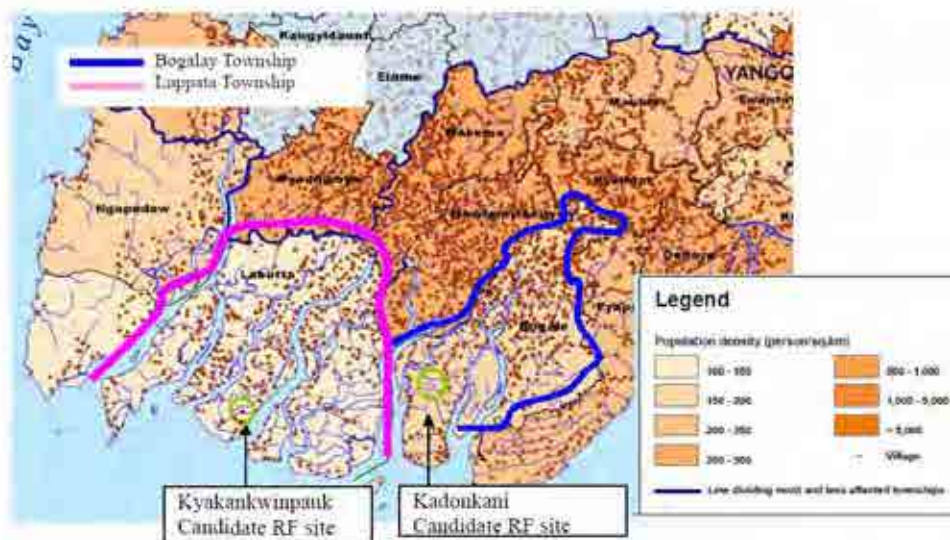


Figure 2-3: Existing villages' location Bogale and Lapputa⁹

Below table shows population in Bogale and Lapputa Township. Bogale has large population and high population density (150-200 persons/km²) compared to Lapputa (100-150persons/km²).

Table 2-10: Population¹⁰

Township	Population
Bogale	349,427
Lapputa	310,099

Next table shows transition of population from 2002 to 2009 in Kadonkani RF and Kyakankwinpauk RF. It will be estimate of population decrease in 2008 in Kadonkani RF because of Cyclone Nargis. However, population transition tendency over the past 8 years in Kadonkani RF is showing increase, this will be surmised that especially population in Bogale Township will be increasing in the area near Bogale Town.

⁹ Post-Nargis Periodic Review IV (MIMU), 2010

¹⁰ Myanmar Information Management Unit (MIMU), 2009

Table 2-11: Population transition from 2002 to 2009

RF	Year 2002	Year 2009	Difference	Average increase rate
Kadonkani	61,172	64,403	3,231(increase)	0.74%/year
Kyakankwinpauk	39,984	35,293	- 4,691(decrease)	-

4) Evaluation of Suitable plantation area

As to the selection of RF as the project sites, either both Kadonkani and Kyakankwinpauk, or just one of the two will be considered. This is evaluated as below table from the viewpoint of implementation and management as Japan's Grant Aid Scheme.

Table 2-12: Evaluation of RF as the project sites

Case	RF	Evaluation
1	Kadonkani and Kyakankwinpauk	△
2	Kadonkani	◎
3	Kyakankwinpauk	○

If case 1 is selected for the project sites, this means there are 2 candidate sites. Then Bogale FD will control Kadonkani RF, and Lapputa FD will control Kyakankwinpauk RF. The only transport to and from each site is by boat, meaning it will take more than 10 hours. And also this project will be implemented mainly by human power therefore it will not be easy to manage implementation. Taking into consideration maintaining plantation quality and accurate implementation of the project, it is preferable to select only one RF as the project site.

Secondly, comparing Case2 and Case3, if mangrove plantation was implemented at each RF with the same plantation area, it is estimated that the population to benefit from mangrove plantation in Kadonkani RF will be bigger than Kyakankwinpauk RF. In addition to this, currently the only transport is by boat in Kadonkani RF. However, roads and bridges around this RF are under construction, therefore, it will be expected population increase around this RF due to construction of infrastructure and accessibility improvement. As a result, future increase of population that will benefit from protection from tidal influences in Bogale is anticipated. Moreover, the Myanmar side is requesting mangrove plantation in Kadonkani RF, if the project will be implemented only one RF.

Based on the above, Kadonkani RF (Case 2) is most suitable for mangrove plantation as the project site.

< Note: Current situation of construction of roads and bridges to Kadonkani RF >

Below figure shows current construction progress of roads and bridges to Kadonkani RF. A road to the north area of Kadonkani RF has already been constructed. Currently a bridge is under construction that will provide accesses from Bogale Town to the north area of Kadonkani RF by vehicle.

And also, extension of road to the south side of Kadonkani RF is under construction as shown in the figure below, in the near future a road will be constructed which makes access to the south area of Kadonkani possible by vehicle.

Construction of roads including bridges will mean improvement of accessibility to Kadonkani RF, where only boat is possible to access up to now. As the result of improvement of accessibility due to construction, it is highly likely that population will increase at a higher rate (compared to current). At the moment, Kadonkani RF is low population density area in Bogale Township, but there is enough possibility of rapid population increase as can be seen from its recent very high growth rate.



Figure 2-4: Existing villages' location Bogale and Lapputa¹¹

Table 2-13: Recent population transition and increase rate¹²

Township	2007 Before Nargis	2009	Increase	Average increase rate
Bogale	285,909	349,4279	63,518	10%/year

¹¹ Myanmar Information Management Unit (MIMU),2009

¹² Myanmar Information Management Unit (MIMU),2009

(3) Selection of a forest compartment as the project site from Kadonkani RF and plantation area

Potential area in Kadonkani RF is as already shown in “2-2-2-1 Basic Plan for Mangrove Plantation Plan”. Positional relation of each FC in Kadonkani RF is shown in the Figure below (Blue color means river and creek).

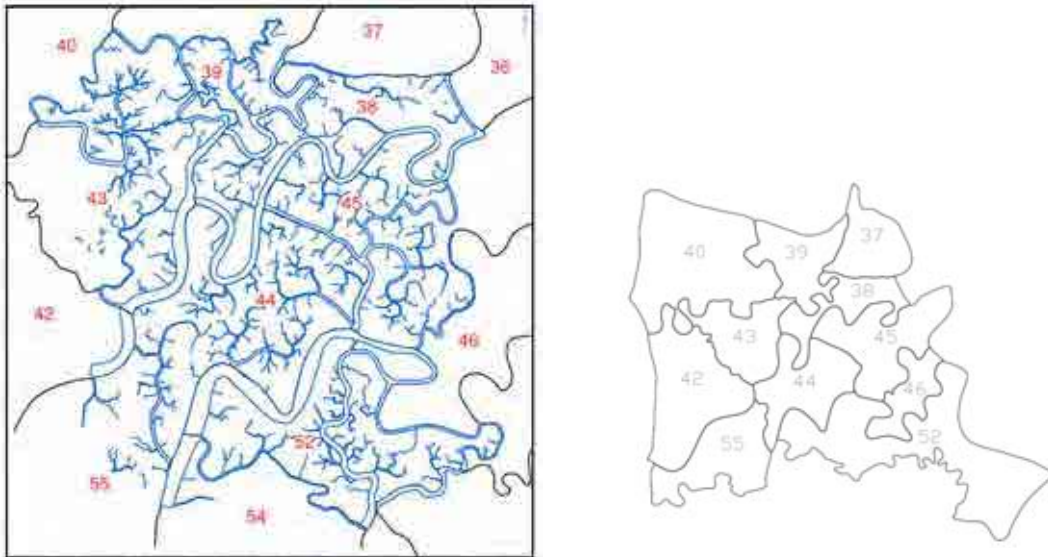


Figure 2-5: FC Map in Kadonkani RF

The north area of FC is selected due to the reason of geographical advantage of locating near town areas in Bogale, and FC, which is facing or holding big river, is selected from the view point of disaster prevention effectiveness (especially tide prevention effectiveness).

From the above viewpoint, FC of 38, 39, 43, 44 is selected for mangrove plantation FC for the project. Then total plantation area is calculated as below table. Already decided upon minimum plantation area of 1,000 ha (2-2-2-1 Basic Plan for Mangrove Plantation Plan) is ensured, therefore these FC are considered for the project site of mangrove plantation.

Table 2-14: The project site (FC) for mangrove plantation in Kadonkani RF

FC No.	Total (ha)	Elevation < 0.75 m (ha)				Elevation >= 0.75m (ha)			
		Dense Brush Land	Sparse Brush Land	Grass-land	Sub-Total	Dense Brush Land	Sparse Brush Land	Grass-land	Sub-Total
38	312	23	47	32	102	71	80	59	210
39	148	15	18	19	52	37	27	32	96
43	233	16	54	46	116	37	44	36	117
44	461	78	116	50	244	94	84	39	217
Total	1,154	132	235	147	514	239	235	166	640

(4) Mangrove Species Selection

Below table shows existing dominant species in Kadonkani RF.

Table 2-15: Existing Dominant Species in Kadonkani RF

Mangrove Species	Local name	Elevation
<i>Kandelia candel</i>	BYUEBAINNTAUNT	Elevation < 0.75 m
<i>Nypa fruticans</i>	DANI	
<i>Sonneratia caseolaris</i>	LAMU	
<i>Sonneratia griffithii</i>	LABA	
<i>Amoora cucullata</i>	PANTTHAKAR	Elevation \geq 0.75m
<i>Brugueira sexangula</i>	BYUESHEWAR	
<i>Ceriops decandra</i>	MADAMA	
<i>Excoecaria agallocha</i>	THAYAW	
<i>Heritiera fomes</i>	KANASO-YAY	

These species were scored according to dominancy, seed abundance and availability, survival rate, growth rate, site matching (compatibility between characterization of species and site condition) and resiliency to cyclone (below table).

Table 2-16: Scores and Ranking of Existing Species in Kadonkani RF

Mangrove Species	Elevation	Dominancy	Availability	Survival rate	Growth rate	Site matching	Resiliency	Total (Rank)
<i>Kandelia candel</i>	75 cm >	6	3	3	6	7	7	32 (4)
<i>Nypa fruticans</i>	75 cm >	7	7	8	9	9	5	45 (3)
<i>Sonneratia caseolaris</i>	75 cm >	1	1	1	1	1	1	6 (1)
<i>Sonneratia griffithii</i>	75 cm >	5	2	2	2	3	3	17 (2)
<i>Amoora cucullata</i>	75 cm \leq	3	9	9	5	6	2	34 (4)
<i>Brugueira sexangula</i>	75 cm \leq	9	5	4	4	5	6	33 (3)
<i>Ceriops decandra</i>	75 cm \leq	8	6	5	7	8	9	43 (5)
<i>Excoecaria agallocha</i>	75 cm \leq	4	4	7	8	4	4	21 (2)
<i>Heritiera fomes</i>	75 cm \leq	2	8	6	3	2	8	29 (1)

Based on the ranking, *Sonneratia caseolaris* and *Heritiera fomes* were nominated as major candidates for each land use. However, for *Heritiera fomes* facultative shade plant, continual shade culturing and management are absolutely essential not only during nursery period but also after transplantation to the field. Furthermore, the patching number may be large because the survival rate is anything but good (sixth out of nine). *Heritiera fomes* is useful species, as such the technical cooperation project has also sought a suitable planting method, but it has not established one yet. Therefore this project decided to reject *Heritiera fomes* as a candidate.

Then suboptimal candidate was sought among other species which dominate near the target site. Upon field survey and research report reviewing, *Sonneratia apetala* and *Avicennia officinalis* emerged as candidates. These two species are quite common for plantation in the Ayeyawady Delta. From the result of the follow-up survey by FD (below table), we can see that these species can grow early and survive.

Table 2-17: Mean Height of Five-year-old stand¹³

Mangrove Species	Mean stand height (m)
<i>Sonneratia apetala</i>	15.0
<i>Avicennia officinalis</i>	8.0
<i>Bruguiera gymnorrhiza</i>	1.5
<i>Bruguiera sexangula</i>	2.0
<i>Aegiceras corniculatum</i>	3.5
<i>Rhizophora apiculata</i>	3.0
<i>Rhizophora mucronata</i>	3.0
<i>Ceriops decandra</i>	2.0

Sonneratia apetala, the fastest growth species, cannot substitute for *Heritiera fomes* because its suitable elevation is less than 75 cm. Therefore, the survey team decided to select *Avicennia officinalis* for elevation of 75 cm or more with due consideration for elevation suitability and established plantation method (below table).

Table 2-18: Mangrove Species for Kadonkani RF

Elevation	Mangrove Species (Local name)
0.75 m >	<i>Sonneratia caseolaris</i> (Lamu)
0.75 m =<	<i>Avicennia officinalis</i> (Thamae Gyi)

¹³ Source: Forest Department

(5) Mangrove Plantation Schedule

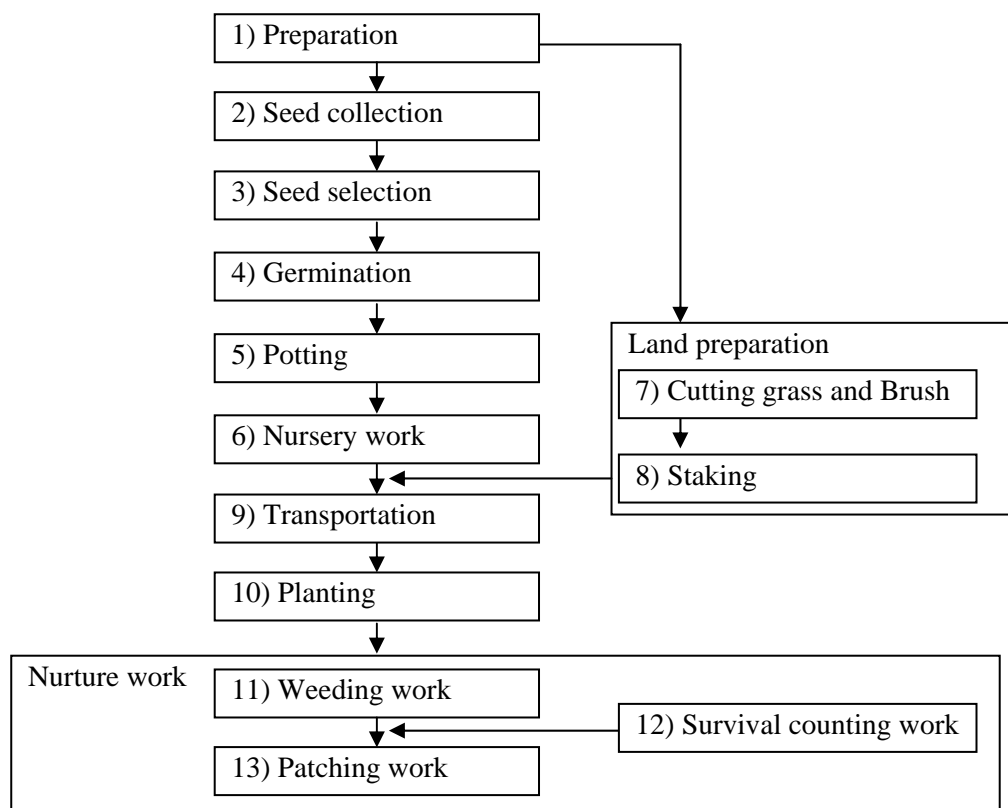


Figure 2-6: Plantation schedule

Note: Above work will be implemented taking into consideration fire protection.

(6) Planting Number and Density for Plantation

Planting number and density is set as follows.

Table 2-19: Planting number and density

Land use	Planting number	Density
Dense Brush land	1,750 (plants/ha)	70%
Sparse Brush land	2,150 (plants/ha)	85%
Grassland	2,500 (plants/ha)	100%

(7) Implementation Schedule of the Project for the Plantation

1) Project Term

It is expected that implementation of the project will start in November. The project period is expected to be approximately 3.5 years (41 months). Therefore the project is divided according to the following table.

Table 2-20: Estimated Term and Period of the Project

Term	Period (Japan fiscal year)
Term 1	November ~ March (First year)
Term 2	April ~ March (Second year)
Term 3	April ~ March (Third year)
Term 4	April ~ March (Fourth year)

2) Plantation Area of Each Term

It is estimated that annual possible plantation area is approximately maximum 1,000 ha from the point of view of implementation and actual planted results in the target sites. In the first term of the project, time will be set aside for preparation work (temporary office and nursery facilities construction, and so on), therefore first time of plantation area is considered approximately 300ha taking smooth implementation into consideration.

3) Plantation Area of Each Term

Plantation in the project site is implemented from north area of FC. It is limited to only between August and September for seed collection of *Avicennia Officinalis*, on the other hand, it is possible to collect seed through a year for *Sonneratia caseolaris*. Implementation of mangrove plantation will start from November so it is impossible to collect seeds of *Avicennia Officinalis* from November of First year. Therefore, during the first term, seed collection and nursery work will be implemented only for *Sonneratia caseolaris* then first planting will be implemented only *Sonneratia caseolaris*.

Based on the above mentioned, planting term, planting area and Mangrove Species is planned as following table.

Table 2-21: Plantation plan (Term2 and Term3) in Kadonkani RF

Term	FC	Area/ Number	a. <i>Sonneratia caseolaris</i>				b. <i>Avicennia officinalis</i>				Total
			Grass Land (2,500plants/ha)	Brush Land Sparse (2,125plants/ha)	Brush Land Dense (1,750plants/ha)	Sub-total	Grass Land (2,500plants/ha)	Brush Land Sparse (2,125plants/ha)	Brush Land Dense (1,750plants/ha)	Sub-total	
Term2	38	Planting Area (ha)	32	47	23	102	0	0	0	0	102
		Total Planting number	80,000	99,875	40,250	220,125	0	0	0	0	220,125
	39	Planting Area (ha)	19	18	15	52	0	0	0	0	52
		Total Planting number	47,500	38,250	26,250	112,000	0	0	0	0	112,000
Sub-total(Term2)	43	Planting Area (ha)	46	54	16	116	0	0	0	0	116
		Total Planting number	115,000	114,750	28,000	257,750	0	0	0	0	257,750
		Planting Area (ha)	97	119	54	270	0	0	0	0	270
		Total Planting number	242,500	252,875	94,500	589,875	0	0	0	0	589,875
Term3	38	Planting Area (ha)	0	0	0	0	59	80	71	210	210
		Total Planting number	0	0	0	0	147,500	170,000	124,250	441,750	441,750
	39	Planting Area (ha)	0	0	0	0	32	27	37	96	96
		Total Planting number	0	0	0	0	80,000	57,375	64,750	202,125	202,125
Sub-total(Term3)	43	Planting Area (ha)	0	0	0	0	36	44	37	117	117
		Total Planting number	0	0	0	0	90,000	93,500	64,750	248,250	248,250
	44	Planting Area (ha)	50	116	78	244	39	84	94	217	461
		Total Planting number	125,000	246,500	136,500	508,000	97,500	178,500	164,500	440,500	948,500
Total		Planting Area (ha)	50	116	78	244	166	235	239	640	884
		Total Planting number	125,000	246,500	136,500	508,000	415,000	499,375	418,250	1,332,625	1,840,625
		Planting Area (ha)	147	235	132	514	166	235	239	640	1,154
		Total Planting number	367,500	499,375	231,000	1,097,875	415,000	499,375	418,250	1,332,625	2,430,500

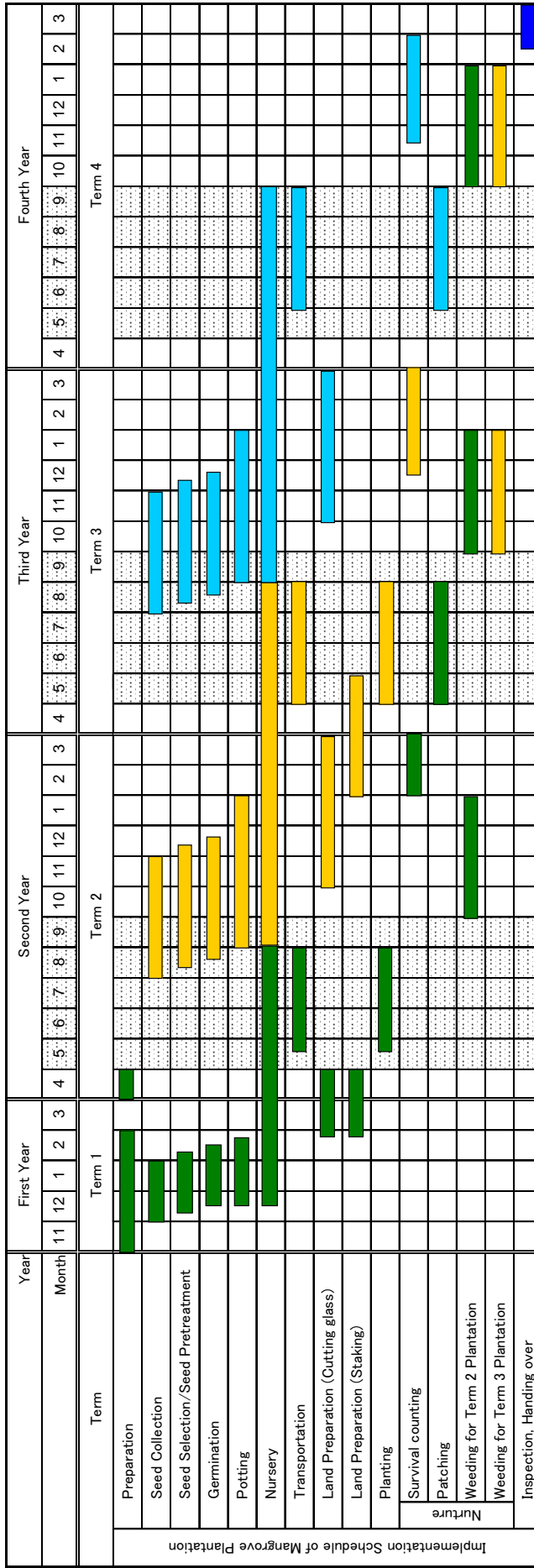
4) Plantation Schedule of the Project

Plantation schedule of Kadonkani RF are considered as follows. And also next table shows outline schedule of plantation of the project.

In the project, planting will be implemented twice (in 2 terms) because of large plantation area of Kadonkani RF. Season of seed selection and planting are possible only around the rainy season, therefore it is important to make a schedule taking into consideration this seed selection and planting season. Weeding work, survival counting work, and patching work based on the result of survival counting work will be implemented after planting work.

Rainy season of Term 2 will be the first year of planting, rainy season of Term 3 will be second year of planting, then patching work will be implemented in the third year following planting. In the Fourth year, weeding work and survival counting of total planted area will be implemented; then the planted area will be handed over in March of Fourth year upon completion of the project.

Table 2-22: Plantation schedule in Kadonkani RF



▨ Rainy Season

█ Term2 Plantation Schedule

█ Term3 Plantation + Term2 Patching Schedule

█ Term4 Patching Schedule

2-2-2-2 Basic Plan for the Cyclone Shelter with Forest Watch Tower

The number and location of cyclone shelters to be constructed is according to the following table;

Table 2-23: The number and site of Cyclone Shelter Construction

Reserved Forest	The number and site of Cyclone Shelter Construction
Kadonkani RF	Site: 55FC, Number: 1
Pyinalan RF	No construction
Kyakankwinpauk RF	No construction

Construction of Cyclone Shelter in Pyinalan RF and Kyakankwinpauk RF is excluded because plantation site of mangrove was selected in Kadonkani RF.

The survey found that there were at least 6 cyclone shelters in and around Kadonkani RF. Most of them are located in the area north and east of Kadonkani RF, and one is located to the west.

The team confirmed with the Myanmar side that the location of the cyclone shelter will be east of FC 55 because of the following two reasons. If the cyclone shelter is constructed in the center of Kadonkani RF, then: a) it can be expected to function as a watch tower to prevent cutting down of mangrove plantations in the north area by local residents encroaching from the south, and b) it can be expected that local residents and laborers of the project will evacuate more safely in case of emergency by cyclone because the other shelters are located quite far away.

A capacity of 150 persons is considered valid for the shelter because there are no large villages near the target site of the shelter, and also it is enough capacity for laborers to evacuate while implementing the project.

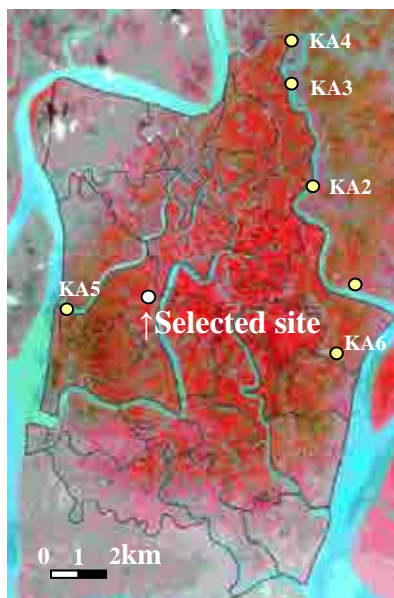


Figure 2-7: Location of the selected site for cyclone shelter¹⁴

¹⁴ KA1 ~ KA6 shows existing cyclone shelter location

Below table shows outline of design of the cyclone shelter with forest watch tower.

Table 2-24: Outline Design of the Cyclone Shelter

	Specification	Note
Capacity	150 persons	The request to Japan
Site location	Kadonkani RF, FC 55 Location (731336,1765547)	Selected the site during the field survey based on the request
Effective area (per person)	0.45 m ² / person ¹⁵	
Effective area (Shelter room)	67.5m ²	150 persons × 0.45m ² = 67.5m ²
Toilet	4 toilets	
Drinking water for Emergency	Stock of rain water	
Electricity	Not planned	
Ground Floor Level	GL +3'4" (+1.00m)	GL +2' (+0.60m) (Estimated high tide level)
First Floor Level	GL +15' (+4.50m)	GL +6~12' (+1.80 ~ + 3.70 m) (Estimated surge height flood level)
Foundation	Mud foundation	Weak soil condition
Structure	Reinforced concrete building	
Wind load	55.9 m/sec ¹⁶	
Seismic load	0.15g ¹⁷	



Figure 2-8: Outline plan of the Shelter

¹⁵ Design Guidelines for Australian Public Cyclone Shelters

¹⁶ Myanmar Engineering Society (MES)

¹⁷ The same as above

There was no existing standard that clearly shows effective area per person for cyclone shelters. Effective area per person of existing cyclone shelter was $0.10 \sim 0.60 \text{ m}^2 / \text{person}$. In the project, therefore, the team adopted $0.45 \text{ m}^2 / \text{person}$ from Design Guidelines for Australian Public Cyclone Shelters, taking into consideration of area where a man or a woman can sit down and existing facilities.

The cyclone shelter is a facility for use in emergency. In case of emergency of cyclone, people evacuate first floor. If more than 150 persons evacuate this shelter, which is more than capacity of the shelter, it is possible that these persons can evacuate to a roof floor. The shelter is not intended to be a multipurpose office. The ground floor is open piloti style, namely the shelter is raised on pillars.

(1) Site / Facility Arrangement Plan

Site for the construction of the shelter is located in the delta area of mangrove. The site is flat, with no slopes at all. There is no infrastructure of water supply and electricity.

The shelter is arranged so that the entrance of the stairs faces the river. Boats are the only way to access the shelter, then road and so on in the site area will be constructed in the project.

(2) Building Plan

1) Floor Planning

First floor will be evacuation room in the event of a cyclone. Effective area per person is $0.45 \text{ m}^2 / \text{person}$ as mentioned, then minimum area will be at least 67.5 m^2 ($0.45 \text{ m}^2 \times 150 \text{ person} = 67.5 \text{ m}^2$). Based on this 67.5 m^2 , 75 m^2 will be total effective area of first floor ($5 \text{ m} \times 5 \text{ m} \times 3 \text{ rooms}$).

Toilets and water supply facilities is arranged on the first floor for use in an emergency. Water resource of water supply facility is rain water then water tank as reservoir is also arranged.

A watch tower is constructed on the roof.

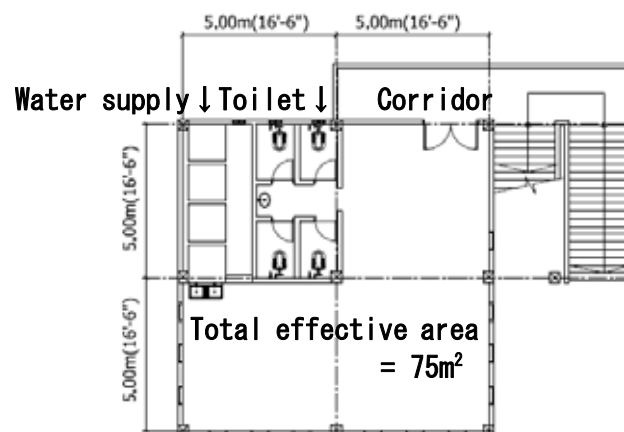


Figure 2-9: First Floor Layout Plan

2) Cross Section Plan

In consideration of flood level in the event of a cyclone and tide level during the rainy season, the ground floor is designed with a floor level of GL + 3'4" (+1.00m), the first floor is designed with a floor level of GL +15' (GL+4.50m).

3) Structure Plan

a) Structure Type

Reinforced concrete structure is adopted in consideration of enough resistance to cyclone and earthquake. Reinforced concrete structure is being adopted as structure type for existing shelter in the project site in general.

b) Applicable Standard

As the Myanmar side does not have its own standards, the American Concrete Institute (ACI) standards are basically used as the structural design standards for concrete buildings. ACI standards will be used for design of the cyclone shelter.

c) Building Materials

- Un-Reinforced Concrete $f_c' = 2,150 \text{ psi} (15 \text{ N} / \text{mm}^2)$
- Reinforced Concrete $f_c' = 3,000 \text{ psi} (21 \text{ N} / \text{mm}^2)$
- Reinforcing Bars $f_y = 45,000 \text{ psi} (315 \text{ N/mm}^2)$

d) Design Load

- Floor $60.0 \text{ Ib/ft}^2 (2,900 \text{ N/m}^2)$
- Corridor $70.0 \text{ Ib/ft}^2 (3,500 \text{ N/m}^2)$

e) Wind Load and Seismic Load

Please refer to Table 2-23.

g) Foundation of Structure

Two types of foundation are considered: Spread foundation (Individual footing and Mat foundation) and Pile foundation. Spread foundation is divided into two types (Individual footing and Mat foundation), individual footing consists of many small footings, and mat foundation consists of only one large footing. Mat foundation is very suitable for weak soil condition compared to individual footing.

According to the result of the geotechnical boring and soil test, bearing capacity of estimated foundation ground was $0.40 \text{ t/ft}^2 (4.3 \text{ t/m}^2)$. It is considered adoption of individual footing is difficult in terms of condition of weak soil, therefore mat foundation is adopted as a

foundation type then size (length and width) of mat foundation will be calculated in consideration of bearing capacity of weak soil and weight of the cyclone shelter.

h) Facility Planning

Main purpose of the cyclone shelter is for emergency use therefore, there will be no electrical instillation. Water supply facility and toilets are installed for only emergency use when cyclones strike. It is not expected to use these facilities during the dry season.

2-2-2-3 Basic Equipment Plan

Following table shows result of verification of requested equipment procurement.

Table 2-25: Result of verification of requested equipment

Requested equipment	Procurement equipment	Number	Destination of procurement
Vehicles for management	4WD pick up	2 vehicles	Yangon project headquarters Bogale FD office
Trucks for transportation of materials	Not procurement		
Passenger and cargo boats	Fiberglass Boat with Engine	1 boat	Byonemway Mangrove Nursery and Extension Center
Construction equipment (heavy machinery)	Not procurement		

(1) Vehicles for management

Basically, boat will be used for transfer in the project site; however vehicles will be needed to travel between Bogale FD office (which will control the project directly), Yangon (where Project headquarters will be located) and Nay Pyi Taw (where headquarters of Ministry of Environmental Conservation and Forestry is located).

According to the operation and maintenance plan¹⁸, operation days of vehicles are planned as below tables;

Table 2-26: Planned operation days of vehicles per year

Vehicles		Days per year
For: Bogale FD office	During the project	298days
	O & M after the project	252days
For: Yangon project headquarters	During the project	80days
	O & M after the project	80days

Taking into consideration of 230 standard service days of 4WD pick up truck, vehicles for Bogale FD office has plan to operate more than 230 days. In the near future, construction of road and bridge will be completed then it will make possible to access Kadonkani RF by vehicle. Therefore, it will be needed of vehicle in order to implement proper O & M, so the planned number of operation days (above table, for Bogale) is considered appropriate. In addition to this, there is no vehicle in the Bogale FD office currently, therefore it is proper for vehicle procurement to Bogale FD office.

Planned operation days of vehicle for Yangon project headquarters is 80 days, which is less than 230 standard service days of 4WD. However, planned operating days of vehicles for Bogale FD office is

¹⁸ Operation and Maintenance plan for the project for mangrove rehabilitation plan for enhancement of disaster prevention in the Ayeyawady area in the Union of Myanmar

more than 230 days, so it might not be enough to operate the project by only one vehicle of Bogale FD office and also it will be expected to need more operation days for implementation of soft component activity. Moreover, taking into consideration improvement of accessibility to the project site in the near future, it is considered as appropriate of vehicle procurement for Yangon Headquarters of the project.

(2) Trucks for transportation of materials

Transporting in the project site is used only by boat. Transportation of pots and so on is implemented by boat and human power. Therefore, there is no need of procurement trucks for transportation of materials.

(3) Passenger and cargo boats

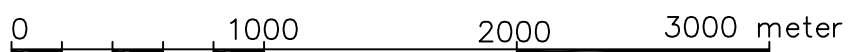
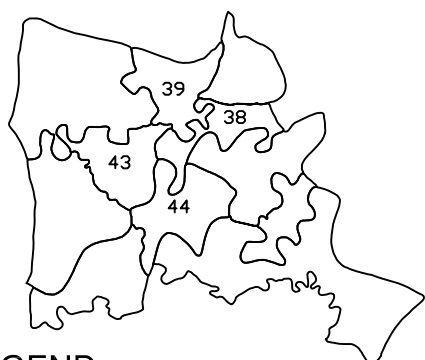
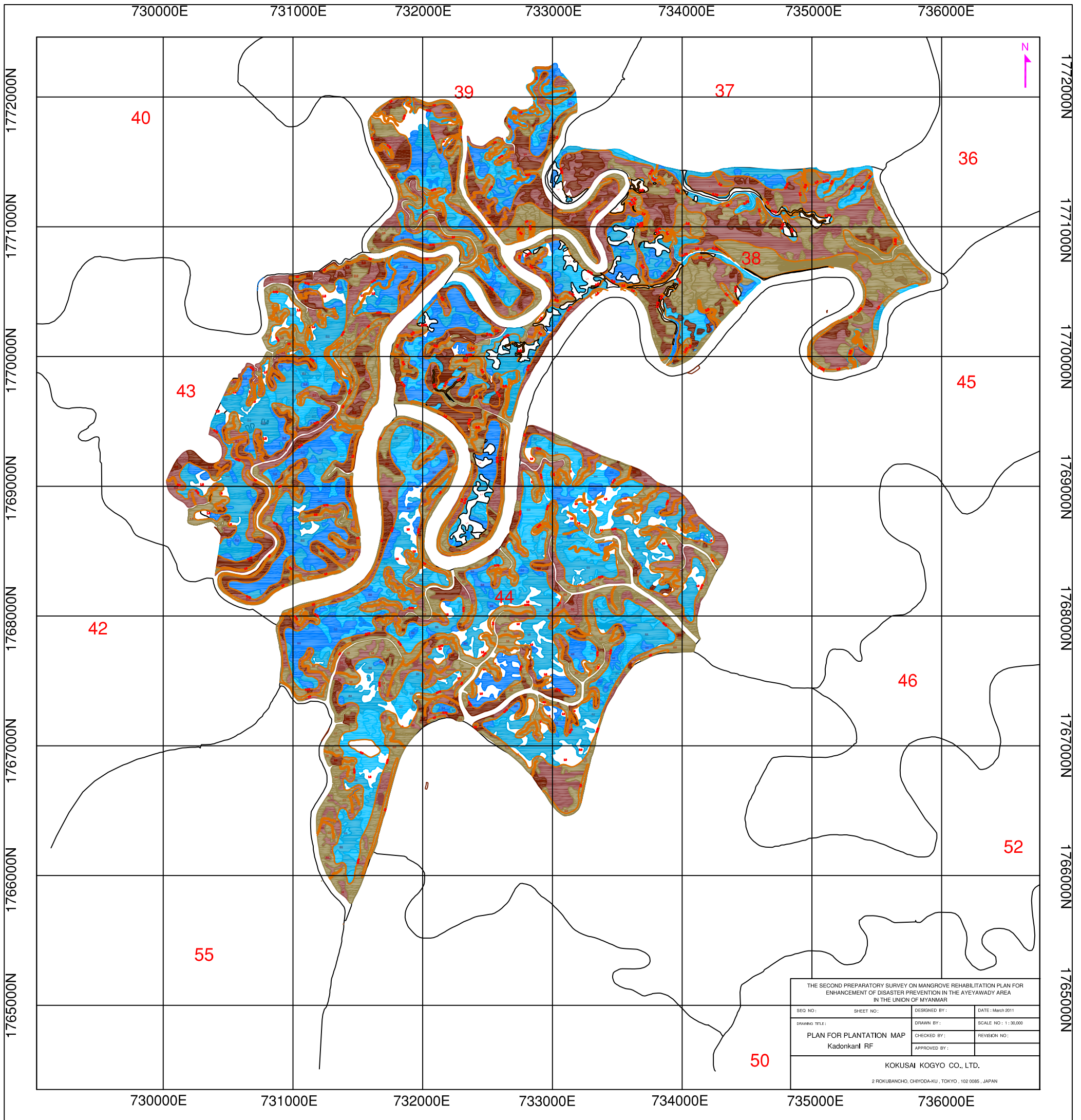
Transporting in the project site is only by boat. FD staff will stay at the Byonemway Mangrove Nursery and Extension Center, which is located near the project site. Therefore, it will be used for main office of the project. There are no boats at Byonemway Mangrove Nursery and Extension Center. Implementation of the project (which will be a large scale plantation), will require one boat for exclusive use of the project. Therefore it is considered as appropriate for procurement of a passenger and cargo boat for Byonemway Mangrove Nursery and Extension Center.

(4) Construction equipment (heavy machinery)

In the project, basically all component of plantation will be implemented by human power. It is no need to use construction equipment for implementation of the project. Therefore, there is no need to procure construction equipment

2-2-3 Outline Design Drawing

Please refer to next page.



LEGEND

COLOR CODE	CONTOUR ELEVATION LAND USE	PLANTATION SPECIES
	0.5m_0.75m Grass Land	Sonneratia caseolaris (Lamu)
	0.5m_0.75m Brush Land Sparse	Sonneratia caseolaris (Lamu)
	0.5m_0.75m Brush Land Dense	Sonneratia caseolaris (Lamu)
	0.75m_1.0m Grass Land	Avicennia officinalis(Kanasoyay)
	0.75m_1.0m Brush Land Sparse	Avicennia officinalis(Kanasoyay)
	0.75m Above Brush Land Dense	Avicennia officinalis(Kanasoyay)

Term	RF	Area/ Number	a. <i>Sonneratia caseolaris</i>				b. <i>Avicennia officinalis</i>				Total
			Grass Land (2,500plants/ha)	Brush Land Sparse (2,125plants/ha)	Brush Land Dense (1,750plants/ha)	Sub-total	Grass Land (2,500plants/ha)	Brush Land Sparse (2,125plants/ha)	Brush Land Dense (1,750plants/ha)	Sub-total	
Term2	38	Planting Area (ha)	32	47	23	102					102
		Total Planting number	80,000	99,875	40,250	220,125					220,125
	39	Planting Area (ha)	19	18	15	52					52
		Total Planting number	47,500	38,250	26,250	112,000					112,000
43	Planting Area (ha)	46	54	16	116					116	
	Total Planting number	115,000	114,750	28,000	257,750					257,750	
Sub-total(Term2)		Planting Area (ha)	97	119	54	270	0	0	0	0	270
		Total Planting number	242,500	252,875	94,500	589,875	0	0	0	0	589,875
Term3	38	Planting Area (ha)	0	0	0	0	59	80	71	210	210
		Total Planting number	0	0	0	0	147,500	170,000	124,250	441,750	441,750
	39	Planting Area (ha)	0	0	0	0	32	27	37	96	96
		Total Planting number	0	0	0	0	80,000	57,375	64,750	202,125	202,125
43	Planting Area (ha)	0	0	0	0	36	44	37	117	117	
	Total Planting number	0	0	0	0	90,000	93,500	64,750	248,250	248,250	
44	Planting Area (ha)	50	116	78	244	39	84	94	217	461	
	Total Planting number	125,000	246,500	136,500	508,000	97,500	178,500	164,500	440,500	948,500	
Sub-total(Term3)		Planting Area (ha)	50	116	78	244	166	235	239	640	884
		Total Planting number	125,000	246,500	136,500	508,000	415,000	499,375	418,250	1,332,625	1,840,625
Total		Planting Area (ha)	147	235	132	514	166	235	239	640	1,154
		Total Planting number	367,500	499,375	231,000	1,097,875	415,000	499,375	418,250	1,332,625	2,430,500

Figure 2-10: Plan for Mangrove Plantation

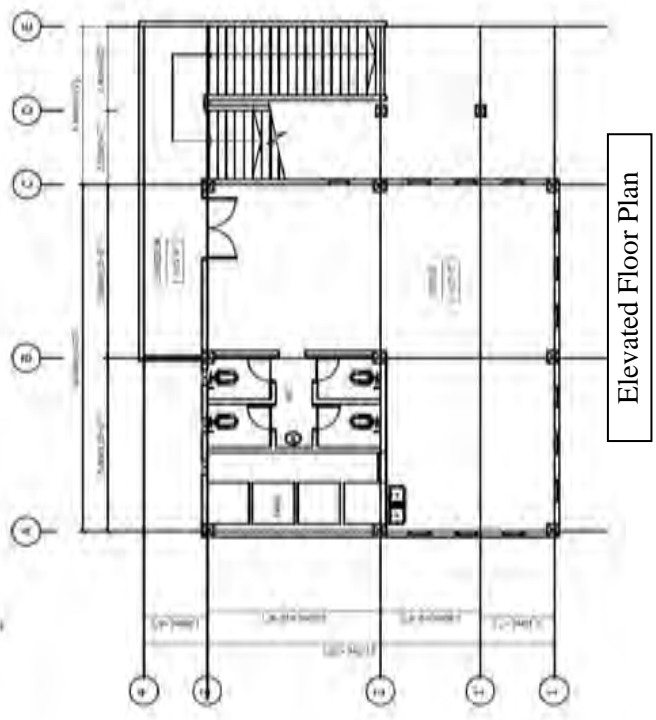
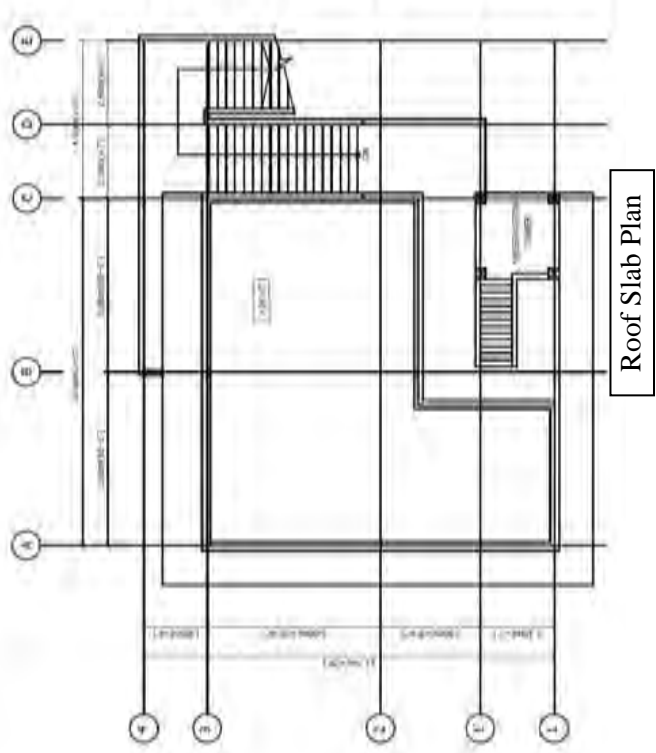
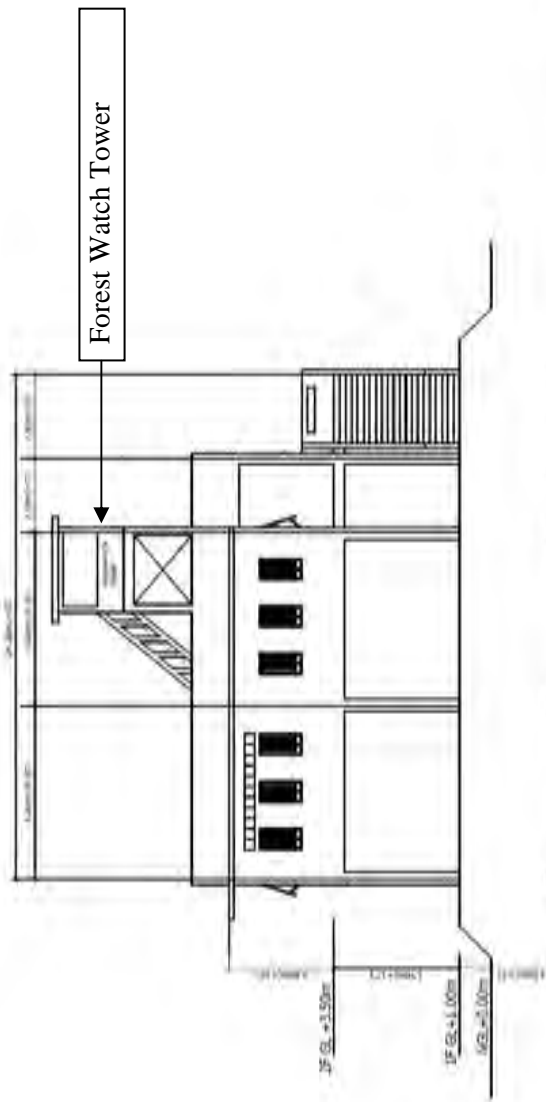


Figure 2-11: The Cyclone Shelter with Forest Watch Tower

2-2-4 Implementation plan

2-2-4-1 Implementation Policy

After the government of Japan and Myanmar have signed the Exchange of Notes (E/N), the government of Myanmar will conclude a contract with a Japanese consultant firm recommended by the Japan International Cooperation Agency (JICA) to implement operations with regard to this Project, such as the detailed design, operations related to tenders and contracts, and supervision of their implementation.

On the basis of this contract, the consultant shall implement the detailed design and draw up the tender and contract documents, after the completion of which the consultant will invite tenders for planting, facility construction and the procurement of equipment with the participation of the representatives of the Myanmar government. The consultant shall then select and specify the contractors.

The contractors shall, under the guidance and supervision of the consultant, procure seeds, raise seedlings, plant and tend the trees, and carry out the maintenance and management of the plantation sites. These contractors shall also construct a cyclone shelter and procure the equipment needed to complete this Project.

The planting, facility construction, equipment procurement and implementation supervision shall be carried out in accordance with the following policies:

- (1) The construction work, from the conclusion of the main contract to planting and facility completion, shall require about 3.5 years. A project implementation plan and supervision plan shall be established in view of the long construction period.
- (2) The completion of multiple operations (planting, facility construction and equipment procurement) by the completion date shall be ensured by selecting Japanese companies with abundant experience in planting projects and construction work, and with track records of success in similar projects in South-east Asia including Myanmar.
- (3) The preparations to be made by the Myanmar side, such as the acquisition of land for the planned construction site, removal of existing unnecessary facilities, and leveling of land, shall be completed before the start of the Project. Careful negotiations shall be held with the relevant organizations and local residents to ensure that the progress of this Project is not delayed.
- (4) Thorough preparations shall be made in collaboration with the Myanmar side in order to ensure the smooth progress of the various procedures required in the implementation of this Project. Examples of such preparation in detail are as follows:

- Issue of long-term visas to the Japanese staff of the consultant and contractors
- Tax exemption and customs clearance for the import and export of procured equipment
- Import and export of third-country products, etc.

(5) The Project offices shall be located appropriately so as to ensure close communications between JICA Myanmar office and relevant organizations including the FD.

(6) The consultant's and contractor's staff in charge of implementation shall be stationed permanently on site.

(7) Implementation supervision by permanently-stationed consultant staff

The following policies shall be adopted to allow the permanently-stationed staff to manage implementation of the work:

- The staff shall be stationed permanently from the start of construction to completion and handover, in order to supervise implementation.
- This Project covers a wide range of fields including planting operations, facility construction and the procurement of necessary equipment. Thus the consultant shall provide a system of supervision that can handle the specialized management required for each of the operations.
- In the planting operation, observation and inspection shall be carried out at each stage: procurement of seed, raising of seedlings and planting of seedlings. Appropriate instructions and guidance shall be given to the contractors.
- In the facility construction, observation and inspection shall be carried out to check facility layout, testing of concrete works, arrangement of reinforcement layout, material testing, and so on. Accurate instructions and guidance shall be given to the contractors.
- Regular contact shall be maintained and reports submitted periodically to officials of the Myanmar government and the JICA office.

2-2-4-2 Implementation Condition

(1) Relationship of project sites and major cities

The locations of the capital city of Nay Pyi Taw, the major city of Yangon and the project site at Bogale Township in relation to each other are as shown in the figure below. Transport from the capital city of Nay Pyi Taw or the major city of Yangon to Bogale Township or from Bogale Township to the Kadonkani RF, where the trees are to be planted, is both difficult and time- and energy-consuming. The locations will have a significant influence on the building of a management (supervision) system.

Transportation from Yangon to the plantation site in Kadonkani RF takes 10.5 hours in total; from Yangon to Bogale Township and the Bogale Township FD office, 4.5 hours by 4WD; and from Bogale Township to the Kadonkani RF plantation site (Main Office) is about 6.0 hours by boat.

Since the above transportation times are what can be expected in the dry season, poorer road conditions during the rainy season will make transportation times longer.

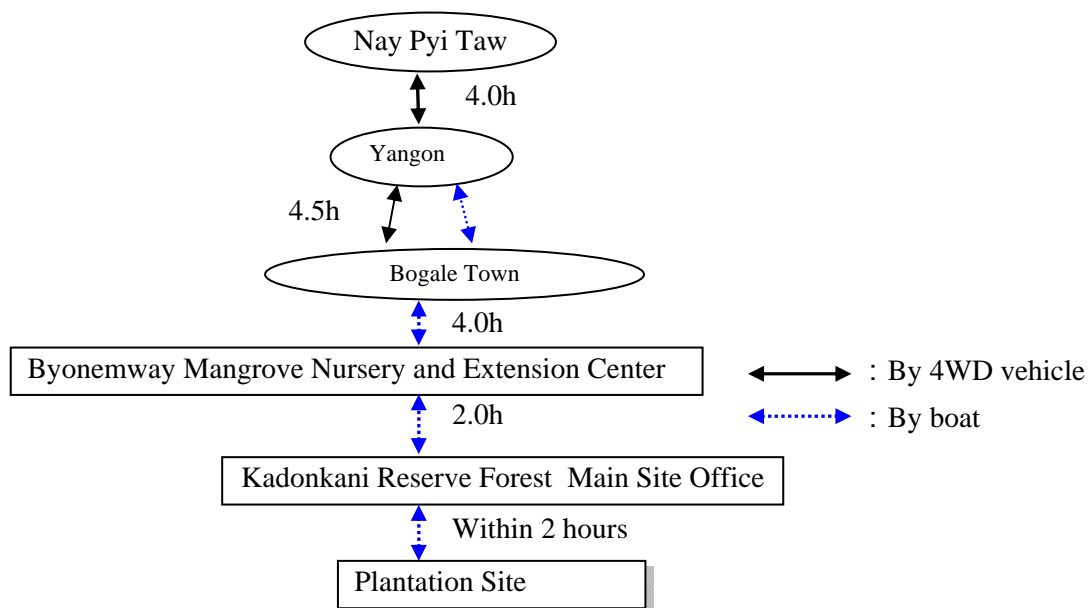


Figure 2-12: Relationship between project site and major cities, etc.

(2) Communication conditions

In Bogale Township, fixed-line telephones are available and mobile phones can be used to make phone calls, although the sound quality is poor. In Kadonkani RF, only mobile phones can be used and it is very difficult to make phone calls. Internet access is available only at some of the facilities (such as the FD Office and U.N. Office) in Bogale Township.

(3) Electrical power

In Bogale Township, electrical power is supplied but power failures often occur (The frequency depends on the season). In the villages located close to the projected plantation area, no utility power is supplied, and private power generation systems only are available at a limited number of houses and facilities.

(4) Materials

Most of the construction materials can be procured in Yangon.

2-2-4-3 Scope of works

With regard to the implementation of this Project with the Grant Aid of the Japanese government, the scopes of responsibility of the Japanese side and the Myanmar side are as shown in the table below:

Table 2-27: Scope of responsibility of the Japanese side and the Myanmar side

Responsibilities of the Japanese side	Responsibilities of the Myanmar side
(1) Construction of temporary facilities required for planting in this Project	(1) Acquisition of land planned for planting and facility construction
(2) Raising of seedlings and planting and tending of trees	(2) Application for permits and approvals required for planting and facility construction
(3) Procurement of construction materials, equipment, vehicles etc.	(3) Tax exemption and customs clearance of construction materials, equipment, vehicles, etc. and related supplies
(4) Construction of cyclone shelters with forest watch towers	(4) Exemption of tax and other surcharges applicable to Japanese nationals involved in the implementation of this Project
	(5) Preparation of expenses, equipment, furnishing, furniture, etc. required for the effective use of facilities and equipment after handover
	(6) Bank arrangements and Authority to Pay (A/P) procedures with regard to the implementation of Grant Aid cooperation project

2-2-4-4 Consultant Supervision

The purpose of supervision by the consultant in this Project is the inspection, direction and supervision of the raising of seedlings, planting and tending of trees, construction of facilities and procurement of equipment in the Kadonkani RF carried out by the contractors in accordance with the contracts, special conditions of contracts, specifications and drawings.

- The consultant shall inspect, direct, and manage facility construction and equipment procurement by the contractors to ensure that these tasks are implemented within the periods specified in the contracts, specifications and drawings.
- The consultant shall supervise and manage on-site the raising of seedlings and planting and tending of trees by the contractors to ensure that these tasks are implemented in accordance with the contracts, specifications and drawings.
- The consultant shall prepare, in addition to the implementation design system, a support system in Japan for the implementation supervisors stationed permanently in Myanmar in order to ensure constant supervision and confirmation of the state of progress of the Project.

The operations to be carried out by the consultant after the Exchange of Notes (E/N) are divided into two phases: The detail design phase in which the tender documents will be prepared, and the supervision and management phase in which the facility construction and planting operations will be carried out.

The following section describes the operations required in each phase.

During the construction supervision, construction management engineers, directing engineers specialized in seedling cultivation and planting technologies and soft component specialists shall be dispatched as required to provide assistance in establishing a sustainable maintenance and management system in the FD.

(1) Detail design

The main work to be carried out by the consultant in the implementation design phase is as follows:

- Preparation of planting plan drawings that indicate forest groups
- Preparation of cyclone shelter design drawings
- Preparation of contracts, particular specifications, specifications, special contract conditions, tender documents, etc.
- Calculation of planned tender amounts
- Acting as a deputy in holding of tenders

The consultant shall also carry out the following in field survey operations:

- Field reconnaissance such as fact-finding survey, checking of forest groups, measurement survey, planting plans, and so on at the plantation site
- Field survey of the planned sites for construction of cyclone shelters
- Survey of market prices
- Check of the detailed plan for soft components
- Survey of other unchecked items

(2) Supervision of implementation

As described earlier in Section 2-4-2 (1), "Relationship of project sites and major cities," access to the plantation site in this Project is not easy. Therefore appropriate supervision and safety shall be taken into consideration in the allocation of personnel.

A field supervision office (Main Office) shall be established in the Kadonkani RF. The Main Office shall be staffed by two local engineers who will take charge of supervising the planting operation in the Kadonkani RF, report to the FD office in Bogale Township, and handle coordination, paperwork, etc. In addition, a supervisory office shall be established in Yangon staffed by a resident Japanese supervising engineer with a plantation engineer as his assistant. The Yangon supervisory office shall serve as the central base for the supervision of implementation in this Project, and shall handle such operations as controlling the Main Office, reporting the state of progress to the headquarters of the FD of the Ministry of Environmental Conservation and Forestry located in Nay Pyi Taw, and to the headquarters of this Project (FD) to be established in Yangon, as well as reporting to the JICA Myanmar office in Yangon and coordination of contact with those concerned with this Project who are stationed in Yangon.

In line with the above arrangements, the planned assignment of supervisory personnel and the allocation of offices for supervision of implementation are as shown in the figure below:

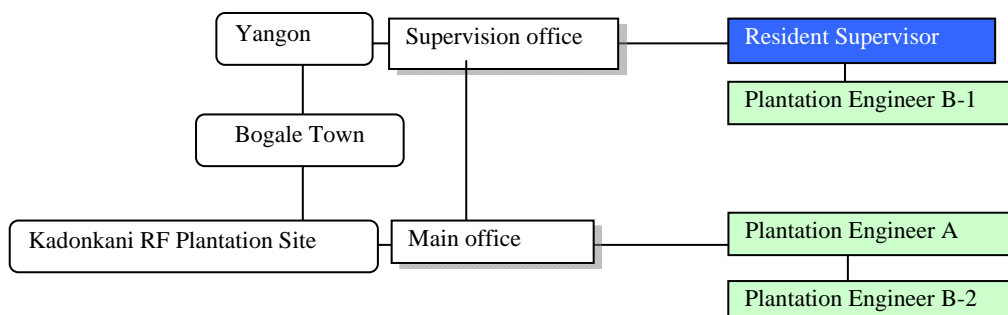


Figure 2-13: Organization for supervision of implementation

2-2-4-5 Quality Control Plan

(1) Planting operation

- Check of plantation area (check status of land leveling and weeding works)
- Visual check of seed status
- Count of bud breaks and calculation of the bud break rate
- Count of nursery survivals and calculation of survival rate
- Check of conditions for seedling transport from the nursery to the plantation site
- Check of planting conditions
- Check of cultivation conditions
- Count of trees that have taken root and calculation of survival rate (root-taking rate)

(2) Facility construction (Cyclone shelter)

- Check of the construction site ground
- Check of working drawings
- Check of concrete mix design, check of test mix, observation of field test, observation of compressive strength test
- Check of reinforcing bar quality
- Check of implementation conditions
- Check of work completed

(3) Inspection of procured equipment

- Check of specifications of equipment

2-2-4-6 Soft Component Plan

(1) Background behind planning of soft components

The aim of the "Mangrove Rehabilitation Plan for Enhanced Disaster Prevention in the Coastal Area of the Union of Myanmar" is to plant mangrove trees in an area of 1,154 ha to bring about the early rehabilitation of mangrove forests, the disaster-prevention function of which against the impact of cyclones has been verified.

The target area has been managed as a reserved forest since the beginning of the 20th century and is dotted with villages of fishers and farmers who collect firewood, lumber and other necessary forestry products from this reserved forest, which is a major cause of deforestation. Whereas the mangrove forest serves as a necessary resource for the local residents, they do not fully understand that the deforestation is weakening its disaster prevention function and is ultimately disadvantageous to the residents.

The mangrove forest where trees are to be planted in this Project is to be managed in principle by the FD, and a mangrove forest management plan in which the Department plays a central part is to be prepared. Before the preparation of the plan, the local residents need to understand the objective of planting the mangrove forest (disaster prevention), and therefore the mangrove forest management plan shall be prepared with the participation of the local residents. This operation shall tie in with the technical cooperation project "Integrated Mangrove Rehabilitation and Management Project through Community Participation in the Ayeyawady Delta" to ensure that the "Standard Plantation Procedures" developed in the project for the staff of the Ministry of Environmental Conservation and Forestry can be used on a practical basis. The FD staff will participate in the training to be provided in collaboration with a training organization of the Ministry of Environmental Conservation and Forestry in line with the aforementioned standard procedures, in order to enable the FD staff to manage the mangrove forest through community participation in cooperation with the technical cooperation project.

At the same time, emergency drills shall be carried out using the existing cyclone shelters, etc. in the villages covered by the Project. The aim of preparing the mangrove forest management plan through community participation and of the emergency drills is to improve the local villagers' understanding of the disaster prevention function of the mangrove forests, their awareness of disaster prevention and their awareness and concern for mangrove forest conservation as well as the continued conservation of the planted mangrove forest in line with the prepared mangrove forest management plan.

(2) Objective of the soft component

The formulation of a mangrove forest management plan through community participation, the commencement of activities for continual conservation of mangrove forests, and deepening of the residents' understanding of the functions of the mangrove forest

The aim of the soft component is to formulate a mangrove forest management plan through discussion and deliberation between the FD and the local residents in order to deepen the local residents' understanding of mangrove forest conservation and to ensure the continued conservation of the mangrove trees planted in this Project by implementing the established management plan.

(3) Checking outputs and level of achievement

Table 2-28: Outputs and how to check achievement

Output	Achievement criteria	How to check level of achievement (draft)
1. The management plan for the planted mangrove trees will be prepared through community participation, led by the FD.	<ol style="list-style-type: none"> 1. Has the mangrove forest management plan been formulated by the FD staff? 2. Do the residents understand the mangrove forest management plan for the target area? 	<ol style="list-style-type: none"> 1. Mangrove forest management plan 2. Hearing survey of the residents who participated in the preparation of the plan
2. The residents' awareness of disaster prevention will be improved.	<ol style="list-style-type: none"> 1. Do the residents understand how to evacuate when a cyclone strikes? 2. Do the FD staff in the target area recognize the position and understand the status of the cyclone shelter? 3. Do the residents understand the disaster prevention effect of the mangrove forest? 	<ol style="list-style-type: none"> 1-1. Hearing survey of the residents 1-2. Identification of the degree of dissemination of the existing disaster prevention maps 2. Hearing survey of the FD staff 3. Hearing survey of the residents
3. The residents' understanding of the functions of the mangrove forest will be deepened.	<ol style="list-style-type: none"> 1. Do the residents understand the functions of the mangrove forest? 2. The residents' dependence on mangrove forests for their living 	<ol style="list-style-type: none"> 1. Hearing survey of the residents 2. Survey of the residents' use of firewood 3. Survey of aquatic life

(4) Activities (Input plan)

Year	Overview of activities	Target	Site of activities	Implementation resource
Activities for Output 1: The management plan for the planted mangrove trees will be prepared through community participation led by the FD.				
First year	1.1 Checking the existing mangrove forest management plan 1.2 Examining the policies for formulation of the mangrove forest management plan in the plantation area covered by this Project 1.3 Examining the policies for the selection of villages for community participation, and selection of the villages 1.4 Examining and deciding on the process for formulating future management plans	FD staff, Residents of villages close to the plantation site covered by this Project	FD office in Bogale Township, Villages in and around the Kadonkani RF	FD staff, Japanese consultant, Local consultant
Second year	1.5 Holding workshops with village residents, explaining the mangrove forest management draft plan and hearing opinions from the residents, in line with the policies created for the formulation of a mangrove forest management plan. 1.6 Examining the mangrove forest management draft plan in view of the opinions heard at the workshops			
Third year	1.7 Holding workshops for discussions with village residents on the mangrove forest management draft plan 1.8 Reviewing the mangrove forest management draft plan on the basis of the results of the above workshops			
Fourth year	1.9 Explaining the revised mangrove forest management plan to the residents to notify them that the plan has been formulated and inform them of its content			
Activities for Output 2: The residents' awareness of disaster prevention will be improved.				
First year	2.1 Checking the state of use of the existing cyclone shelters in the target area 2.2 (In addition to 1.3 above) Checking and selecting villages close to the Project site where emergency drills are to be conducted 2.3 Examining and deciding on the policies for conducting emergency drills 2.4 Checking the existing data for this project area such as disaster prevention maps 2.5 Examining how to evacuate to the cyclone shelters to be constructed in this Project	FD staff, Residents of villages close to the plantation site in this Project	FD office in Bogale Township, Villages in and around the Kadonkani RF	FD staff, Japanese consultant, Local consultant
Second year	2.6 Holding workshops with the residents of target villages to hold emergency drills 2.7 Holding emergency drills using the existing cyclone shelters on the basis of the results of the workshops			
Third year	2.8 Holding emergency drills in the target villages 2.9 Studying the results of the emergency drills			
Fourth year	2.10 Holding workshops with the residents of the target villages to discuss the results of the emergency drills and to carry out a survey on disaster prevention awareness			

Year	Overview of activities	Target	Site of activities	Implementation resource
<u>Activities for</u>				
<u>Output 3: The residents' understanding of the functions of the mangrove forest will be deepened.</u>				
First year	3.1 Examining and deciding on implementation plans for a survey of aquatic life 3.2 (In addition to 1.3 and 2.2 above) Selecting sites and villages where the survey on aquatic life will be carried out	FD staff, Residents of villages close to the plantation site in this Project	FD office in Bogale Township, Villages in and around the Kadonkani RF	FD staff, Japanese consultant, Local consultant
Second year	3.3 Holding workshops with residents of the target villages to explain the aquatic life survey through community participation and the functions of the mangrove forest 3.4 Implementing the aquatic life survey 3.5 Surveying the current situation regarding the use of firewood			
Fourth year	3.6 Implementing the aquatic life survey, summarizing the survey results, and checking them in collaboration with the participating residents 3.7 Summarizing the aquatic life survey results and checking them in collaboration with the participating residents 3.8 Summarizing the firewood use survey results and checking them in collaboration with the participating residents 3.9 Reviewing past activities regarding the functions of the mangrove forest and discuss the functions of the mangrove forest			

(5) Utilization of the local consultant and implementation process

In the soft component activities, the local consultant shall be made optimum use of and the Japanese consultant shall work on a spot-dispatch basis, serving as the general coordinator for the consultants and as the controller in the determination of overall policies. This activity shall be implemented mainly in the dry season of each year in line with the plantation work to be carried out over four terms. The implementation period of this activity is roughly divided into four periods, in which the Japanese consultant shall carry out activities on a spot-dispatch basis four times (4.5 months in total). The local consultant shall assign two employees to carry out activities, each for 14 months.

Table 2-29: Scope of responsibility of the Japanese side and the Myanmar side

	First year	Second year	Third year	Fourth year	Total
Japanese consultant	1.5 months	1.0 month	1.0 month	1.0 month	4.5 months
Local consultant 1	4.0 months	4.0 months	2.0 months	4.0 months	14.0 months
Local consultant 2	4.0 months	4.0 months	2.0 months	4.0 months	14.0 months

(6) Outputs

The outputs (draft) from the soft component activities shall be as shown in the table below for each of the activities in each year.

Table 2-30: Scope of responsibility of the Japanese side and the Myanmar side

	Activities relating to Output 1	Activities relating to Output 2	Activities relating to Output 3
First year	<ul style="list-style-type: none"> • Draft policies for formulation of the mangrove forest management plan 	<ul style="list-style-type: none"> • Draft policies for holding of emergency drills • Policies for evacuation should a cyclone strike during this Project 	<ul style="list-style-type: none"> • Draft plan for holding an aquatic life survey
Second year	<ul style="list-style-type: none"> • Workshop results and mangrove forest management draft plan (second year) 	<ul style="list-style-type: none"> • Workshop results • Emergency drill results (second year) 	<ul style="list-style-type: none"> • Workshop results • Results of the aquatic life survey (second year) • Results of survey on the current situation regarding the use of firewood (second year)
Third year	<ul style="list-style-type: none"> • Workshop results and mangrove forest management draft plan (revised draft) 	<ul style="list-style-type: none"> • Workshop results • Emergency drill results (third year) 	None
Fourth year	Mangrove forest management plan (final)	<ul style="list-style-type: none"> • Workshop results and summary of emergency drills 	<ul style="list-style-type: none"> • Summary of aquatic life inventory surveys • Results of survey on the current situation regarding the use of firewood

The results on the above activities shall be evaluated and examined. During implementation and after completion of the soft component, the following reports shall be submitted:

1. Soft component progress status report
2. Soft component completion report

(7) Obligations of the government of the recipient country

1) Obligations during implementation of the soft component

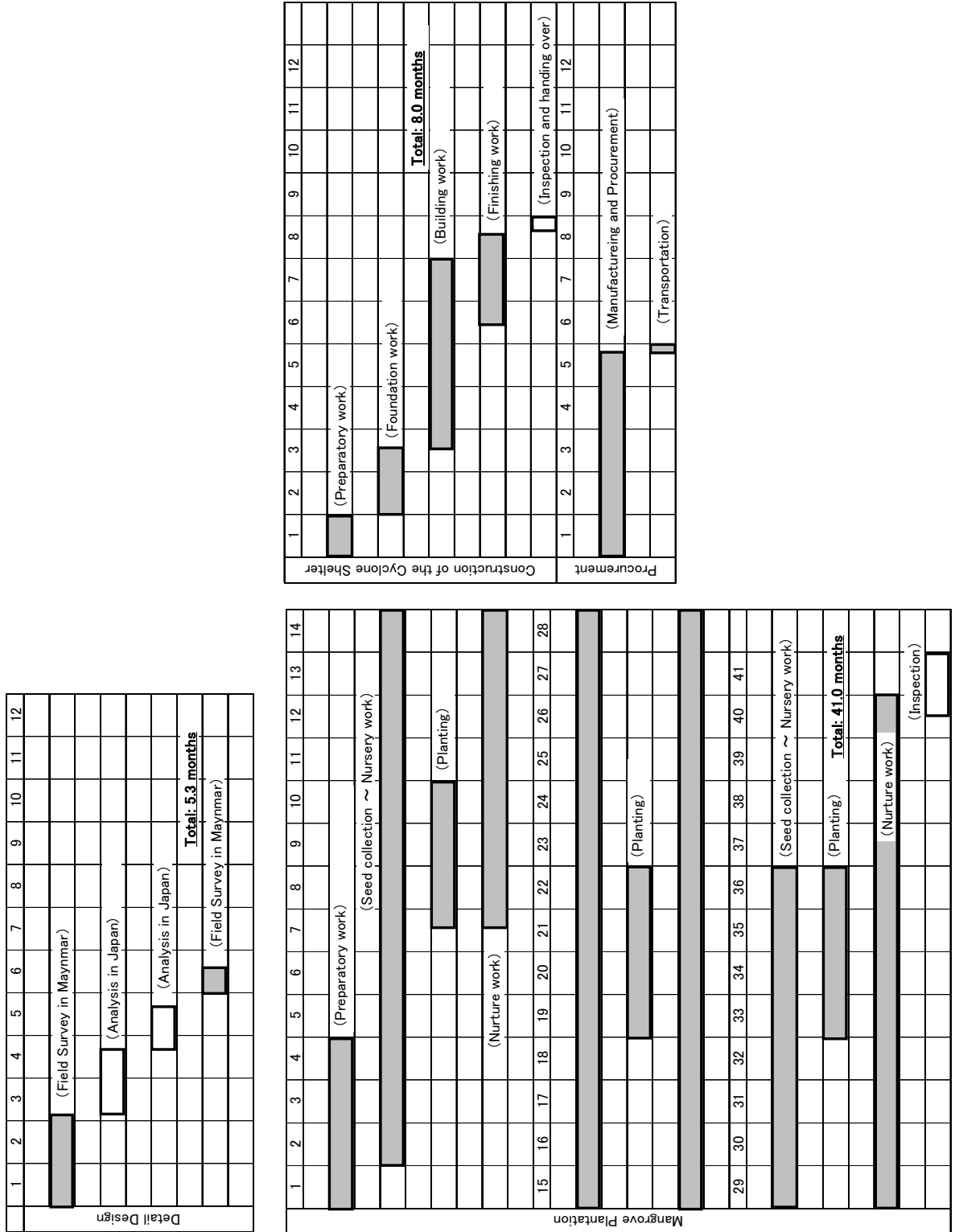
- Active participation and cooperation by the staff (*i.e.* foresters, rangers and other staff members who are in charge of the areas covered by this Project) of the Bogale Township FD office which is the counterpart in the implementation of this soft component plan
- Permission for travel and activities in Myanmar to be granted to the Japanese consultant and the local consultant engaged in the implementation of this soft component plan
- Provision of offices to serve as field offices for the activities
- Request to relevant ministries and agencies for cooperation in and permission for activities

2) Obligations after completion of the soft component

- Promotion of the mangrove forest management plan
- Dissemination and active use of experience and knowledge acquired in the activities of this soft component

2-2-4-7 Implementation Schedule

Table 2-31: Implementation Schedule



2-3 Obligations of Recipient Country

Within the Myanmar side, the FD of the Ministry of Environmental Conservation and Forestry is the body responsible for this Project.

This Project, to be implemented under the Grant Aid cooperation scheme of Japan, must be implemented in conformity with the budget scheme of the Japanese government. Therefore, in each phase of the Project the departments responsible on the Myanmar side shall have responsibility for carrying out the tasks listed below and shall do so without delay.

- Conclusion of the contract with a Japanese consultant based on the Exchange of Notes (E/N)
- Payment of the contract money to the above contractors through the issue of an Authorization to Pay (A/P) to a Japanese foreign exchange bank immediately after the conclusion of the contract
- Payment of service charges to the above bank in accordance with the arrangements between banks immediately following the issue of an A/P
- Opening of the office required for construction supervision and the assignment of personnel to it
- Immediate issue as required of entry permits and long-stay visas for the members of the Japanese consultant and contractors entering Myanmar to carry out the work
- Acquisition of the land required for facility construction and provision of the site to contractors
- Granting of tax exemption benefits for construction equipment and materials, and for procured equipment
- Prompt handling of delivery procedures for equipment to be imported from Japan or a third country and the payment of necessary customs clearance costs
- Observation of tree planting and inspection of facilities and equipment at each stage (in accordance with requests made by the consultant)
- Prompt issue of the completion certificates required at each stage

2-4 Project Operation Plan

2-4-1 Operation and Management structure

Operation and management structure for mangrove forest after implementation of the project will be planned according to the following table;

Table 2-32: Operation and management structure after the project

Position for the Project	Number	Position
Administrative Level		
Project Director	1	Director General
Deputy Project Director	1	Deputy Director General
Project Manager	1	Director of Planning Division
Project Coordinator	1	Deputy Director of Planning Division
Implementation Level		
Field manager	1	Staff Officer
Field staff	1	Range Officer
Field staff assistant	2	Dy. Range Officer
Forest guard	3	Forester
Driver	2	
Boat operator	1	

2-4-2 Operation and management plan

2-4-2-1 Mangrove forest

After handing over the Project, FD shall execute the following maintenance works for the Mangrove Plantation. The schedule of maintenance is shown in following figure.

Table 2-33: Operation and management plan after the project

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Fire protection		■	■	■	■							
Weeding						■	■	■	■	■		
Supplemental Plant						■	■	■				
Forest Guard	■	■	■	■	■	■	■	■	■	■	■	■

*Supplemental Planting or patching: If necessary.

2-4-2-2 The Cyclone Shelter with Forest Watch Tower

Daily cleaning shall be done by the staff of Bogale FD office (Forest Guard and Dy. Range Officer). Basically the facility is very simple design but the roof shall be coated by waterproof paint every ten years. Some renovation work shall be done whenever necessary. The cyclone shelter will be managed properly.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

This cost estimation is provisional and would be further examined by the Government of Japan for the approval of the Grant. A breakdown of cost based on the aforementioned obligations of each country is estimated as follows:

2-5-1-1 Obligation of Myanmar Side

Obligation of Myanmar side: 45,253,000 Kyat

Obligation	Cost (Kyat)
Staff salary related to Mangrove operation and management during the project	15,375,000
Commission for Banking Arrangement (B/A)	9,878,000
Tax for import vehicle	20,000,000
Total	45,253,000

2-5-1-2 Condition of Cost Estimation

(1) Time of Cost Estimation

The project cost was estimated in July 2011.

(2) Exchange Rate

The project cost was calculated using the following average exchange rate in six (6) months from January 1 to June 30, 2011.

1 USD = 83.00 JPY

(3) Schedule for Plantation, Construction and Equipment Procurement

The schedule is shown in “2-2-4-7Implementation Schedule”

(4) Others

The project cost was estimated according to the Guideline of Japanese Grant Aid.

2-5-2 Operation and Maintenance Cost

Operation and Maintenance will be implemented planned as “2-4-2 Operation and management plan”.

Operation and Maintenance Cost per year is estimated as following table:

Table 2-34: Operation and Management Cost (Kyat)

Item	O & M Cost	Note
Fire protection	855,000	
Weeding	5,703,000	
Supplemental Plant	—	If necessary
Forest Guard	492,000	
Total	7,050,000	

This Operation and Maintenance cost accounts for 0.1% of total budget of Forest Department, and it will be about 30% of Bogale Township FD of one year budget. Although occupying 30 % of Bogale Township FD Budget is a high ratio, FD has a plan to add some budget for the project. Therefore, FD will surely be able to carry out the Project operation and maintenance for the Grant Aid Project by the Japanese Government.

Chapter 3

Project Evaluation

3. Project Evaluation

3-1 Preconditions

Persons concerned and participants for implementation of the project shall be arranged properly. And also it is required to take appropriate measures to secure the budget of the “Myanmar side” with respect to the project implementation and the soft component activities.

3-2 Necessary Inputs by Recipient Country

3-2-1 Utilize the Experience of the Participation of the Technical Cooperation Project

FD staff, participating in the technical cooperation project currently underway in the project site, shall also participate in this project to actively use the knowledge and expertise they have gained.

3-3 Important Assumptions

3-3-1 No strikes of Cyclone (Nargis Level) to the Project Site

It will be take 5 years until planted mangrove will grow in order to function as disaster prevention. Therefore, if cyclone like Nargis struck the project site, it might bring catastrophic damage for planted mangrove under nature work.

3-3-2 Sustainable mangrove forest management and preservation

In order to achieve objective of the project and overall goal, it is required to implement nature works and preservation such as weeding work continuously by FD staff after handing over to the Myanmar side.

3-4 Project Evaluation

3-4-1 Validity

The Project implementation by Grant Aid is evaluated to be reasonable based on the result of this survey for the following reasons.

- (1) Beneficiary population of the project is considerable, a number of whom are in the “worse off” category.
- (2) “Myanmar Action Plan on Disaster Risk Reduction 2009-2015” was drawn up in July 2009, the action plan shows 7 main policies including plantation and construction of cyclone shelter. The goal of the action plan is “To make Myanmar Safer and more Resilient against Natural Hazards, thus Protecting Lives, Livelihood and Developmental Gains”, implementation of the project contribute achievement of the goal of the action plan.
- (3) FD, as the implementation agency, has experience and techniques as to mangrove plantation and management, and then has enough capability to implement mangrove operation and management after the project. And also, mangrove plantation and construction of the cyclone shelter are common in the project site so it does not require special techniques for construction and management.
- (4) This project is a related project of Japan Aid Policy of Basic Human Needs that benefit to local

residents directly

- (5) This project is not a profit-earning project.
- (6) Negative impact on the environment is not generated by the Project implementation according to the Environment Impact Assessment (EIA).
- (7) The Project implementation by Japanese Grant Aid scheme is not particularly difficult.

3-4-2 Effectively

3-4-2-1 Quantitative Impact

Quantitative impact to be expected by implementation of this project is mentioned below.

Table 3-1: Quantitative Impact after implementation of the Project

Indicator	Baseline (2011)	Target value (2019)
Beneficiary local residents of wind breaking through mangrove plantation	0 people	4,400 people
Beneficiary local residents of tide prevention through mangrove plantation	0 people	Approximately 210,000 people
Green house effect gas reduction	0 ton / year	Approximately 35,450 ton / year
Capacity of the shelter in and near the project site	2,309 people	2,459 people

3-4-2-2 Qualitative Impact

Qualitative impact to be expected by implementation of the Project is mentioned below.

- (1) Improvement of Forest management and preservation capacity of FD staff.
- (2) Improvement of local resident awareness of disaster prevention and conservation of mangrove forest.
- (3) Coastal ecosystems and biological diversity will be protected and conserved through proper management of mangrove forest, and contribution to water purification.
- (4) The local resident will benefit economically and environmentally due to biological diversity and utilization as firewood through pruning of branches.

From the above-mentioned contents, implementation of the project is assessed reasonable and effective.