CHAPTER II-6 TECHNICAL SYSTEM FOR SOLID WASTE MANAGEMENT

6.1 Source Reduction

In accordance with the waste hierarchy, a series of source reduction programs was proposed on Boracay Island and the Mainland of Malay. For the reduction of biodegradable waste, which accounts for about 30-40 % of the generated waste, at the source, promotion of home composting was proposed for households and business establishments. As for the reduction of non-biodegradable waste, promotion of returning of bottles to the dealers and a reduction in the number of plastic shopping bags used were proposed. In addition, on Boracay Island, use of specific packages was proposed to be prohibited, while on the Mainland of Malay, a group recycling program was proposed for promoting the recycling activities of junkshops. The proposed source reduction programs are summarized in Table 6.1-1.

Table 6.1-1 Description of Source Reduction Programs

Target	Program	Component	Description
Reduction of biodegradable waste	"BALIK[1] BIO-WASTE" Program	Promotion of home composting	Small scale composting is promoted to households and small scale business establishments.
Reduction of non-biodegradable waste	"BALIK BOTE" Program	Promotion of returning of bottles to the dealers	The producers are requested to return container and packaging wastes to recycling industries. A deposit system to collect the empty container and packaging wastes from consumers is to be introduced.
	"BALIK BAYONG" Program	Promotion of reduction in the number of plastic shopping bags used	Step by step reduction of the number of plastic shopping bags used starting from "my bag" campaign.
	Program on Prohibition of Using Specific Packages on Boracay		In accordance with the progress of other source reduction programs, utilization of specific packages on Boracay Island will be prohibited.
	Program on Group Recycling		Recyclable waste is to be collected at existing meeting points such as schools and churches so that junkshops can come to buy them.

Source: JICA Study Team

6.1.1 Source Reduction of Biodegradable Waste

Because MO No.185 stipulates that the households which have a relatively large garden (more than 50m^2) should implement composting at home, home composting is mainly carried out in rural areas. This activity should be promoted by revision of the MO. Biodegradable waste generated is sometimes used for livestock feed at each source, or provided to the nearby framers and this activity is expected to be conducted continuously on

[1] "BALIK" means "Return" in Tagalog, while BIO-WASTE, BOTE and BAYONG mean biodegradable waste, bottle, and bag, respectively. So, BALIK BIO-WASTE means return of biodegradable waste (to the earth), BALIK BOTE means return of bottles (to the shops), and BALIK BAYONG means return of bags (at hand) as my bag.

the Mainland of Malay. This will further reduce biodegradable waste. In order to promote reduction of biodegradable waste at the source effectively, the "BALIK BIO-WASTE" Program is proposed as shown in Table 6.1-2.

Table 6.1-2 Content of "BALIK BIO-WASTE" Program

Content	Target Generation Source	Target Area	Materials to be Addressed
Promotion of composting of biodegradable waste	Households and small scale business establishments	Boracay Island and Mainland of Malay	Food waste and garden waste

Source: JICA Study Team

The following activities are planned to be conducted by the "BALIK BIO-WASTE" Program.

- Promotion of home composting of food waste and garden waste through a series of dissemination workshops and trainings including introduction of various kinds of home composting methods such as composting using compost bins and compost pits.
- Introduction of incentive schemes such as reduction of the GCF and providing rewards to those business establishments who reduced the amount of their biodegradable waste.
- Introduction of monitoring and instruction systems regarding home composting activities
- Revision of the MO on home composting, e.g. the threshold size of the yard should be changed from "50 m^2" to "30m^2".
- Constitution of a new MO that requests newly developed business establishments such as hotels, resorts and restaurants to carry out composting of food and garden wastes which are generated from their premises.

The implementation organization of the "BALIK BIO-WASTE" Program is shown in Table 6.1-3.

Table 6.1-3 Implementation Organization of the "BALIK BIO-WASTE" Program

Item	Responsible Organization	Role of Responsible Organization
Promotion	Selder Leaders[2], Schools, Private Sector Organizations	The Selder leader promotes home composting activities for neighboring households. Schools are also possible venues to promote composting through the students. For business establishments, the promotion is to be carried out by private sector organizations including NGOs such as BCCI and BFI
Introduction of incentive schemes	MOM Barangays,	The MOM will prepare the overall incentive system, while barangays will implement the system
Monitoring and instruction system	Barangays, Selder Leaders	Monitoring and instruction is to be carried out by the Selder leaders of each barangay after they have received instruction.
Constitution and Revision of MO	MOM	The MOM will prepare the MO with the consultation of the SB

Source: JICA Study Team

6.1.2 Source Reduction of Non-Biodegradable Waste

With an increase in the number of tourists and a change of life style, package waste has increased and is expected to increase significantly in the future. As countermeasures, a series of source reduction programs for non-biodegradable waste are proposed as shown in Table 6.1-4.

Table 6.1-4 Contents of Source Reduction Programs for Non-Biodegradable Waste

Program	Target Generation Sources	Target Area	Materials to be Addressed
"BALIK BAYONG" Program	Residents and Tourists	Boracay Island	Plastic shopping bags
"BALIK BOTE" Program	Residents and Tourists with support of distribution industry	Boracay Island	Used bottles
Introduction of Waste Avoidance Program	Residents, Tourists and Business establishments	Boracay Island	Container and packaging wastes
Introduction of Group Recycling	Residents on the Mainland of Malay	Mainland of Malay	Recyclable wastes

Source: JICA Study Team

(1) "BALIK BAYONG" Program

This program is proposed to reduce utilization of plastic shopping bags at the generation stage, and to attain the final goals of "no utilization of plastic shopping bags". The following sub-programs are proposed as 1st and 2nd stages.

- 1st Stage : Campaign on "Bring My Bag" for Shopping
- 2nd Stage: Prohibition of Plastic Shopping Bag Use for Shopping

[2] Each barangay has some communities which are classified by location or region. A community is called a Selder (cell) and has a leader. Each Selder leader has an important role to provide orientation and assistance to the homeowners in setting up their own home composting.

1) Campaign on "Bring My Bag" for Shopping

As the first step, a campaign on "Bringing My Bag for Shopping" will be implemented. Use of reusable shopping bags is promoted for shopping through a series of campaigns. There are mainly two types of shoppers on Boracay Island, i.e. tourists and residents. As for the tourists, they can borrow a bag for shopping during their staying on Boracay Island or can purchase a bag to utilize as my bag and as a souvenir. When the tourists go to the shops, they will be able to receive rewards by an Eco-seal System (e.g. discount or stamps will be given to the shoppers when they utilize "my bag" at shops instead of plastic shopping bags. If they collect a certain number of the stamps, a reward will be provided). As for the residents, my bag, which will be distributed by the MOM through the campaign or their own bag, will be promoted to use for shopping. Same as for the tourists, those residents who use my bags for shopping will be able to receive the rewards. The concept of the first stage sub-program is illustrated in Figure 6.1-1.

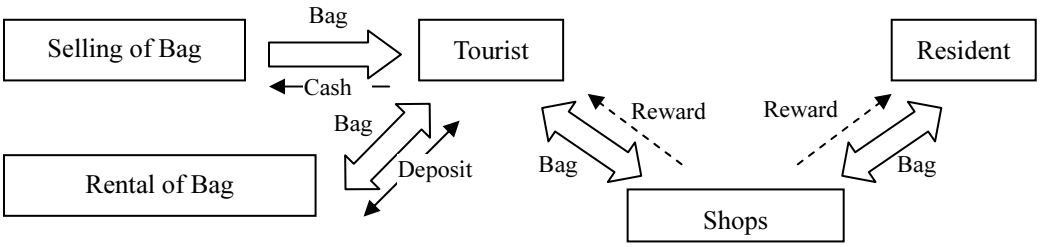

Figure 6.1-1 Campaign on Bringing My Bag for Shopping

Source: JICA Study Team

Bags sold on Boracay Island which can be used as "May Bags"	My Bags used in the world	
		
		

Figure 6.1-2 Example of My Bag

Source: JICA Study Team, Eco-bag Book

The following activities are planned to be conducted in the first stage of "BALIK BAYONG" Program as a campaign on “Bring My Bag” for shopping:

- Promotion of using my bag by the residents through a series of public awareness campaign activities. This includes distribution of “my bags” to the residents for promotion purpose and explanation of the program to the shop owners and obtaining their cooperation for the promotion. My bags will be distributed to the residents free of charge during the campaign.
- Introduction of an incentive system such as an Eco-seal system for those who use “my bad” for shopping.
- Introduction of a rental system of “my bag” for tourists who stay short term or those residents who forget to bring “my bag”.
- Selling “my bags” to the tourists at the arrival places of so that they can use the bags during their stay on Boracay Island.
- Introduce a system to charge for plastic shopping bags with consideration of the customer’s attitude, response and opinions to promote the prohibition of plastic shopping bag use.

2) 2nd Stage: Prohibition of Plastic Shopping Bag Use

As the second stage of the “BALIK BAYONG” Program, plastic shopping bag use is prohibited as MO. The following activities are planned to be conducted for the program.

- Explanation of the prohibition system to the shop owners and residents, and obtain their consensus
- At the beginning stage of the 2nd stage, the prohibition system is introduced for large scale shops as a pilot project. The system shall be expanded into other shops with consideration of the result of the pilot activity
- Constitution of the MO on the provision of prohibition of plastic shopping bag use on Boracay Island
- Introduction of an inspection system for the enforcement of MO

The implementation organization of the "BALIK BAYONG" Program is shown in Table 6.1-5.

Table 6.1-5 Implementation Organization of the "BALIK BAYONG" Program

Item	Responsible Organization	Role of Responsible Organization
Promotion	MOM, Barangays and Shop owners	The MOM and barangays promote the activities with cooperation of shop owners.
Establishment of incentive schemes	MOM, Barangays and Shop owners	Incentive systems such as eco-seal are to be introduced by shop owners with instruction by the MOM and barangay.
Constitution and revision of MO	MOM, Barangays	The MOM and barangays prepare the draft concept of MO with the consultation of the SB and then the SB approves it.
Introduction of inspection system for the enforcement of MO	Selder Leader and Environmental Monitoring Team	Monitoring and instruction is to be carried out by the Selder Leader and Environmental Monitoring Team with instruction of the MOM and barangays.

Source: JICA Study Team

(2) "BALIK BOTE" Program

The objective of the "BALIK BOTE" Program is to establish a system whereby the producer collects the container and packaging wastes which may be produced by their products based on the theory of extended producer's responsibility. There is a good example in which San Miguel's Brewery Co. Ltd. collects recyclable waste bottles such as PET bottles and glass bottles voluntarily together with their empty beer bottles. The system is planned to be gradually established as follows:

- Those producers who sell goods to the retailers on Boracay Island are requested to register with the MOM and declare the amount of containers and packaging material of the goods to be brought to Boracay Island.
- Those producers are requested to collect the containers and packaging wastes from the consumers through retailers.
- The retailers are requested to collect the containers and packaging wastes from consumers through local shops and stores.
- A local deposit system or incentive system is to be introduced for collection of the containers and packaging wastes from the consumers.

The following activities are planned to be conducted in the first stage of the "BALIK BOTE" Program.

- Selection of the target producers
- Explanation to the shop owners and residents, and obtain their consensus
- Trial implementation including an opinion survey of consumers and commercial sector enterprises for introduction of the system
- Constitution of the MO on the system
- Enforcement of the MO through its monitoring

The implementation organization of the "BALIK BOTE" Program is shown in Table 6.1-6.

Table 6.1-6 Implementation Organization of the "BALIK BOTE" Program

Item	Responsible Organization	Role of Responsible Organization
Promotion	MOM, Shop owners, Retailers and Producers	The MOM conducts an opinion survey with cooperation of shop owners, retailers, and producers as well as consumers. Shop owners, retailers and producers conduct the promotion of the activity with support by the MOM
Constitution and revision of MO	MOM, Barangays	The MOM prepares the concept of the MO with the consultation of the SB.
Monitoring and Instruction	Environmental Monitors	Monitoring and instruction is to be carried out by Selder Leaders with instruction of the MOM and barangays.

Source: JICA Study Team

(3) Program on Prohibition of Using Specific Packages on Boracay

In order to reduce the amount of waste generated at the sources, "avoidance" of the use of materials which may become the waste after use should be tackled as much as possible. This program is to prohibit utilization of specific packages on Boracay Island as a symbolic activity. The elimination of specific packaging waste on Boracay Island is introduced by stipulation of MO.

The following activities are planned to be conducted for the Program on Prohibition of Using Specific Packages on Boracay:

- Selection of target packages to be prohibited for use on Boracay Island. The packages are to be selected from among the wastes which may become the residual waste. The target packages with available substitutes should be selected.
- Explanation of the prohibition system to the residents and business establishments and obtain their consensus.
- Constitution of MO on the Prohibition of Using Specific Packages on Boracay Island.
- Introduction of a checking and monitoring system for the enforcement.

One of the possible targets of the waste avoidance is small plastic packages of shampoo or rinse which are often used at hotels and resorts, namely "sachets". In this case, refillable bottles are recommended for use at hotels and resorts (see Figure 6.1-3). The other possible target is polystyrene foam used for cups of noodles even though it can be converted into other products.

Sachets for Shampoo and Rinse

Refillable Bottle for Shampoo and Rinse

Figure 6.1-3 Example of Substitute from Sachet to Refillable Bottle

Source: JICA Study Team

The implementation organization of the Prohibition of Using Specific Packages on Boracay is shown in Table 6.1-7.

Table 6.1-7 Implementation Organizations of the Prohibition of Using Specific Packages on Boracay

Item	Main responsible organization	Role of each organization
Dissemination and promotion	MOM, Barangays, and Private Sector Organizations	The MOM, barangays, and private sector organizations such as BCCI and BFI disseminate information regarding the activities to the residents, and business establishments.
Development of basic rules and constitution of the MO	MOM	The MOM prepares the concept of the MO with the consultation of the SB.

Source: JICA Study Team

(4) Group Recycling Program

In semi-urban and rural barangays on the Mainland of Malay, the population density is lower than other barangays and no collection service is in place at present. Considering the access difficulty for the collection trucks as well as the lesser amount of waste generated, the daily collection service is not urgently necessary in these areas.

There are several junkshops on the Mainland of Malay, but they normally do not want to come to buy recyclables without adequate amount. In order to promote diversion through recycling, group collection is proposed to be introduced in this area. It is proposed that the several waste generators should store recyclable waste at a designated place where people periodically and frequently gather so that the junkshops can come to buy a certain amount of recyclables. Actually, although group collection of the recyclable has been carried out in some schools; their target is only the school students. As well as the schools, other

collection points such as churches (brought by public) or storefronts could be considered. The contents of the Group Recycling Program are as follows (see Figure 6.1-4);

- NGOs, private sectors, schools and churches are expected to participate in the program.
- The containers for collecting recyclables with proper segregation are to be installed with support of the MOM and barangays
- For example, the students bring recyclable waste when they go to school, or the residents bring recyclable waste when they to go to church, storefronts such as shops or markets and put the recyclable waste into the containers set at each collection point.
- The junkshops are told to come to buy the recyclables when a certain amount had been accumulated.
- The money collected is to be used for further implementation of the program or distributed to the participants.

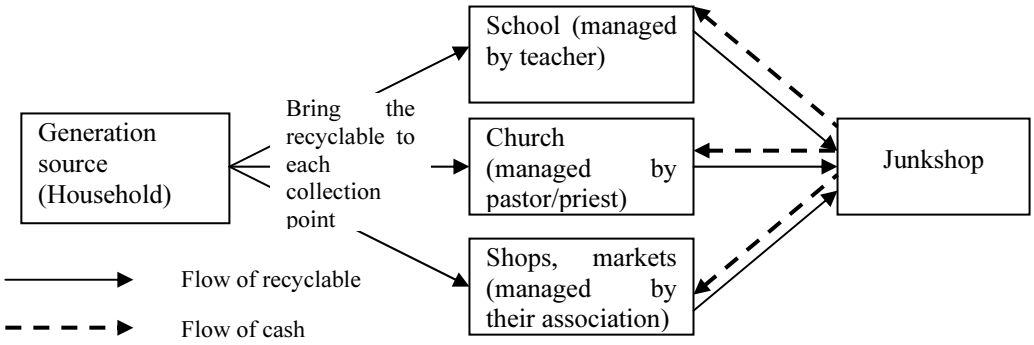

Figure 6.1-4 Group Recycling System

Source: JICA Study Team

The major activities to promote the group recycling are as follows:

- Identification of suitable collection points where the waste generators (groups) bring and store the recyclables.
- Installation of segregated collection boxes at the collection points
- Development of basic rules for group recycling such as discharge day, time and items allowed.
- Dissemination to the public and collectors (junkshops are considered to be collectors)
- Constitution of the MO on the group recycling

The implementation organizations of the Group Recycling Program are shown in Table 6.1-8.

Table 6.1-8 Implementation Organization of the Group Recycling Program

Item	Responsible organization	Role of Responsible Organization
Dissemination and promotion	MOM, Selder Leader, Private Sector Organizations, Schools, and Churches	Selder leaders disseminate information regarding the activities and procedures to residents of their own selder. Private sector organizations disseminate information regarding the activities to the costumers. Each school and church informs the people of the activities.
Installation of collection boxes at the collection points	Barangay	Barangay implement financial support for the promoters and disseminators, especially regarding installation of collection boxes.
Development of basic rules and constitution of MO	MOM, Barangay	The MOM prepares the MO with cooperation of the barangays as well as schools, churches and private sector entities.

Source: JICA Study Team

The Group Recycling Program could be applied to not only the no collection service areas but also collection service areas as a supplementary recycling system.

6.2 Sweeping

Official street and beach sweeping is conducted manually on Boracay Island by the BSWMAT, but no official sweeping is conducted on the Mainland of Malay. On the other hand, since there is the MO regarding cleanliness of the premises of business establishments and residential houses, namely “Tapat Ko Linis Ko”, they should clean the street or beach in front of their premises.

Under this condition, it is proposed that street and beach sweeping should be carried out by the following system:

- In principle, large-scale business establishments (hotels and resorts) are requested to have the responsibility for street and beach sweeping in front of their premises.
- The current street sweeping system by the MOM should continue as it is for the relatively densely populated areas and along the main roads. Additionally, the service areas should be extended to the main roads in Barangay Caticlan on the Mainland of Malay because more littered waste is expected along the main roads including in front of the port and air port due to the increased number of tourists and business establishments.
- Beach sweeping areas will be extended to areas in addition to the White Beach such as the Puka Shell Beach and the Manoc-Manoc Beach or other tourist spots on an ad hoc basis during the peak season.
- In the residential areas with narrow streets, mainly the households are requested to accept the responsibility of street sweeping in front of their premises.

Although the manual method is planned to be continued, additional staff will not be needed to cover the extended areas on Boracay Island because the cooperation from the business

establishments is expected for sweeping activities through enforcement or encouragement of "Tapat Ko Linis Ko". On the other hand, two new staff for sweeping for the main road of Barangay Caticlan on the Mainland of Malay will be necessary in the future.

6.3 Collection and Transport

6.3.1 Planning Concept

(1) Basic Concept

On Boracay Island, the main waste generation sources are located along the main street and White Beach and primary collection together with station collection is implemented there. On the other hand, on the Mainland of Malay, currently only Barangay Caticlan and the areas along the road from Barangay Caticlan to Barangay Poblacion are covered by collection service. In the other areas, there are no collection services due to low population density, limited access and existence of the custom of self-disposal. In the future, waste collection services should be provided for those areas until the amount of waste generation is over the permissible range. In this context, the strategies of collection and transport are as follows:

- On Boracay Island, the target collection ratio is 100% toward 2017. For this, the primary collection service areas should be expanded.
- Segregated collection should be introduced for the whole of Boracay Island, but on the Mainland of Malay it should be only in the service coverage area of the Caticlan Cluster MRF (Barangays Caticlan, Sambiray and Argao) although collection service is planned to be introduced in the service coverage area of the Kabulihan Cluster MRF.
- On the Mainland of Malay, collection ratio in urban and semi-urban barangays should be 90% toward 2017.

(2) Collection Plan

1) Collection Plan on Boracay Island

The waste collection and transport to the Manoc-Manoc Centralized MRF is mainly carried out by curbside collection or the combination of station collection and primary collection with segregated collection. The collection of biodegradables is carried out everyday in all the tourist and commercial areas and also in the high population density areas because biodegradables require treatment immediately due to the odors and vermin problems. On the other hand, recyclables and residual wastes can be stored for a few days according to the public awareness survey. In this context, biodegradable waste is basically to be collected everyday and recyclable and residual wastes is to be collected on alternative days of the week.

Primary collection by push carts or tri cabs is planned to be carried out in some areas. When the solid waste is discharged in plastic bags with segregation, in terms of segregated collection, a container system or compactor truck is not suitable. Dump trucks are utilized

for the secondary collection and tri-cabs or push carts for the primary collection. The size of the vehicle is determined in aspect of collection efficiency and accessibility of existing roads. The proposed collection system on Boracay Island is summarized in Table 6.3-1.

Table 6.3-1 Collection Plan for Boracay Island

Items \ Area	Coverage Area of Manoc-Manoc Centralized MRF
Collected Waste	Biodegradable, Recyclable, Residual
Collection Frequency	Biodegradable : Every day Recyclable : Three times a week Residual : Three times a week
Collection Method	Curbside collection, door to door collection and combination of primary collection and station collection

Source: JICA Study Team

Based on the future waste flow, the number of required trips and vehicles is estimated as shown in Table 6.3-2.

Table 6.3-2 Collected Waste Amount to be Transported to MRF

MRF	Type of Waste	Collected waste [ton/day]			Number of required trips [trip / day]			Number of required vehicles		
		2007	2012	2017	2007	2012	2017	2007	2012	2017
Centralized MRF (Manoc-Manoc)	Biodegradable	3.2	6.5	7.9	4	5	6	2	2	2
	Recyclable		6.1	7.4		9	10		5	6
	Residual		4.9	6.0		5	6			
MRF (Yapak)	Biodegradable	0.6	0.0	0.0	2	0	0	1	0	0
	Recyclable					0	0			
	Residual					0	0			
MRF (Balabag)	Biodegradable	3.7	0.0	0.0	3	0	0	1	0	0
	Recyclable	2.3	0.0	0.0	3	0	0	1		
	Residual	1.6	0.0	0.0	3	0	0	1		

Note: Capacity of the truck is $5m^3$
Source: JICA Study Team

2) Collection Plan on the Mainland of Malay

There is a limited collection service on the Mainland of Malay. However, the amount of waste generated is expected to increase on the Mainland of Malay and the introduction of a collection system will be needed in the near future even though the current source reduction activity is expected to be enhanced by promotion activities. In this context, biodegradable, recyclable and residual wastes generated in the area of Barangays Caticlan, Sambiray and Argao is to be collected and transported to the Caticlan Cluster MRF and the residual waste generated in the other areas is to be collected and transported to the Kabulihan Cluster MRF as shown in Table 6.3-3.

Table 6.3-3 Proposed Collection System for the Mainland of Malay

Item \ Area	Coverage Area of Caticlan Cluster MRF	Coverage Area of Kabulihan Cluster MRF
Collected Waste	Biodegradable, Recyclable, Residual	Residual
Collection Frequency	Biodegradable : Everyday Recyclable : 2 times per week Residual : 2 times per week	Residual : 2 times per week
Collection Method	Curbside collection	Curbside collection

Source: JICA Study Team

Based on the future waste flow, the number of required trips and vehicles is estimated as shown in Table 6.3-4.

Table 6.3-4 Collected Waste Amount to be Transported to MRF or SLF

MRF	Type of Waste	Collected waste [ton/day]			Number of required trips [trip / day]			Number of required vehicles		
		2007	2012	2017	2007	2012	2017	2007	2012	2017
Caticlan Cluster MRF	Biodegradable	0.8	0.6	1.0	0.5	1	1	1	1	1
	Recyclable		0.6	0.9	0.5	0.5	0.5			
	Residual		0.5	0.7						
Kabulihan Cluster MRF	Residual	0.0	0.6	0.9	0	1	1	1	1	1

Note: Capacity of the truck is $5m^3$
Source: JICA Study Team

6.3.2 Improvement of Collection System on Boracay Island

(1) Revision of Collection Service Area Corresponding to the Proposed Centralized MRF

Since a centralized MRF is proposed in Barangay Manoc-Manoc, the collection system should be re-developed corresponding to the re-arrangement of the MRF. Currently the boundary of the collection area is determined based on the boundary of each barangay. In accordance with the establishment of the Manoc-Manoc Centralized MRF, collection service areas do not have to be restricted by the boundaries of barangays and the collection routes should change from the current collection ones. The collection service areas can be integrated as described in Figure 6.3-1.

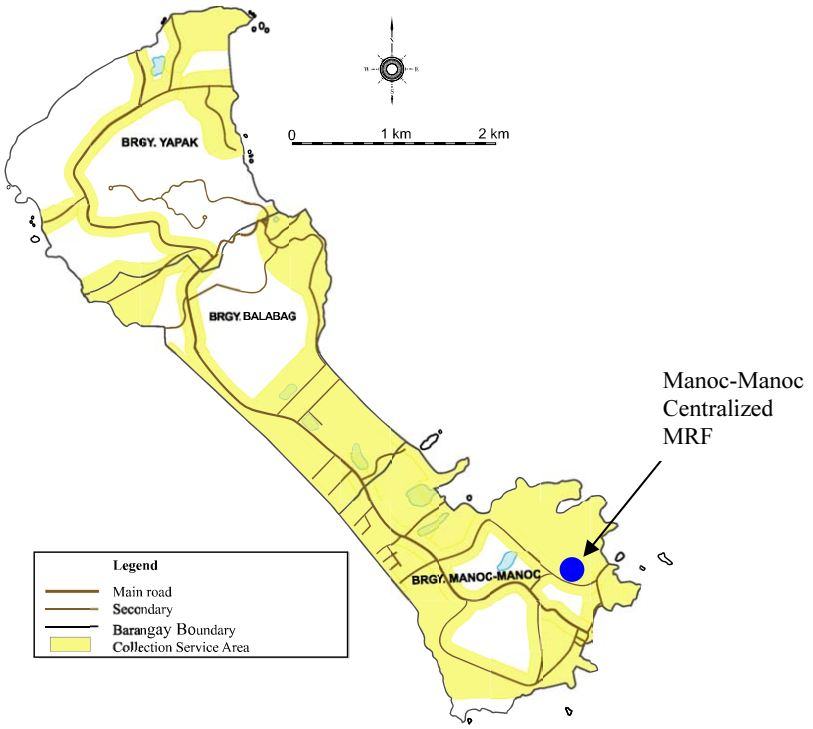

Figure 6.3-1 Collection Service Area of Boracay Island After Development of the Manoc-Manoc Centralized MRF

Source: JICA Study Team

(2) Extension of Primary Collection Service Area

In the areas that currently have no collection due to the narrow roads, the primary collection service should be provided for nearly 100% service coverage. The type of vehicles to be introduced is the tri-cab, which is a motor bike with a cart for carrying the load. The segregated waste that is collected is to be carried in the tri-cabs and transported to each collection point near the area. At every collection point, one container each for segregated storage of biodegradable, recyclable and residual wastes should be installed with a notice board for segregated discharge. One example of the collection procedure of primary collection is described as Figure 6.3-2. In the process of primary collection, collection vehicles such as push cart, tri-cab or cycle cart collect the waste from each generation source and transport to the waste collection point.

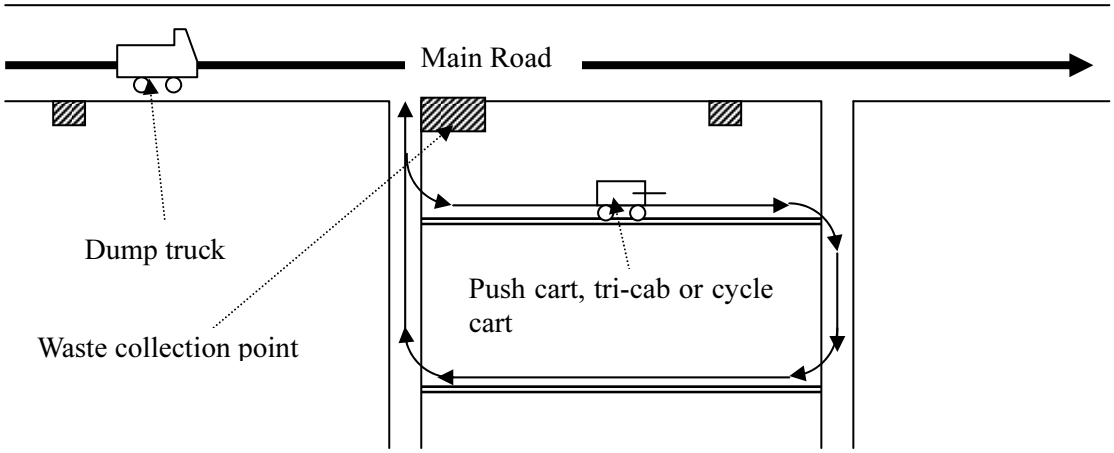

Figure 6.3-2 Primary Collection and Collection Point

Source: JICA Study Team

(3) Improvement of Source Segregated Collection

Even after the segregation, the food waste often contains unsuitable biodegradable wastes such as bones, shells or others that the farmer needs sorted out. This sorting activity is unhealthy and it sometimes delays waste unloading activities from collection vehicles. On the other hand, segregated collection should be introduced for the area where segregated collection is currently not implemented i.e. Barangays Yapak and Manoc-Manoc. The following activities are proposed to be conducted for the improvement/extension of source segregated collection.

1) Promotion of Segregated Storage and Discharge

Introduction and improvement of segregated collection requires segregated discharge by the waste generators. For smooth segregated discharge, segregated storage is also needed. Therefore, segregated storage utilizing a method that is easy for each household and business establishment is to be promoted.

- Storage of biodegradable, recyclable, and residual wastes with proper segregation in households or business establishments is necessary.
- Discharge of the segregated waste in semi-transparent plastic bags of the designated different colors at a designated date and time for each area is necessary.
- The main discharge place should be indicated by sign boards

Figure 6.3-3 Image of Discharge Place with a Sign Board and Waste in Semi-Transparent Plastic Bags

Note: The above picture is a composite picture.
Source: JICA Study Team

Proposed Segregation Manner
a. Criteria for Segregation of Municipal Solid Waste (MSW) by Type
- Biodegradable waste: Treatable by bioreactor for producing compost or by carbonization system
- Recyclable waste: Salable to junkshops, recyclable at the MRFs
- Residual waste: Other non-hazardous wastes
- Special Waste: Household hazardous waste

b. Facilitation for Proper Segregation
- Type of collected waste is different depending on date or areas
- Clear indication of collection points and the type of waste to be discharged

The activities of the proper segregated storage and discharge are as follows.

- Preparation of guidelines for segregated storage methods at households or business establishments which fit into the segregated collection
- Preparation of three trash bins for each of the three categories of biodegradable, recyclable and residual waste at each waste collection point
- Implementation of a series of IEC programs including dissemination workshops and preparation of a manual regarding the methods
- Promotion and financial support to utilize colored transparent plastic bags for each type of waste to be segregated at the sources
- Preparation of the sign boards at the discharge points

2) Revision of Segregated Collection Schedule

Segregated collection should be introduced for the whole of Boracay Island to minimize the burden of the sorting activities in MRF as well as to promote the public awareness of 3R activities. Considering the result of a public awareness survey that residual and recyclable

wastes can be collected only twice or three times a week, the collection of different wastes on different dates should be introduced in order to minimize the cost of the collection system. The schedule for the segregated collection is to be adjusted and the proposed collection schedule is as shown in Table 6.3-5.

Table 6.3-5 Proposed Schedule for Segregated Collection

Type of waste	Barangay Manoc-Manoc	Barangays Balabag and Yapak
Biodegradable	Everyday	Everyday
Recyclable	Monday, Wednesday, Friday	Tuesday, Thursday, Saturday
Residual	Tuesday, Thursday, Saturday	Monday, Wednesday, Friday
Other wastes	Sunday	Sunday

Source: JICA Study Team

(4) Revision of Collection Methods

The areas of Boracay Island in aspect of collection can be divided into four types such as the areas along the main road (Area No.1), the areas along the White Beach (Area No.2), the areas where there are households and business establishments that are located densely with only narrow roads (Area No.3), and the areas where there is currently no collection service (Area No.4). Each type of collection service areas of Boracay Island is described in Figure 6.3-2.

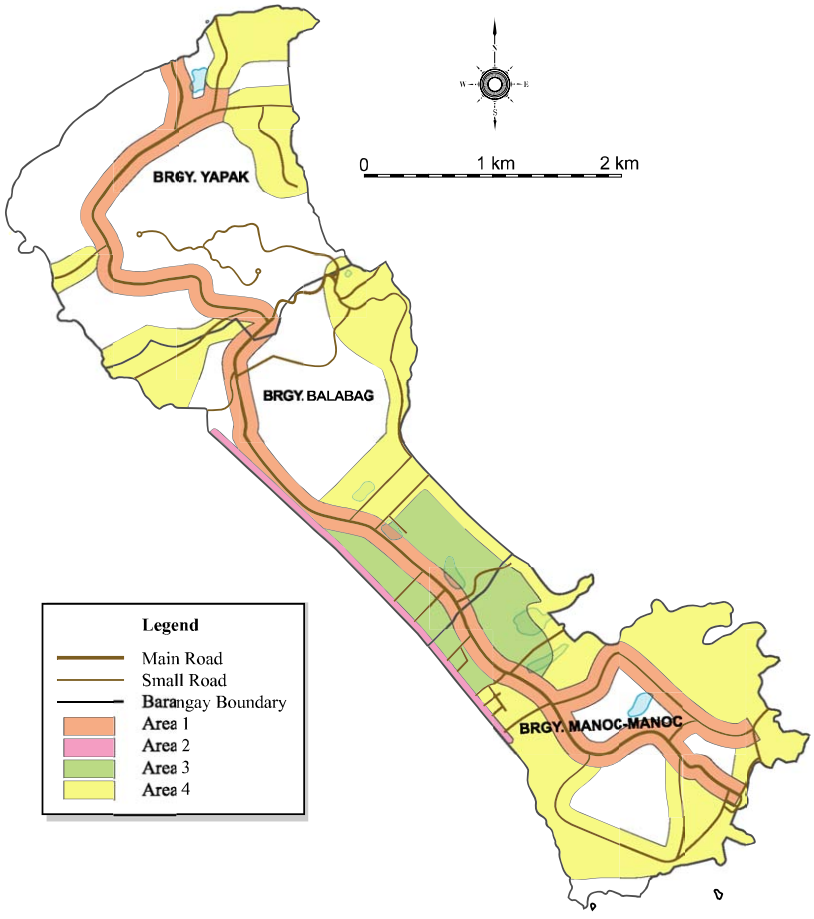

Figure 6.3-4 Type of Collection Service Area on Boracay Island

Source: JICA Study Team

Since the collection method applied depends on characteristics of the areas such as population density, accessibility, and road condition, the suitable collection methods are compared as shown in Table 6.3-6.

Table 6.3-6 Comparison of Collection Methods

Collection Method		Advantage	Disadvantage	Suitable Area
Door to Door	Waste collectors collect the waste from each household or business establishment using waste collection vehicles.	Convenient for waste generators	Not cost effective waste collection.	Densely populated areas with narrow roads
Curbside	The waste generators place the waste at the curbside along the road to be collected by vehicles	Convenient for waste generator and more efficient than door to door collection	Possibility of waste scattering if the waste is not discharged appropriately. Monitoring is required to ensure appropriate discharge.	Densely populated areas with sufficiently wide roads
Station Collection	Containers or bins are installed in the station for waste collection. Waste generators or collectors of primary collection bring the waste to the containers.	Efficient collection	Possibility of waste scattering from containers if the waste not is discharged appropriately. Monitoring is required to ensure appropriate discharge	Must have adequate space for storage equipment

Source: JICA Study Team

Curbside collection is basically suitable for the densely populated areas with roads that are in good enough condition and where there is not enough space for the stations. Area 1 is suitable for that type of collection because of the high population density and sufficiently wide roads with a small space for waste storage. Area 2 consists of densely populated areas with business establishments. The amount of waste discharged from business establishments is large and is equal to several times the amount from households. For these areas, door to door collection could be adopted in addition to the current collection system.

For Area 3, a combination of primary and station collections is proposed. The roads in the area are too narrow to access by collection vehicles such as dump trucks. In that case, the combination of the primary collection by push cart, tricycle cart or cycle cart and secondary collection by collection vehicles such as dump trucks are proposed.

For Area 4, as well as Area 1, curbside collection is suitable for efficient collection. In this area, there is sufficient land to implement composting. Therefore, the main characteristics of the collected waste are expected to be mainly non-biodegradable waste. The collection frequency can be reduced to only two or three times a week though collection service needs to be initiated for the areas where there is currently no collection service. Based on the above discussion, the collection methods are summarized in Table 6.3-7.

Table 6.3-7 Suitable Collection Method for Each Area

Area	Collection Method	Collection frequency
Area 1 (Along main road)	Curbside collection (Segregated Collection)	Biodegradable : everyday Recyclable : three times a week Residual : three times a week
Area 2 (Along beaches)	Door to Door collection (Segregated Collection)	Biodegradable : everyday Recyclable : three times a week Residual : three times a week
Area 3 (Area currently served by eco boys)	Door to Door collection (primary collection by pushcart) (Segregated Collection)	Biodegradable : everyday Recyclable : three times a week Residual : three times a week
Area 4 (No collection area)	Gradual expansion of curbside collection (Segregated Collection)	Biodegradable : twice a week Recyclable : once a week Residual : once a week

Source: JICA Study Team

Segregated collection with segregated discharge that has been effectively sorted at the sources is necessary to effectively increase the diversion at the MRF. Segregated collection should be introduced in an effective manner in consideration of the lower operation and maintenance costs and degree of the awareness of those who discharge the waste. The conceivable segregated collection methods are compared as shown in Table 6.3-8.

Table 6.3-8 Comparison of Segregated Collection

Segregated Collection Method		Advantage	Disadvantage
Collection by different type of collection vehicle for each type of waste	Each type of segregated waste discharged is collected by a collection vehicle determined for its type.	- Adequate collection service is provided to waste discharger - Convenient for waste generators	- Not cost effective waste collection due to the increase of collection frequency.
Collection by different date for each type of waste	Discharged segregated waste is collected by a collection vehicle. The type of waste to be collected is determined by the date.	- Cost effective - Decrease of burden of checking activities by collectors	- Frequency of collection service will decrease - Cooperation from the waste discharger is necessary
Collection by collection vehicles divided by partitions for each type of waste	All types of segregated waste discharged are collected in the respective portion of a collection vehicle that has been divided by partitions for each type of waste.	- Adequate collection service is provided to the waste dischargers - Convenient for waste generators	- The space for each type of segregated waste on a collection vehicle is small - There is a possibility of mixing of waste on the collection vehicle.

Source: JICA Study Team

As s result of the comparison it has been determined that if the dissemination, promotion and enforcement of the proposed segregated collection system is implemented properly and continuously, “Collection by different date for each type of waste” is more cost effective and reduces the burden of the collectors. The residual and recyclable wastes can be stored in the discharged place for a few days but not the biodegradable wastes according to the public awareness survey which was carried out in the Study. Therefore, “collection by different dates for each type of waste” with implementation of an IEC program” is to be introduced.

(5) Procurement of Collection Equipment

For the primary collection, suitable types of collection vehicles are compared as follows (it is not possible to access some areas by a dump truck): Push carts are proposed to be introduced for densely populated areas with narrow roads including the mall and cycle carts are proposed for the relatively lower populated areas with narrow roads as shown in Table 6.3-9.

Table 6.3-9 Comparison of Collection Equipment for Primary Collection

Equipment	Average Speed	Adoptability to Road Condition	Accessibility regarding Roads	Evaluation
Push cart	3 - 6 km/h	Suitable for flat areas and narrow roads	The usage is viable in all the areas which have roads	Suitable for malls or market areas with high density population and many customers
Tricycle cart (tricycle with cart)	10-30 km/h	Suitable for hill areas and narrow roads	There are restrictions in the shopping or market areas	Suitable for residential areas with sloping roads and low population density areas
Cycle cart (Bicycle with cart)	5-10 km/h	Suitable for flat areas and narrow roads	The usage is viable in all the areas which have roads	Suitable for residential areas which have relatively low density population

Source: JICA Study Team

As for the secondary collection, suitable types of collection vehicles are compared as shown in Table 6.3-10.

Table 6.3-10 Comparison of Collection Equipment for Secondary Collection

Equipment	Average Speed	Compaction /Dumping Capabilities	Handling of Unloaded Waste	Evaluation	
Compactor	10-30 km/h	Existence of compaction and dumping capability	It is difficult to handle the waste compacted in the compactor after unloading.	It is not suitable for segregated collection of recyclable or biodegradable wastes. It is also not suitable for handling residual wastes after sacking,	×
Dump truck	10-30 km/h	Existence of dumping capability but no compaction	It is easy to handle unloaded waste and easy to unload the waste as well.	It is suitable for segregated collection as well as for handling of sacked waste.	○
Tipper	10-30 km/h	No compaction or dumping capability	It is easy to handle unloaded waste but slightly difficult to unload the waste.	It is suitable for segregated collection but the lack of a dump function causes difficulty in unloading.	×

Note：○：Suitable, ×：Not Suitable
Source: JICA Study Team

The segregated waste collected is to be carried in the tri-cabs and transported to each collection point. Equipment necessary for extension of the collection areas is as shown in Table 6.3-11.

Table 6.3-11 Primary Collection Equipment Required for Extension of the Collection Areas

Extension Area	Barangay	Type of area	Collection vehicle		Containers at collection points
			Type	Number	Number
Ilig-iligan, Hagdan Kandingon Beach, Balinghai,Punta Bunga	Yapak	Population density is relatively low with narrow roads	Tri-cab ($2m^3$)	1	1 ($6m^3$)
Ambulong	Balabag	Hilly area	By Eco-aide	3	1 ($3m^3$)
Bulabog beach	Balabag	Population density high and road is narrow	Push cart ($3m^3$)	1	1 ($6m^3$)
Angol Area	Manoc-Manoc	Population density is relatively high and narrow roads	Tri-cab ($2m^3$)	1	1 ($10m^3$)
			Push cart ($2m^3$)	1	
Tulubhan	Manoc-Manoc	Population density is not so high and relatively hilly with narrow roads	Tri-cab ($2m^3$)	1	1 ($6m^3$)
Malabunot	Manoc-Manoc	Population density is not so high and relatively hilly with narrow roads	Tri-cab ($2m^3$)		
Cagban looban	Manoc-Manoc	Population density is relatively low with narrow roads	Tri-cab ($2m^3$)	1	1 ($6m^3$)

Source: JICA Study Team

(6) Human Resource Development for the Collection Service

For the improvement of the collection system on Boracay Island, a series of trainings is proposed for eco-aides, truck drivers, collectors and monitoring team members for smooth implementation of the improved collection system to cover the following items:

<u>For eco-aides</u>:

- Collection coverage areas, collection points and routes
- Segregation methods
- Recoding data and submitting reports to the supervisor

<u>For truck drivers, collectors, and monitoring team members:</u>

- Segregated discharge method
- Type of segregated waste
- Segregation methods
- Collection routes and collection points
- Operation and maintenance methods for collection equipment

6.3.3 Introduction of Collection System on the Mainland of Malay

Since there is currently only limited collection services on the Mainland of Malay, a collection system is proposed. In principle, segregated collection is to be introduced the same as on Boracay Island, i.e. it is to be segregated into biodegradable, recyclable and residual wastes. The waste collected in Barangays Caticlan, Sambiray and Argao is transported to the Caticlan Cluster MRF, while the waste collected in the other areas (only residual waste) is to be transported to Kabulihan Cluster MRF.

Two collection methods are proposed depending on the area conditions, i.e. one for the urban areas and the areas along the main road (Area 1), and the other for the semi-urban areas (Area 2) as shown in Table 6.3-12.

Table 6.3-12 Collection Methods on the Mainland of Malay

Area	Collection Method	Collection frequency
Area 1 (Along the main road and urban areas)	Curbside collection (Segregated Collection)	Biodegradable : everyday Recyclable : twice a week Residual : twice a week
Area 2 (Semi-urban areas)	Gradual expansion of the collection areas using curbside collection (Segregated Collection)	Twice a week for biodegradable, once a week for recyclable and residual

Source: JICA Study Team

A collection truck with a capacity of $5m^3$ is proposed to be procured according to the introduction of the collection system. In addition, truck drivers and helpers as well as Eco-aides are to be appointed for the collection.

Training of eco-aides and the monitoring team members are needed for smooth introduction of the collection system on the Mainland of Malay. The training for introduction of the collection system is to include the items as follows:

- Collection routes and collection points
- Operation and maintenance methods for collection equipment
- Segregation methods

6.3.4 Transport of Residual Waste

The residual waste collected on Boracay Island is planned to be transported through the Manoc-Manoc Centralized MRF to Kabulihan SLF on the Mainland of Malay including the marine transportation. Unloading and loading at the Manoc-Manoc Port and the Caticlan Port is to be conducted for the marine transportation. The residual waste collected in Barangays Caticlan, Sambiray and Argao on the Mainland of Malay which are covered by the Caticlan MRF should be transported from the MRF to Kabulihan SLF. On the other hand, the residual waste collected from other barangays on the Mainland of Malay should be transported directly to the Kabulihan SLF.

Currently, the MOM has contracted with a private company to transport the stored residual waste at three MRFs on Boracay Island to the site for the proposed Kabulihan SLF for temporary storage at a cost of 400 PhP/m^3. Considering the current marine transportation procedure, alternative procedures have been considered, i.e. no sacking, sacking, compaction after sacking. As a result of the comparison, the option of sacking is identified as the most suitable procedure for handling of residual waste as shown in Table 6.3-13.

Table 6.3-13 Comparison of Residual Waste Handling

Option	Environment	Transportation	Operation cost	Evaluation
No sacking	Adverse impact during transportation process	If loading is needed during the transportation process, it is difficult.	Relatively low	×
Sacking	No serious adverse impacts	If there are loading processes during the transportation, it is relatively easy.	Relatively high	○
Compaction after sacking	No serious adverse impacts	If there are loading processes during the transportation, it is relatively easy.	High	△

Note：○：Suitable, △：Applicable, ×：Not Suitable
Source: JICA Study Team

Considering the amount of the residual waste (approximately 13 ton/day) and the transportation frequency in 2012, the residual wastes can be transported in the same way as at present. The transportation plan for the residual wastes from the Manoc-Manoc Centralized MRF and Caticlan Cluster MRF to the Kabuhihan SLF is summarized in Table 6.3-14.

Table 6.3-14 Transportation Plan for Residual Waste From MRFs to SLF

Route of Transport of Residual Waste		Residual waste [ton/day]		Number of required trips [trip / day]		Number of required vehicles	
		2012	2017	2012	2017	2012	2017
Residual waste from Manoc-Manoc Centralized MRF	MRF to Port (collection vehicle ($5m^3$))	10.4	8.0	6	4	1	1
	Port to Port (pump boat ($30m^3$))	10.4	8.0	1	1	1	1
	Port to Kabulihan SLF (collection vehicle ($15m^3$))	10.4	8.0	2	2	1	1
Residual waste from Caticlan Cluster MRF	MRF to Kabulihan SLF	1.0	1.6	1	2	1	1

Source: JICA Study Team

6.4 Intermediate Reduction at MRF

6.4.1 Planning Concept

A centralized MRF is proposed to be set up at Barangay Manoc-Manoc on Boracay Island (Manoc-Manoc Centralized MRF). As for MRFs on the Mainland of Malay, two cluster MRFs are proposed, the Caticulan Centralized MRF and Kabulihan Centralize MRF. The planning concepts for the proposed MRFs are as follows:

- To utilize the equipment in the existing MRFs for the new centralized or cluster MRFs
- To develop the centralized MRF phase by phase with consideration of financial constraints and social acceptance
- To implement effective and suitable segregation according to actual material flow of recyclable and compostable materials
- To monitor the segregation condition of the collected waste
- To implement periodic training of the MRF workers for enforcement of the segregation, composting and recycling
- To secure enough storage space for the residual waste in addition to the segregated recyclables and compost products
- To introduce new or advanced recycling technologies which are applicable for MRFs to prepare the products
- To develop markets for recyclable materials and compost products
- To reduce the residual waste that needs to be transported to the proposed SLF

6.4.2 Design Concept of MRF

(1) Design Concept of Manoc-Manoc Centralized MRF

The Manoc-Manoc Centralized MRF is planned to handle the solid waste generated in the entire area of Boracay Island. The solid waste transported to the MRF by segregated collection including biodegradable, recyclable and residual wastes is planned to be handled in each handling area of the MRF as follows:

1) Receiving of the Waste

After biodegradable, recyclable and residual wastes are hauled into the MRF, the wastes are measured at a weighbridge (portable weighbridge) and unloaded in the unloaded areas. Currently, 70 to 80% of the biodegradable and residual wastes collected have been segregated and 80 to 85% of the recyclable waste collected has been segregated according to the WACS. The segregation rate of the collected waste is proposed to be monitored periodically and the result should be utilized for the motivation of the people in each barangay to segregate their wastes before disposing of them. The segregation for recycling is conducted in order to sell the recyclables to junkshops and sieving is also conducted for making proper quality compost.

2) Handling of Biodegradable Waste

There are many technologies to produce recycled or organic products from biodegradable waste. Composting and carbonization are the technologies available that have already been employed in the Philippines as shown in Table 6.4-1.

Table 6.4-1 Comparison of Biodegradable Waste Treatment Methods

Method	Process	Advantage	Disadvantage	Evaluation
Composting (Bioreactor)	After unloading the waste, biodegradable waste is put into a bioreactor. After processing of 4 to 8 hours and a curing stage, the compost is produced.	Operational cost is relatively low. There are potential compost markets in the hotels or resorts for ornamental plants and landscaping.	As well as other composting method, it need the curing stage to produce good quality compost	○
Composting (Vermi-composting)	Vermi-composting is the technology to prepare compost through the action of earthworms.	Initial and operation cost is low. The quality of compost is relatively good.	Careful handling of vermi is needed. It takes a relatively long time to prepare the compost product.	△
Charcoal production	Cellulose waste, animal waste, and biodegradable waste are source materials of charcoal.	There is a potential fuel market in this.	The required technical experience is not currently available in the area.	△
Biogas	The biogas such as CH_4 is generated from a bio gas system by fermentation of biodegradable waste.	There are demands for energy.	Initial and operational costs are high.	×

Note : ○ : Suitable, △ : Applicable, × : Not Suitable
Source: JICA Study Team

The land of Boracay Island is limited and there is no available land for the large scale composting by windrow method. Though biogas may be one of the possible options for handling of biodegradable, it is not suitable handling manner of biodegradable waste considering the operational cost and technological capability. On the other hand, composting of biodegradable by a bioreactor is a technology which is currently used for the handling and they have experience. In this context, biodegradable waste such as food waste and garden waste is planned to be treated in bioreactors. As soon as the biodegradable waste including food waste and garden waste are received at the MRF, impurity such as glass, plastic or metal are removed. The biodegradable treatment flow is described in Figure 6.4-1.

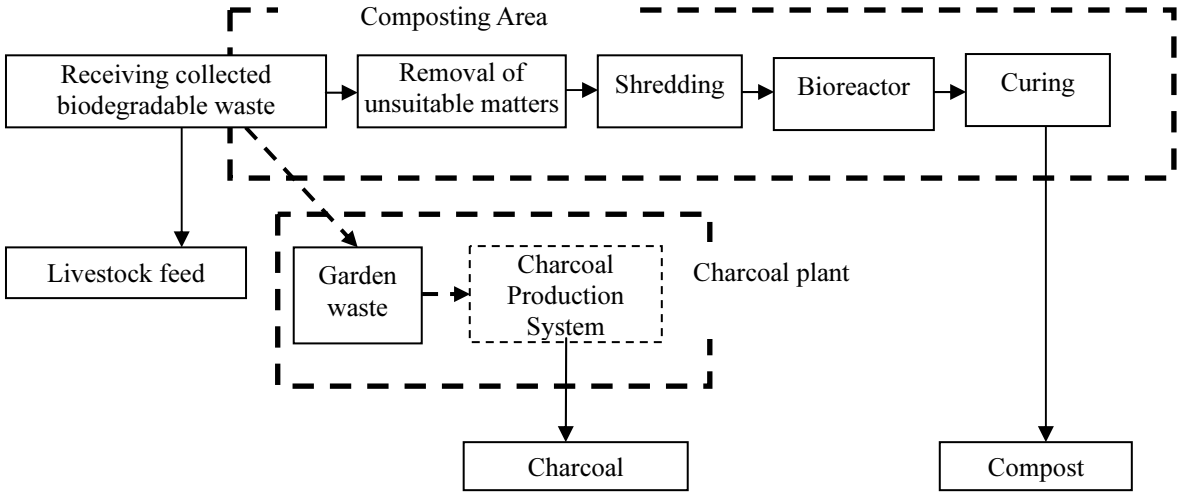

Figure 6.4-1 System Flow for Handling of Biodegradable Waste at the MRF

Source: JICA Study Team

The produced compost could be utilized for the rehabilitation of the old dumping site as soil conditioner and there is a demand to utilize the compost for the gardens of the hotels, resorts, golf-links and the MRF itself.

3) Handling of Recyclable Waste

A Recyclable Handling Area is proposed in the MRF which includes the unloading area, a belt conveyor for sorting activities, a polystyrene foam handling area and glass crushing area. The sorting area is to be covered with a roof to protect the working conditions for sorters from the rain and strong wind. For effective segregation, a belt conveyor is proposed with a receiving container for recyclable materials. Waste materials will be segregated on the conveyor as well as the cemented floors by the sorters. Labeled bins or sacks for the different types of recyclable wastes will be positioned in comfortable locations for the workers. The work flow for handling of recyclable waste is as shown in Figure 6.4-2.

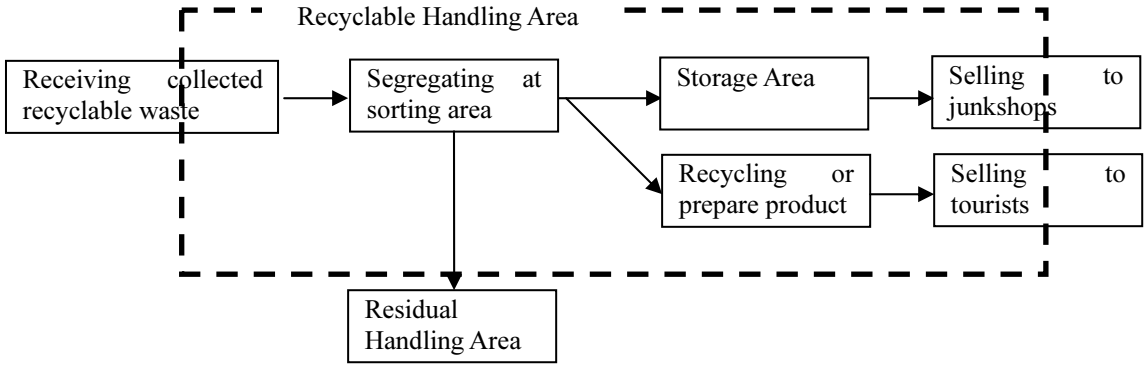

Figure 6.4-2 System Flow for Handling of Recyclable at the MRF

Source: JICA Study Team

A storage area or shed is proposed for the recyclable wastes, which is designed to provide storage capacity of approximately one week storage. It will have a roofed shed to exclude rainfall and wind in order to prevent the degradation, especially for paper and cardboard. A label or notice board is to be prepared to identify the stored recyclable wastes. An organized and well-kept storage area would facilitate easy trading for both the MRF workers and their regular buyers (junkshops).

There are some potentially recyclable wastes which have not been sold to junkshops. They should be recycled at the MRF but should be promoted considering the technical capabilities of the staff.

4) Handling of Residual Waste

After unloading residual waste at the MRF, the unloaded residual waste is to be sacked for transport to the proposed SLF. To prevent the waste from scattering, it is important to sack the residual waste, especially during the marine transportation portion including unloading and loading at the ports. However, in order to minimize the transport cost of the residual waste from the MRF to the SLF, the practice of bailing the residual waste is also proposed to reduce the bulk of the waste. The proposed work flow for handling of the residual waste is shown in Figure 6.4-3.

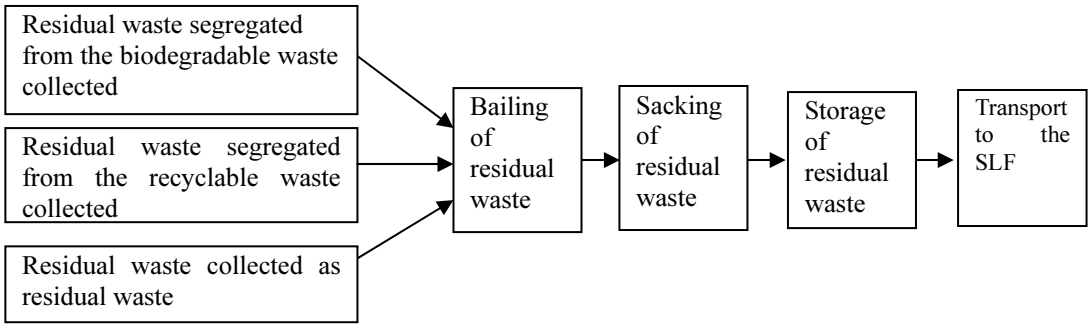

Figure 6.4-3 System Flow for Handling of Residual Waste at the MRF

Source: JICA Study Team

Though new technologies for currently non-recyclable materials such as plastic films, leather, rubbers or laminated papers have had little practical application in the Philippines, new recycling technologies regarding non-recyclable materials are recommended to be used tried in the future. Actually, the DOT is planning to provide the MOM with a pulverizer for residuals and an earth mortar mixer and block maker in order to reduce the amount of residual waste to be brought to the SLF. The reduction of the amount of residual wastes as well as the maximum utilization of the waste is proposed to be conducted at the MRF.

5) Waste Flow from the MRF

It is planned that recyclables such as glass bottles, PET bottles, hard plastics, papers and cartons be sold to junkshops and compost produced be sold to hotels, resorts or golf-links as well as the farmers. The residuals are planned to be transported to the proposed SLF.

The recycling products are expected to be produced in the Centralized MRF. Currently, used tires are used for decoration of flower beds in the Balabag MRF. Currently, pots are being made by mixing polystyrene foams and used cooking oil in a melting oven. If small recycled products with attractive designs were produced from items such as glass or paper they could be turned into attractive souvenirs for the tourists and may become the symbol of the environmentally friendly island.

(2) Design Concept of the Cluster MRFs on the Mainland of Malay

The proposed Caticlan Cluster MRF on the Mainland of Malay is proposed to have the function of temporary storage of residuals before the transport to Kabulihan SLF so that the transport can be made for an economically optimum amount of waste. As for the proposed Kabulihan Cluster MRF which is located inside the SLF, recyclables are to be segregated there from the transported residual waste.

6.4.3 Facility Plan for the MRFs

(1) Manoc-Manoc Centralized MRF

1) Location

The Manoc-Manoc Centralized MRF is proposed be established by expanding the existing MRF based on the following reasons:

- In consideration of a new transportation route from the MRF to the SLF, the MRF should be located close to the port which is utilized for the marine transportation of the residual waste.
- The MRF should be located at a place which does not cause negative environmental impacts to the neighboring areas.

2) Facility and Equipment Plan

The facilities and equipment in the existing Manoc-Manoc MRF are planned to be utilized in the proposed Centralized MRF, in principle, to reduce the investment costs. The proposed facilities and equipment at the Manoc-Manoc Centralized MRF are summarized in Table 6.4-2.

Table 6.4-2 Proposed Facilities and Equipment for Manoc-Manoc Centralized MRF

Category	Facility/Equipment	Quantity		Usage	General Specification	Year of Procurement or Construction
		2010 (Phase I)	2012 (Phase II)			
Biodegrad-able handling	Bioreactor (0.5t/day)	1	3	Primary fermentation of biodegradable waste	Existing (0.5t/day),	-
	Bioreactor (1t/day)	1	1		New purchase (1t/day)	2009 and 2011
	Bioreactor (2t/day)	0	1		New purchase (2t/day)	2011
	Shredder	2	3	Shredding garden waste	0.5 t/hr	2008 and 2011
	Charcoal making system	1	1	Preparation of charcoal from garden waste or other biodegradable waste	0.5t/hr	2011
	Biodegradable Handling Area	0	1	To serve the bioreactor and charcoal system, etc.	500 m^2	2011
	Curing Area for compost	0	1	Curing and storage of primary fermented biodegradable	450 m^2	2011
Recyclable handling	Belt Conveyor	0	1	Supply and delivery of separated materials	20m	2011
	Storage Area	0	1	Temporary storage of recyclables and hazardous waste	310m^2	2011
	Glass crusher	1	1	Crushing glass to prepare cullet	0.5t/hr	2008
	Plastic densification system	1	1	Prepare blocks or tiles from polystyrene foam melted with used oil	5kg/hr	2008
	Plastic crushing and pressing machine	1	1	Pressing for waste compaction	-	2012
	Recyclable Handling Area	1	1	Sorting of recyclable	375m^2	2011
Residual handling	Recycling system for residual waste (Hollow block preparation system)	0	1	Preparation of hollow blocks from the residual plastics	-	2011
	Bailing Machine	1	1	Pressing machine for residual	0.5t/hr	2009
Other facility and equipment	Recycling Promotion Center	0	1	Exhibition and promotion of recycled product	86m^2	2014
	Portable Weigh bridge	1	1	Measurement of amount waste received	20t	2011
	Office	1	1	Management work of MRF	200m^2	2009
	Gate/Gate House/Fence	1	1	Determine the boundary of the site and check the people or vehicles to enter into the site	200m of fence and 6m^2 of gate house	2011
	Vehicle Washing Area	1	1	The area for washing vehicle by utilizing rainwater or other water	10 m^2	2011
	Buffer Zone /Garden	1	1	Buffer zone and garden prepared by utilizing compost produced in MRF	-	2010 and 2012

Source: JICA Study Team

3) Managing Organization and Number of Staff

The operation of the MRF needs a cooperative organization. Basically, the current staffs of the three MRFs are planned to work in the centralized MRF. The necessary number of staff for operation of the centralized MRF is shown in Table 6.4-3.

Table 6.4-3 Number of Staff for Manoc-Manoc Centralized MRF

Position	Contents of Work	Phase I (2010)			Phase II (2012)	Phase III (2015)
		Yapak	Barabag	Manoc- Manoc Centralized MRF		
Manager of MRF	In-charge of over-all MRF operations	1	1	1	1	1
Management supervisor	Inspects the operation of MRF along with Manager of MRF	1	1	1	1	1
Leader	Manages each section of the MRF, collection and transportation and environmental monitoring	0	0	0	4	4
Secretary	Assist supervisor by handling accounting and administrative matters	0	1	1	1	1
Drivers of collection trucks	Driving and maintenance of collection trucks	1	2	3	6	6
Truck helpers	Checks, loads and unloads garbage	2	6	6	12	12
Eco-aide	Collects from inaccessible areas with pushcart daily then also helps in sorting	0	7	0	8	9
Beach Cleaners	Clean the beaches and collect and bring the beach debris to collection points	-	-	-*	20	25
Street Sweepers	Clean roads and collect and bring the garbage from streets to collection points	-	-	-*	20	25
Sorting staff	Segregating recyclable waste and packing residuals	7	7	8	6	8
Technical staffs (Biodegradable handling area)	Operation and maintenance of equipment in the area and handle the biodegradables for composting and making charcoal	0	2	2	2	2
Technical staffs (Recyclable Handling Area)	Operation and maintenance of equipment in the area and handle the recyclables	0	1	1	2	2
Technical Staff (Other areas)	Operation and maintenance of equipment in the area and handle residuals	0	0	1	1	2
Weigh bridge operator	Operate weigh bridge and manage the records of each vehicle and handled waste	0	0	0	1	1
Environmental monitor	Monitoring and enforcement of source segregation activities as well as other public awareness raising activities and collection of GCF	0	5	4	20	25

Note: * Beach cleaners and street sweepers are employed by the MOM directly until 2011, while they are planned to be employed by the re-organized BSWMAT from 2012.
Source: JICA Study Team

(2) Caticlan Cluster MRF

The Caticlan MRF was moved to the south side of the Caticlan Airport in August 2007. It has a total area of approximately 1,500m^2. This Caticulan MRF is planned to be expanded and upgraded as a cluster MRF. Considering the transport distance to the Caticlan Cluster

MRF from the collection areas and the transport distance from the MRF to Kabulihan SLF, barangays Caticlan, Argao and Sambiray shall be covered by the Caticlan Cluster MRF. In Caticlan Cluster MRF, biodegradable, recyclable and residual waste will be received. Hauled biodegradable waste is fermented in the composting pit after the removal of impurity material and shredding. After fermentation, the product is utilized as compost or soil conditioner. Hauled recyclable waste is sold to junkshops after sorting recyclable and residual waste in the sorting area and storage area. Hauled residual is transported to the new SLF after sorting recyclable in sacks. The work flow for each waste at the MRF is shown in Figure 6.4-4.

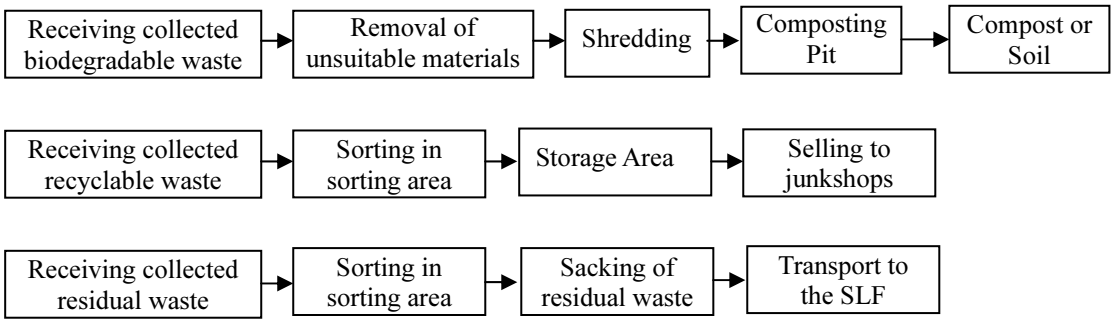

Figure 6.4-4 System Flow for Handling of Waste at Caticlan Cluster MRF

1) Facility and Equipment Plan

Because there is no equipment at the current Caticlan MRF, the following facilities and equipment are proposed to be installed to create the Cluster MRF as shown in Table 6.4-4.

Table 6.4-4 Proposed Facility and Equipment for Caticlan Cluster MRF

Facility/ Equipment	Quantity	Usage	Specification	Year of Procurement or Construction
Composting pit	1	Primary fermentation of biodegradables	-	*
Shredder	1	Shredding garden waste	0.5 ton/hr	2011
Sorting Area	1	Sorting of recyclables	-	*
Storage Area	1	Storage of recyclables	-	*
Garden/Buffer zone	1	Buffer zone and garden utilizing compost produced in the MRF	$20m^2$	2011

Note: * already constructed.
Source: JICA Study Team

2) Managing Organization and Number of Staff

Necessary number of staff for the operation of Caticlan Cluster MRF is shown in Table 6.4-5.

Table 6.4-5 Number of Staff for Caticlan Cluster MRF

No.	Position	Number of staff (2011)	Number of staff (2017)
1	Supervisor	1	1
2	Drivers of collection trucks	1	1
3	Truck Helpers	3	3
4	Sorters/Monitors	2	3
5	Technical Staff (Composting/Recycling, etc)	1	1
6	MRF Secretary	1	1

Source: JICA Study Team

(3) Kabulihan Cluster MRF

The Kabulihan Cluster MRF is to be located inside the proposed Kabulihan SLF. Considering the transportation distance to the MRF from the collection areas, barangays to be covered by the Kabulihan Cluster MRF shall be the ones west of Barangay Cogon, where collection service is planned to be provided. Basically, only residual waste is collected in the collection coverage area of Kabulihan Cluster MRF. Biodegradable waste is handled through home composting. Recyclable waste is basically collected through group collection activities and sold to junkshops. Hauled residual is sacked in the shed in the MRF. The work flow for the residual waste at the MRF is described in Figure 6.4-5.

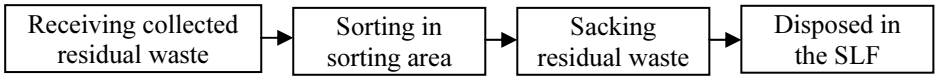

Figure 6.4-5 System Flow for Handling of Waste at Kabulihan Cluster MRF

Table 6.4-6 shows the facilities to be installed at the Kabulihan Cluster MRF.

Table 6.4-6 Proposed Facility for Kabulihan Cluster MRF

Facility	Quantity	Usage	Specification	Year of Procurement or Construction
Storage and sorting area	1	Storage and sorting of recyclables	Around 100m^2	*

Note: * already constructed.
Source: JICA Study Team

6.4.4 Closure of Current MRFs

The existing MRFs in Barangays Balabag and Yapak should be closed safely soon after they finish their roles in order to mitigate environmental impacts on the surrounding environment. For safe closure works, especially the areas of the residual wastes storage and compost pits should be rehabilitated appropriately. Soil reclamation as well as installation of gas ventilation pipes should be carried out in the areas where the waste has been disposed of

together with destruction of sheds, and the sorting and storage area roofs. These closure works should be conducted by the MOM.

6.5 Disposal

6.5.1 Development of New Sanitary Landfill

(1) Condition of Proposed Site for Sanitary Landfill

The site selection for development of new sanitary landfill site has been carried out by DENR with other stakeholders before the commencement of this Study or the JICA preparatory Study. There were three alternative sites for the sanitary landfill site including the finally proposed site in Kabulihan in the Municipality of Malay. One is in Sitio Bacolod, Caticlan and consists of around 3 hectares of rolling terrain about a half kilometer from the main road but no access road. However, some private owners near the area oppose the utilization of the site as a sanitary landfill site. Another site has the area of one hectare in Barangay Cubay Sur bought by the LGU at Php 700 per square meter. It is hilly and with good barangay roads but in the midst of agricultural and residential area that is why it was not approved by DENR. Through this process, the site for the new sanitary landfill was selected by DENR before this Study.

The proposed SLF is located in Barangay Kabulihan approximately four km from Barangay Poblacion. The site straddles the municipal boundary between the MOM and the Municipality of Buruanga (MOB). The site was identified by the DENR in February 2006 at which time it was assessed by the Mines and Geosciences Bureau (MGB) and considered, from a number of technical perspectives, to be a suitable site for the development of a sanitary landfill. The site is accessed by an unpaved road, approximately 4 m wide and 560 m long, from the provincial road between Barangay Poblacion of the MOM and Barangay Poblacion of the MOB. The road has been acquired by the MOM in order to ensure access to the site. The area which can be used for the site extends to 6.25 ha as shown in Figure 6.5-1.

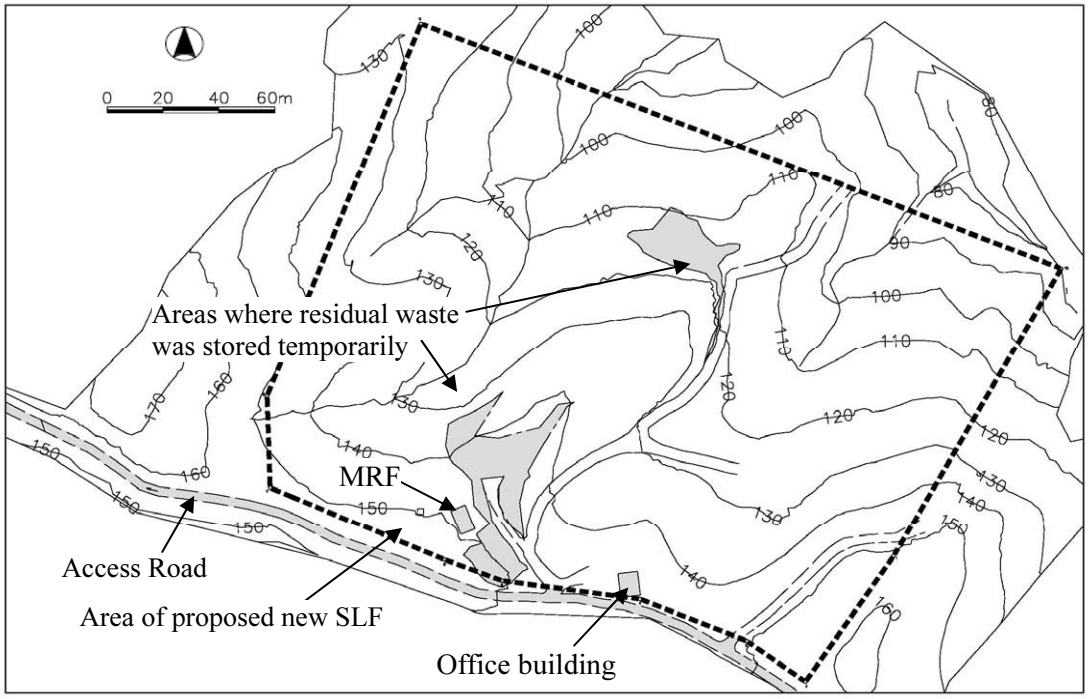

Figure 6.5-1 Topography of the Area of Proposed New Sanitary Landfill

Source: JICA Study Team

The site is rectangular in shape, running approximately 300 m from west to east and approximately 200 m from south to north. The southern limit of the site lies adjacent to the access road, which, at this point, runs along a ridge line separating drainage systems to the north in the MOM (including the site) and to the south in the MOB. The highest elevation at the site is recorded adjacent to the access road along the southern central site boundary at approximately 156 m above sea level (ASL). The lowest elevation, at approximately 80 m ASL is located at the extreme north-east corner of the site adjacent to a perennial creek. The site encompasses two small drainage valleys with an intervening narrow ridge that runs approximately south to north in the central portion of the site. The average gradient in the valley floors of the site is approximately 1:4 although the side slopes are considerably steeper, in many places steeper than 1:2.5 and occasionally as steep as 1:1 (45^{o}).

The MOM has constructed two structures at the site, an office building and a covered shed that is meant to serve as a MRF. The MOM also has a groundwater supply to the site and single phase electricity to the office building. Since late 2006, the MOM has been transferring residual waste from Boracay Island and storing it temporarily at the site, pending the development of the engineered sanitary landfill. The residual waste has been stored in two principal locations adjacent to the central ridge.

(2) Site Development Concept

The SLF is planned to be developed to provide the most efficient arrangement of landfill cells and support infrastructure within the available site area. In addition, the SLF is to be

developed and engineered to minimize potential environmental impacts, while, at the same time, attempting to minimize the initial investment cost. The proposed key features of the landfill design are as follows:

- The existing topography of the site is steep, with gradients typically steeper than 3H:1V. Accordingly, it is necessary to excavate into the existing ground and to flatten the existing site slopes in order to provide adequate capacity for waste disposal in a cost effective manner.
- The geological survey indicates that the superficial geology comprises a variable mix of sandy and gravelly silts and gravelly clays. The permeability of the clay soil is low indicating that it is suitable to act as a natural liner to retard the migration of leachate out of the site.
- The northernmost limit of the SLF is to be provided locally, along the alignment of each of the stream courses, with a retaining structure (embankment dam) in order to increase the void space capacity.
- The natural water flows on-site are to be maintained beneath the site by the provision of a sub-liner drainage system to intercept and maintain groundwater and surface water flows which occur, at least seasonally, in the principal valleys draining the existing site.

It is envisaged that the landfill site be developed progressively in two individual and separate Phases, with Phase 1 proposed to be developed in the southern and eastern parts of the site that are already cleared and deemed to be best suited for development of a landfill cell (Figure 6.5-2). Phase 1 shall be developed under the 10-year SWM Plan, while Phase 2 shall be developed in the final year of filling of Phase 1 which would be after the 10-year SWM Plan period.

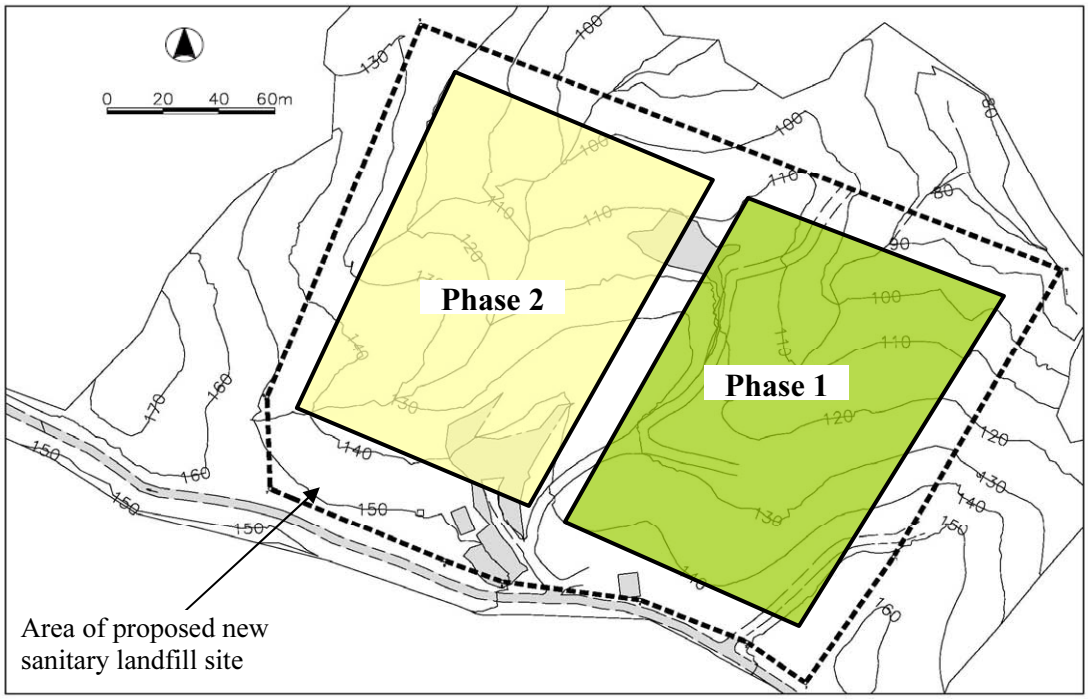

Figure 6.5-2 Site Development Concept of the SLF

Source: JICA Study Team

(3) Design Conditions

1) Estimated Amount of Waste Disposal at the Landfill

The SLF is designed to receive residual waste collected from the MOM. It is estimated that there is approximately 10 -13 tons of residual waste requiring disposal per day. This quantity is not expected to increase significantly within the planning period due to the proposed diversion activities although the total population, number tourists and the collection service area are expected to increase over time. However, for practical planning purposes allowing for some contingencies, it is estimated that the site be designed on the basis of approximately 5,500 tons per annum.

In addition, the SLF should also accommodate the residual waste currently stored on-site and in the MRFs (estimated to be of the order of 8,000m^3 or approximately 2,500 tons) and the residual waste to be generated and requiring disposal until the site is operational (approximately 9,000 tons).

2) Required Landfill Capacity

Based upon the above incoming waste stream, the required capacity of the SLF until 2017 is calculated to be approximately 88,000 m^3 based on the following assumptions.

- compacted density of residual waste of 0.75t/m^3, exclusive of cover materials and capping materials,
- an allowance of approximately 4,000m^3 for the leachate collection gravel above the basal liner,
- an allowance of 5% of the waste volume for soil as cover material,
- an allowance of approximately 5,300 m^3 of soil for intermediate cover, and
- an allowance of 2,500 m^3 for final cover assuming 75 cm clay cap and 15 cm soil cover over a restored area of 2,780 m^2

(4) Design Concept

Since the amount of residual waste to be received is estimated at less than 15 ton/day, the SLF is proposed to be designed as category 1 which is stipulated in DAO 10, Series of 2006. The design requirements for a category 1 landfill are as shown in Table 6.5-1.

Table 6.5-1 Design Requirements for Category 1 Landfill

Features	Category 1
Daily and Intermediate Soil Cover	√
Embankment/Cell Separation	√
Drainage Facility	√
Gas Venting	√
Leachate Collection	√
Leachate Treatment	Pond System
Leachate Re-circulation	At a later stage of operation
Clay liner	Clay liner be at least 60 cm thick and have a permeability of no more than 10^{-5} cm/sec

Source: DAO 10, Series 2006

All waste disposal facilities, regardless of category, shall satisfy the Basic Siting Criteria of Section 40 of RA 9003 and its IRRs and meet all of the following operating requirements, except as otherwise provided:

- Planned capacity with phased cell development,
- Site preparation and containment engineering,
- Compaction of waste to minimum specified target densities,
- Fences, gates and other site infrastructure with surfaced primary access road,
- Record of waste volumes, types and source,
- Separate cells for MSW and treated HCW (Handling and management of HCW should be in accordance with the provisions of RA 6969 and Joint DENR-DOH Administrative Order No. 02 respectively),
- Provision for aftercare following site closure and restoration , and
- Prohibition of waste pickers in the immediate disposal area.

(5) Design of Facilities

The SLF is proposed to be provided with the following principal facilities based on the design requirements of DAO 10 as well as the site conditions:

1) Site Administration and Operations Compound

The SLF is to be provided with the following administration and operational facilities adjacent to the entrance to the site:

- entrance gate
- guard house
- new site office building
- parking lot and hardstand
- temporary waste storage area (to be developed as Kabulihan Cluster MRF)
- fencing and compound lighting
- site utilities – electricity, water supply, and communication links
- weather station

2) Environmental Protection Facilities

The SLF is to be provided with the following environmental protection facilities:

- buffer zone
- leachate collection and treatment system
- storm water drainage system
- sub-liner drainage system
- passive gas vents
- ground water monitoring wells

In addition, a set of standard operating procedures is to be specified to provide enhanced protection to the environment, including compaction and daily covering of waste.

Table 6.5-2 Necessary Equipment for Operation

Equipment		Specifications	Unit	Workload (hrs./week)
1	Backhoe loader	0.6 – 1.0 m^3	1	6-8
2	Bulldozer	15-20 tons	1	2-3
3	Dump truck	5-10 m^3	1	6-8
4	Service vehicle	Pickup truck (4x4)	1	16

Source: JICA Study Team

(6) Commencement of Sanitary Landfill Operation

The anticipated schedule for the development of the proposed SLF is as follows:

- Preparation of detailed design: 1st to 2nd quarters of 2008;
- Construction of Phase 1: 3rd to 4th quarters of 2008, 1st to 2nd -2009
- Commencement of Operation: middle of 2009.

6.5.2 Rehabilitation of the Old Dump Site

(1) Condition of Old Dump Site

The topographic map and the areas to which solid waste has been dumped are sown in Figure 6.5-3. The site occupies a small valley between two low hills, one to the north which reaches an elevation of approximately 63 m ASL. Extending eastwards from Mt. Luho is a small ridge which effectively forms the southern boundary of the site. Approximately 100-200 m to the east of the site is the coastline, which, in this location, comprises a vertical cliff approximately 20 m high.

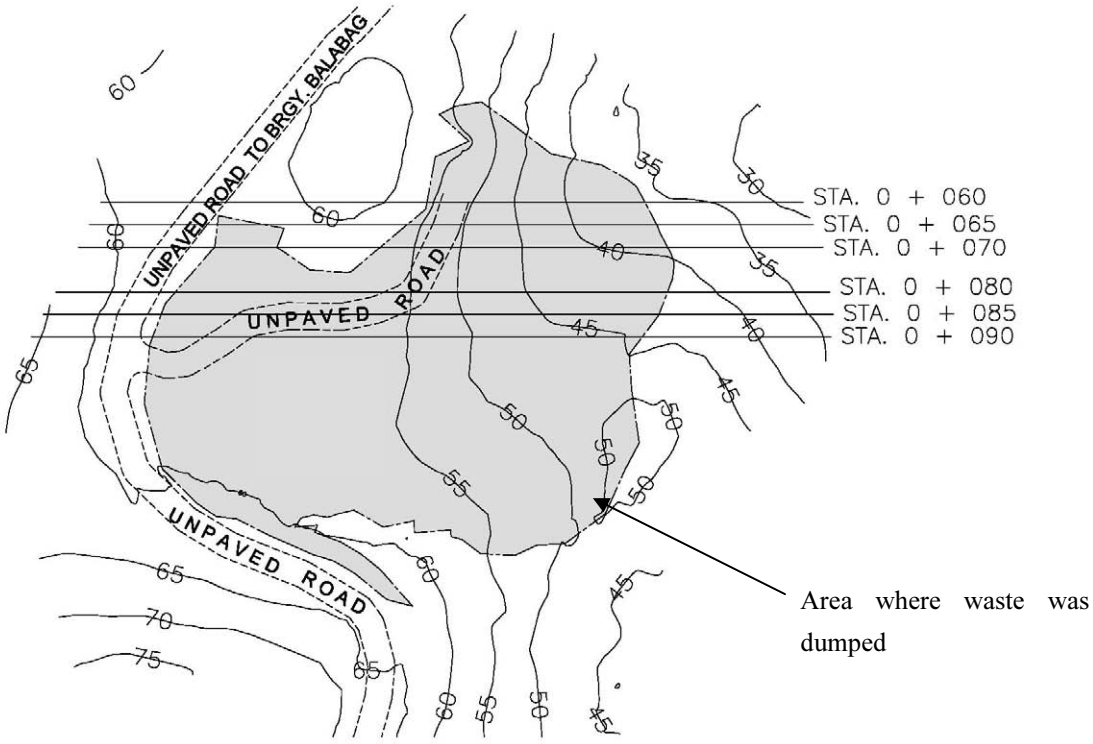

Figure 6.5-3 Topography and Area of where Waste was Dumped at the Old Dump Site
Source: JICA Study Team

It is understood that solid waste was dumped along the northern edge of a steep northeast-southwest ridge. As surveyed, the dumped waste covers an area of approximately 6,330 m^2. The precise extent is difficult to determine given the presence of very dense vegetation along the eastern and southern boundaries of the waste.

The topography of the dump site is essentially flat with a slight mound in the southern half of the site and a steep eastward margin. The recorded maximum depth of waste, as proven through a borehole survey, is around 7 m. The steep eastern margin of the dump site is unstable and is prone to slope failures, particularly in the central and northern sections. Here, failure of the slopes is continuing and has accelerated with the onset of the rainy season. During failure, the waste flows down and out as a series of lenses up to and beyond the recorded margin of the dump site.

Drilling has confirmed that the lower portions of the waste mound comprise ashes, indicative of previous burning of the waste materials. The upper portions of the waste appear relatively fresh and undecomposed, indicative of a lack of moisture in the materials. No leachate has been recorded at the site.

The site is surrounded by, and underlain by, very porous and permeable limestone formations, which facilitate the vertical drainage of any leachate that is generated within the site. The limestones are overlain by pockets of dark brown to red clayey and silty soils that are extremely variable in thickness over short distances. Maximum soil depths are likely to be no greater than 1 m.

(2) Options for Closure of Old Dump Site

The waste was deposited in a shallow but steep sided valley which drains eastwards towards the coastline. The site is underlain and surrounded by coralline limestone which is both fractured and has a high secondary porosity (high void space). The steep eastern margin of the dump site is unstable and is prone to slope failures, particularly in the central and northern sections.

In assessing options for the proper closure and/or rehabilitation of the dump site, there are two fundamental options available, aside from the 'do nothing' option which is not acceptable either to the regulatory authorities or the MOM. These options are:

- Option 1: Rehabilitate the dump site in accordance with DENR Guidelines
- Option 2: Remove the waste and dispose of it elsewhere in an approved landfill facility, presumably at the proposed SLF, and re-instate the site back to its former condition.

DENR Guideline and DAO-06-09 stipulates that the following shall be considered in closing and rehabilitating open dump sites:

- Site clearing (clearance of existing structures)
- Site grading and stabilization of critical slopes
- Application and maintenance of soil cover
- Provision of drainage control system
- Leachate management
- Gas management
- Fencing and security
- Prohibition of burning at the site
- Erection of appropriate signage

Option 1 has been selected. Under Option 1 it is envisaged that the following works should be undertaken:

1) Physical Closure (PC)

- Excavation of existing waste in order to stabilize any unstable slopes by reducing slope gradients to a maximum of 1:3 or 1:4 (compared to 1:1 or steeper at present),
- Excavation of existing waste to reduce the area occupied by the dump site,
- Deposition of waste in the western half of the site in order to re-shape the existing topography into a shape compatible with any proposed future use,
- Compaction of all existing waste in order to reduce the volume of the waste mound,
- The spreading and compaction of a suitable capping soil in order to cover the waste and to minimize the production of leachate,
- The application of a suitable soil cover to both capped parts of the waste or areas cleared of waste in order to promote vegetative growth,
- Re-vegetation of capped and/or cleared areas,

- Provision of stormwater drainage around all capped areas of waste to collect surface run-off and to prevent surface erosion of any areas of capped waste,
- Fencing of the site to prevent unauthorized access, and

2) Post Closure Management (PCM)

- Periodic inspection and maintenance of all capped areas to ensure the integrity of the capped areas, and
- Periodic environmental monitoring especially on ground water quality and sea water quality around the site.

It is not considered necessary, or cost effective, to install any system of leachate collection or treatment. The above measures could significantly mitigate the potential for leachate generation.

(3) Schedule

It is envisaged that the following schedule would apply for the rehabilitation of the old dump site. However, the environmental monitoring of the water quality should be conducted from 2008 continuously.

- Approval of rehabilitation plan by DENR Region-VI (issue of the Authority to Close (ATC) in accordance with DAO 09, Series of 2006): 2008
- Contract arrangement with a contractor : 2008 - 2009
- Physical Closure (PC) works of the old dump site: 2010
  (Preparatory works will be conducted in 2008 by the MOM)

6.6 Special Waste

According to RA 9003, special waste is defined as HHW such as paints, thinners, household batteries, lead-acid batteries, and spray canisters. In addition, HCW, biohazard and other types of waste covered under RA 6969 are also categorized as special waste. Compared to other special waste, the HCW management system should be established with due consideration of potential risks to the environment and human health. This 10-year SWM Plan exclusively focuses on the HCW management.

6.6.1 Basic Concept for Health Care Waste Management

The basic concept of the HCW management is "*To comply with current legislation for heath care waste management."* In order to promote the proper HCW management, the DOH and DENR have issued several pieces of legislation. Several critical pieces of legislation can be summarized below:

Responsibility of hazardous waste generator;

The IRR of RA 6969 clarifies the responsibility of the hazardous waste generators. The waste generators shall be responsible for the proper management and disposal of

their hazardous waste, and bear the cost for the proper storage, treatment and disposal of their hazardous waste.

Requirement for an IEE or Certificate of Non-coverage

Memorandum Circular No. 005-2006 requires primary hospitals to obtain an ECC by preparing an IEE checklist. Clinics (out-patient, heath centers, and dental clinics) including rural heath units need a Certificate of Non-coverage (CNC).

Hazardous waste generator's registration

According to the joint DENR-DOH AO No. 02-2005 and IRR RA 6969 (DAO No. 29-1992 and DAO No. 36-2006), hazardous waste generators are required to obtain a hazardous waste generator's registration from the DENR-EMB Regional Office.

6.6.2 Health Care Waste Management System on Boracay Island

The HCW management system is composed of five steps: 1) segregation; 2) treatment; 3) temporary storage; 4) collection and transportation and 5) final disposal. The appropriate management requires adequate organization, human resources and procurement of materials and resources.

One of the biggest concerns in the HCW management on Boracay Island is a treatment method. Only some of the hospitals or clinics use disinfectant for sharps, however, other HCW is disposed of without proper treatment at present. Thus, a suitable treatment method such as pyrolysis (plasma), autoclave (hydroclave), microwave, and/or irradiation and encapsulation should be established. In addition, an appropriate location where the HCW will be treated also needs to be discussed. In the considerations, three options, i.e. Option 1: individual treatment, Option 2: treatment at a main clinic or hospital, and Option 3: centralized treatment, were compared.

(1) Segregation and Packing System

Taking into account the volume and composition of the HCW, it is proposed to segregate the HCW into at least the following categories:

- Infectious waste
- Sharps: sharps and syringes are separated. Syringes are segregated into the infectious waste
- Pathological waste: once the hospitals/clinics discharge a certain volume of pathological waste, they call a collector to collect the waste because the pathological waste decays easily due to the high humidity and temperature in the area.

Based on the HCW Management Manual issued by the DOH, the recommended segregation manners are summarized in Table 6.6-1. Although a yellow bag is required for the infectious waste, most of the hospitals and clinics in the study area claim that there is no

store that sells a yellow bag on Boracay Island. It is necessary that the MOM should arrange or provide yellow bags to the clinics and hospitals. Currently, most hospitals and clinics reuse a PET bottle or used plastic bottle as a container for sharps. It is also proposed to use a thicker bottle and it should be sealed properly when it is discharged.

Table 6.6-1 Color, Labels and Type of Bags or Containers for HCW

Type of waste	Color and type of bag/container	Type of bag/container	Labeled	Symbol
Infectious waste (small amount of chemical or pharmaceutical waste can be included)	Yellow	Plastic bags, plastic lined cardboard boxes or leak proof containers	Infectious waste	International infectious substance symbol
Sharps	Red	The container is puncture proof made of metal or high-density plastic. It should be rigid and impermeable as well as difficult to open or break.	Sharps	-
Pathological waste	Yellow	Plastic bags, plastic or leak proof containers	Pathological waste	-

Source: HCW Management Manual

(2) Storage

On Boracay Island, most of the hospitals and clinics are so small that they cannot allocate a separate area for a storage space for the HCW. They keep their HCW inside of the facilities such as at a corner of an operation or patient room. In case of storing the HCW in an operation or patient room, the following manners are proposed:

- The storage space is clearly marked with a warning sign.
- The area should be a corner of the room or under a table to avoid contact with patients.
- All HCW should be in a solid container with lids, such as metal, plastic, wood or dense cardboard container.

On the other hand, a few hospitals and clinics keep their HCW at a storage space outside of their facility. However, the storage spaces do not have adequate roofs or fences. The HCW is prone to be soaked with rain and flood water especially during the rainy season. The storage facility should follow the several requirements below as mentioned in the HCW Management Manual:

- The storage area should have an impermeable, hard-standing floor with good drainage.
- It should be possible to lock the storage area to prevent an access by unauthorized persons.
- There should be protection from sun, rain, strong wind, floods, etc.,
- The storage area should be inaccessible to animals, insects and birds.

(3) Treatment

1) Treatment Method

Table 6.6-2 shows the comparison of technologies for HCW treatment. Based on the comparison of advantages and disadvantages of treatment and capital cost of these technologies, an autoclave is recommended as the treatment method on Boracay Island. The reasons are as follows:

- The quantity of the HCW is not large: the nine hospitals and clinics on Boracay Island discharged estimated 6.4 kg/day in 2007 and a projected 7.9 kg/day in 2017. An autoclave is available for small quantities of HCW,
- The autoclave is suitable for treating most of the HCW, i.e. infectious waste and sharps, that are discharged on Boracay Island,
- The equipment size can be small and it is easy to set up in a small hospital or clinic,
- The autoclave is common equipment in medical facilities, the operation is easy for medical staff.
- Capital and treatment costs are relatively lower than other treatment methods.

2) Installation location and Operation of Autoclave

Although an autoclave is recommended as a non-incineration treatment for the HCW on Boracay Island, where the autoclave will be located and who will be responsible for running it have to be discussed. Three options can be proposed as follows:

- Option 1: Individual treatment

  Each hospital and clinic will set up and own the autoclave in their facilities. Each hospital and clinic will treat their HCW on-site by themselves, and have responsibility for managing the autoclave. The treated HCW will be periodically collected and transported to the centralized MRF, and stored there temporarily.

- Option 2: Treatment at a main hospital or clinic

  The autoclave will be equipped at a main hospital or clinic on Boracay Island, and other hospitals and clinics will share the equipment. Each hospital and clinic periodically brings their HCW to the main hospital or clinic where the autoclave is installed. The main hospital or clinic is responsible for treating the HCW. The Boracay Health Center (BHC) is recommended to be the main clinic where the autoclave will be installed.

- Option 3: Centralized treatment

  The autoclave will be located at the centralized MRF. After collection from each hospital and clinic, the HCW is treated at the centralized MRF. The organization which runs the centralized MRF will be responsible for the operation of the autoclave.

Table 6.6-2 shows the comparison of Options. Option 1 is not a reasonable system, because the hospitals and clinics cannot afford to install and manage their own autoclave due to a lack of budget and human resource. Also, the quantity of HCW discharged from each hospital and clinic is so small that the treatment at each hospital and clinic is not cost effective.

Based on the comparison between Options 2 and 3, though their advantages and disadvantages are similar, Option 2 is recommended as a suitable treatment system. Both options can treat a certain amount of HCW at a time and in an economically effective manner. Besides, in each Option, one organization, the BHC in Option 2 and the centralized MRF in Option 3, has responsibility for managing the autoclave, so it will be easy to control the HCW. Thus, the advantages of both Options are similar. However, in terms of the responsibility, Option 2 is much clearer than Option 3. In Option 2, the autoclave is installed in the BHC which is run by the MOM. The officer of the Public Health Service, who is in charge of inspecting and instructing the HCW management, would be the responsible person at the center. As a result, the MOM and the officer of the Public Health Service should be directly involved in the management of the autoclave. More stringent management of the autoclave and better treatment can be expected in Option 2. The following practices are indispensable for the proper implementation of Option 2:

- Adequate budget and enough personnel for operation and maintenance, and training are necessary;
- Instruction for safe transportation of HCW from each hospital and clinic to the BHC is necessary;
- Proper storage space should be built at the BH.

Table 6.6-2 Comparison of Options

Items	Option 1	Option 2	Option 3
Treatment	・ At each clinic/hospital	・ At the BHC	・ At the centralized MRF
Responsibility for treatment and running the autoclave	・ Each clinic/hospital	・ BHC ・ Responsibility is clear because the autoclave is managed by the MOM	・ Organization running the centralized MRF
Simplicity in management and control	・ Each clinic/hospital needs to assign personnel for operation and maintenance. ・ Training is necessary for proper management. ・ Each clinic/hospital needs to monitor their own equipment and operation.	・ BHC assigns personnel for operation and maintenance. ・ Training is necessary for proper management. ・ It would be necessary to monitor the equipment and operation. ・ BHC has to obtain permission to treat HCW.	・ The centralized MRF would assign personnel for operation and maintenance. ・ Training is necessary for proper management. ・ It would be necessary to monitor the equipment and operation. ・ The centralized MRF has to obtain permission to treat HCW.

Items	Option 1	Option 2	Option 3
Collection/ transportation	・ Relatively safe because the HCW is already sterilized at the hospitals/clinics.	・ Hospitals/clinics periodically bring their HCW to BHC in a careful manner such as with proper packing. ・ Adequate storage space should be established at BHC.	・ Periodic collection from the hospitals/clinics and transport to the centralized MRF is necessary in a careful manner such as with proper packing. ・ Safe storage facility is required at the centralized MRF.
Cost	・ Each hospital/clinic pays for installation and running costs. ・ Each hospital/clinic pays for personnel training costs.	・ BHC pays for the installation of the autoclave and personnel training costs. ・ Other hospitals/clinics pay fees for the O&M.	・ The centralized MRF pays for the installation of the autoclave and personnel training costs. ・ The hospitals/clinics pay fees for the O&M.
Investment cost	・ Autoclave (PhP 300,000) * 9 (at all of the hospitals/clinics) = PhP 2.7 million	・ Autoclave (PhP300,000) * 1 (at BHC) = PhP 300,000	・ Autoclave (PhP 300,000) * 1 (at the centralized MRF) = PhP 300,000
Running cost	・ Running cost (PhP 800/ton) * 9 (at all of the hospitals/clinics) = PhP 7,200/ton	・ Running cost (PhP800/ton) * 1 (at BHC) = PhP 800/ton ・ Fees from hospitals/clinics	・ Running cost (PhP 800/ton) * 1 (at the centralized MRF) = PhP800/ton ・ Fees from hospitals/clinics

Source: JICA Study Team

(4) Collection and Transportation

After treatment at the BHC, the HCW is to be transferred to the centralized MRF and stored temporarily at a storage space. It is proposed that the organization which runs the centralized MRF would have responsibility for collection of the treated HCW from the BHC. After temporary storage at the centralize MRF, the treated HCW is brought to the proposed SLF. During the transportation, a separate container or packing is necessary to prevent mixing with other general waste.

(5) Final Disposal

The proposed SLF on the Mainland of Malay is the final destination for the HCW. In the SLF, a special cell for HCW is proposed. The HCW is to be geologically isolated from the environment as well.

(6) Proposed HCM System on Boracay Island

Based on the discussion above, the proposed the HCW management on Boracay Island is presented in Figure 6.6-1.

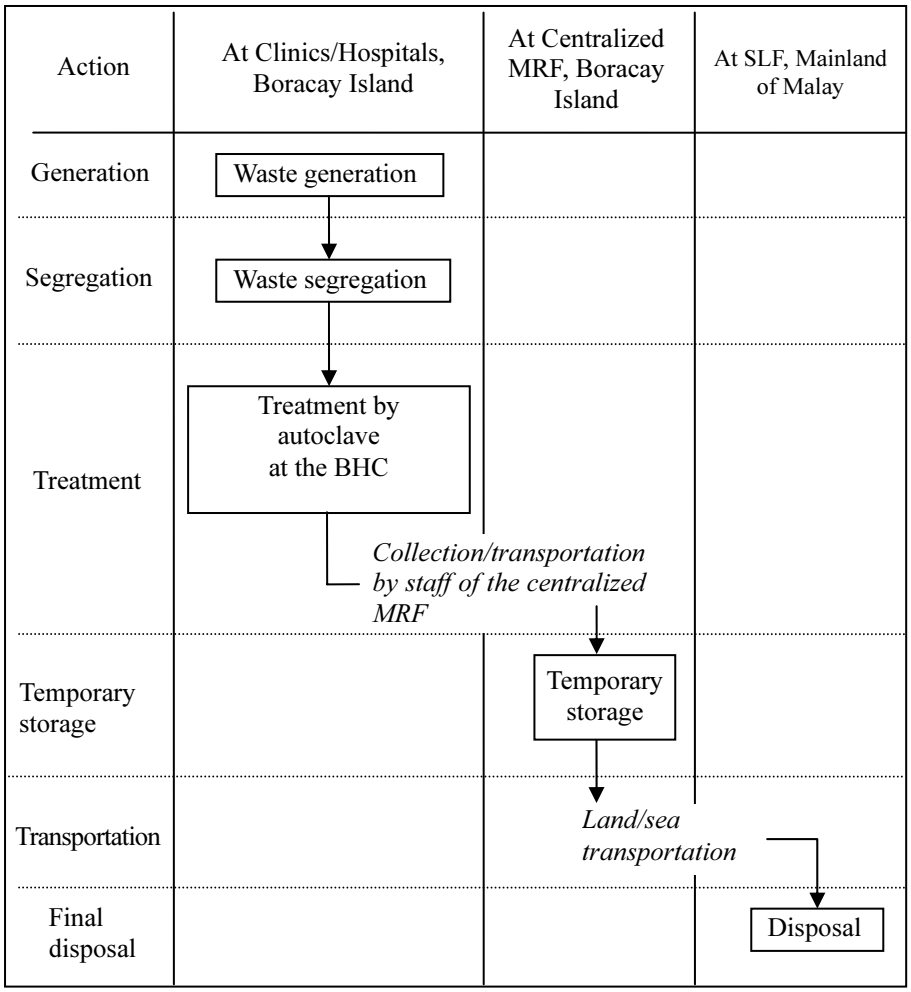

Figure 6.6-1 Proposed Health Care Waste Management System on Boracay Island

Source: JICA Study Team

6.6.3 Health Care Waste Management System on the Mainland of Malay

A system similar to that for Boracay Island can be applied to the HCW management on the Mainland of Malay. Figure 6.6-2 shows the proposed HCW management on the Mainland of Malay. However, a few differences are discussed below.

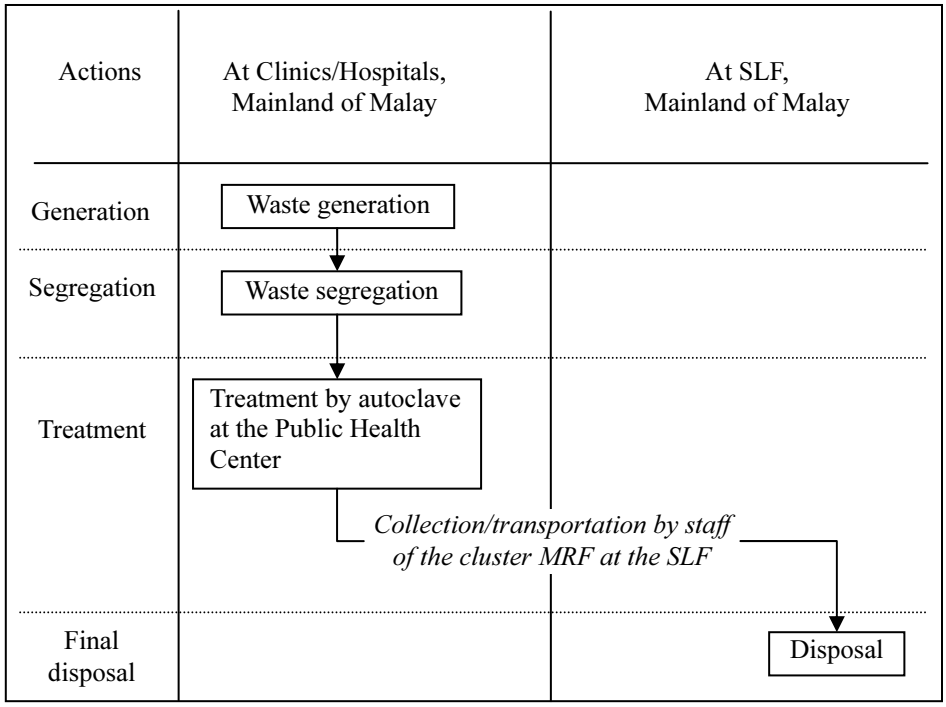

Figure 6.6-2 Proposed Health Care Waste Management System on the Mainland of Malay

Source: JICA Study Team

The autoclave is to be installed in the Public Health Center on the Mainland of Malay where the officer of the Public Health Service stays every Monday, Wednesday and Friday. The Public Health Center will have responsibility for the treatment of the HCW and maintenance of the autoclave. Currently, some hospitals burn and bury their HCW in backyards without proper treatment. The inspection of and instruction to the hospitals to change their disposal manners is crucial. Proper segregation with appropriate bags or containers at each hospital and clinic and periodic transportation from the hospitals and clinics to the Public Health Center should be obligations of the hospitals and clinics. After treatment, the treated HCW is to be periodically collected and transported from the Public Health Center to the cluster MRF established at the SLF.

6.6.4 Special Waste Fee for Health Care Waste

Business establishments have paid the GCF for their generated waste, however, hospitals discharge HCW which is required to be treated in a different way than other wastes in accordance with RA6969. In the 10-year SWM Plan, a way to dispose of HCW appropriately is proposed. In particular, autoclave treatment will be introduced by 2010 on Boracay Island and by 2014 on the Mainland of Malay. From the view point of user charges to recover the costs as the existing GCF, a special waste fee for HCW is proposed.

The special waste fee is priced based on the estimated cost for HCW during the 10-year SWM Plan. The fee includes the depreciation on the basis of lifetime (about eight-years) of autoclaves. Consequently, the fee is categorized into three classes depending on the range

of average number of patients per day of the hospitals. The monthly fee of each class was calculated by dividing the cost for HCW by the number of patients per day as shown in Table 6.6-3.

Table 6.6-3 Estimation Costs for HCW

Items	Unit	Boracay Island (2010-2017)	Mainland of Malay (2014-2017)	Total
Average Cost of Health Care Waste per Year	PhP/year	218,199	284,942	503,142
Average Number of Patients per Year	person/year	59,000	29,000	88,000
Cost per patient	PhP/person	4	10	6

Source: JICA Study Team

The fee by categories and number of hospitals on Boracay Island and Mainland of Malay classified based on the range of patient numbers which is shown in Table 6.6-4.

Table 6.6-4 Calculation of Special Waste Fee for HCW by Class

Fee Class	Range of Patient Numbers (Person/day)	Special Waste Fee of HCW (PhP/month)	Number of Hospitals (Hospital)
A	Less than 10	900	5
B	11 to 30	3,600	5
C	31 to 50	7,200	2

Source: JICA Study Team

CHAPTER II-7 INSTITUTIONAL AND ORGANIZATIONAL SYSTEM FOR SOLID WASTE MANAGEMENT

7.1 Information, Education and Communication (IEC)

7.1.1 Target Audience

Active public participation and community involvement (premised on aggressive information dissemination and education campaigns in all sectors) is critical to the successful implementation of the 10-year SWM Plan. The enforcement of RA 9003 requires concerted efforts from every sector and every member of the communities. Thus, the challenge on information, education and communication (IEC) is how to unify these diverse communities to act towards the vision of "A Sustained and Integrated Solid Waste Management System" of the MOM while accommodating the unique needs of each barangay and each sector. The proposed IEC program of the 10-year SWM Plan attempts to articulate the following objectives:

- To inform the public of the existence of the SWM system as legislated through MO 185
- To encourage the public to make informed SWM decisions and to participate in the programs
- To mobilize communication networks and resources within the community
- To emphasize long-term benefits such as improvement in protected tourism resources, and public health
- To institutionalize continuing public awareness campaigns and education through multi-sectoral partnerships that include the private sector and NGOs
- To synchronize and integrate the information and education campaign activities among the different sectors.
- To promote education regarding SWM in school curriculums

The target audiences and target levels to be achieved by the IEC program are summarized in Table 7.1-1.

Table 7.1-1 Target Audiences and Levels of IEC

Target Audiences	Target Levels
Residents receiving collection service	- Active source reduction activities (avoidance and 3Rs) are conducted - Proper segregated discharge of solid waste is conducted
Residents to be covered by collection service	- Active source reduction activities (avoidance and 3Rs) are conducted - Cooperation with the collection service is achieved - Proper segregated discharge of solid waste is conducted
Residents needing a long time before they are covered by collection service	- Active source reduction activities (avoidance and 3Rs) are conducted
Tourists	- Active source reduction activities (avoidance and 3Rs) are conducted
Business establishments	- Active source reduction activities (avoidance and 3Rs) are conducted - Proper segregated discharge of solid waste is conducted - Proper payment of the GCF
Project proponents and building contractors	- Proper handling of construction debris is conducted
Institutions (health sector: hospitals and clinics)	- Proper handling of health care waste is conducted
Institutions (school sector)	- Active environmental education regarding SWM is conducted

Source: JICA Study Team

7.1.2 Core Messages

The core message of the IEC program should be adapted to the unique needs and context of each sector. The IEC program for the Mainland of Malay starts from the most fundamental concept of SWM, and the practical applications of RA 9003 and MO 185 at the household level. Residents should be informed about the benefits of appropriate disposal versus the environmental and public health risks of traditional modes of disposal, such as burning and dumping. Meanwhile, the program for Boracay Island covers tourists and the tourism sector and business establishments for their cooperation with the SWM program. Basically, the IEC should consist of the following core messages:

A. Vision for SWM and Summary of the 10-Year SWM Plan

It is important to rally the citizens towards one direction and for each citizen or group to see one's role discussed in the 10-year SWM Plan. The emphasis should be on volume reduction at the source (IRR IX Sec. 1), mandatory segregation of solid wastes (RA 9003, Article 2 Section 21), and requirements for segregation and storage of solid waste (Section 22).

IRR Rule IX. Section 1 Waste Segregation and Volume Reduction at the Source

"Volume reduction at the source shall be the first priority of the ecological SWM system. All LGUs shall actively promote among its constituencies the reduction and minimization of wastes generated at the source; responsibility of sorting and segregation of biodegradable and non-biodegradable wastes shall be at the household level, business, commercial , industrial and institutional centers and other point sources of solid wastes .

***Section 21. Mandatory Segregation of Solid Wastes**. "That segregation of wastes shall be primarily conducted at the source, to include household, institutional, industrial, commercial and agricultural sources.*

***Section 22. Requirements for the Segregation and Storage of Solid Waste**. "The following shall be the minimum standards and requirements for segregation and storage of waste pending collection:*

(a) There shall be a separate container for each type of waste from all sources ...
(b) The solid waste container depending on its use shall be properly marked or identified for on-site collection.

B. Economic, Environmental and Public Health Implications of Improper Waste Disposal

RA 9003 was crafted because of the growing concern for the environmental and health impacts of improper waste disposal (e.g. burning waste may cause air pollution, indiscriminate dumping of waste may cause water pollution, clogging of drainage systems and produce breeding grounds for diseases.) Poor sanitary conditions and degradation of natural resources may adversely affect the tourism industry.

C. Salient Points of RA 9003 and MO 185 (including prohibited acts, sanctions, and penalties)

Enforcement of sanctions and penalties by the MOM against violators is necessary to gradually inculcate the sense of responsibility for one's garbage, contrary to the common attitude that the government is solely responsible to manage waste generated in the MOM.

D. Solid Waste Management System

The public should be taught that the 10-year SWM Plan has been developed based on the SWM hierarchy which begins with source reduction. The selection of processes and technologies are biased towards those most economically feasible for the MOM and to those contributing the least negative impact to health and the environment. The costs of SWM per capita and per ton generated, versus the cost benefits, are to be disclosed to make people understand the value of an individual's contribution to the entire SWM program.

7.1.3 Methodology

Successful SWM requires behavior change of the target audiences. The behaviors are considered by referring to Figure 7.1-.1 which provides steps for the change. Most people go through these steps, sometimes moving forward or backward and sometimes skipping steps. Even when people adopt new behaviors, they may revert back to old behaviors, at least under certain circumstances. In the ultimate sense, it is expected that all people would achieve success and maintain that stage.

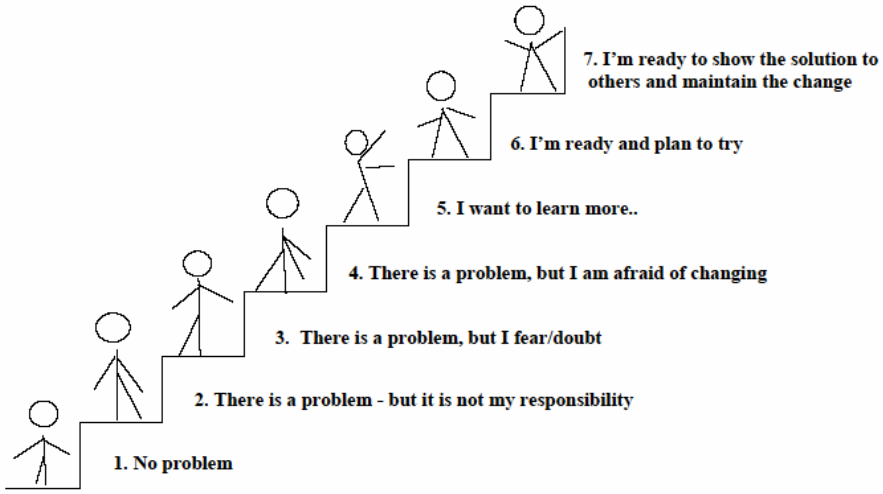

Figure 7.1-1 Steps for Behavior Change of People

Note: The process of changing behaviors and attitudes may happen in the above sequence. Most people move back and forth between steps before achieving success.
Source: "A manual for communication for water supply and environmental sanitation programs" (UNICEF, 1999)

For behavioral change of the people, Mass Communication and Education (MCE) and Interpersonal Communication and Education (ICE) are considered as broad approaches of the IEC. MCE is a useful approach that reaches large audiences quickly and effectively. It includes mass and small media such as print media and public/educational events. On the other hand, an approach using ICE is recognized as an effective two-way communication channel that encourages interactive dialogues between individuals or among group members. Figure 7.1-2 illustrates images of the difference between MCE and ICE. The ICE approach, based on personal communication channels, disseminates, improves and reinforces the acquired knowledge, skills, attitude and behavior between individuals or among diverse group members.

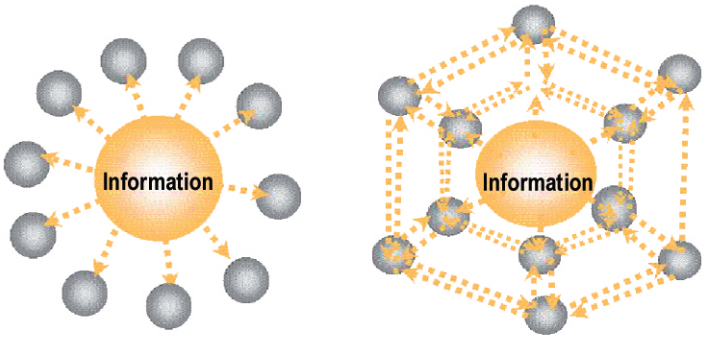

Figure 7.1-2 Mass and Interpersonal Communication and Education

Source: JICA Study Team

The methods which can be used for the ICE program based on the above approaches are listed in Table 7.1-2.

Table 7.1-2 Media for Mass and Interpersonal Communication and Education

Mass Communication and Education (MCE)	Interpersonal Communication and Education(ICE)
1. Mass media - Electronic media (radio, web-sites) - Print media (newspapers, magazines, posters, leaflets, and stickers) - Traditional media (billboards and banners) 2. Special events (public and educational events)	1. School environmental education 2. Creation and/or encouragement of community groups such as women's clubs, youth clubs, and children's clubs, to strengthen their activities 3. Other local awareness activities (public meetings, rallies, workshops, etc.)

Source: JICA Study Team

7.1.4 IEC Program

The IEC program is proposed to be conducted in a three-pronged manner:

- Training for trainers of the IEC program
- General public advocacy regarding the 10-year SWM Plan
- The IEC activities geared towards behavior change

First in the order of the IEC program is to provide training and improve the capability of local officials, especially barangay SWMCs, and the entire SWM workforce. They are to be trained in the different components of SWM. Training is to be in the form of lectures, hands-on demonstrations and study tours.

General barangay assemblies are to be conducted in every barangay to formally launch the 10-year SWM plan. These are especially important for upland barangays where the only source of public notices is the barangay officials. There shall be zone-to-zone visits by the barangay councils in their respective zone jurisdictions and house-to-house visits by the monitors. Monitors, as revealed by the public survey results for Boracay Island, are the most common source of information regarding SWM, especially segregation.

Various IEC activities are proposed to be adopted, taking advantage of the different methods available, that may include, but are not limited to, the ones as shown in Table 7.1-3.

Table 7.1-3 Proposed IEC Programs

No.	Media	Descriptions	Contents
I. Mass Communication and Education (MCE)			
I-1: Mass Media			
(1) Electronic Media			
1.	Radio (short messages)	Radio has been identified as a major news and information source which is a relatively low cost media to raise people's awareness on a large scale.	Short catchy messages and jingles on SWM are broadcast.
2	Radio (talk programs)	Talk programs could generate vivid local level discussions. Experts on SWM deliver the topics so that the important messages can be disseminated.	Regular radio talk programs on various subjects on SWM are broadcast.
3	Websites	Websites could provide the people with details of the SWM activities as well as the contents of the 10-year SWM Plan	The components, progress, and outcomes of the 10-year SWM plan as well as SWM information are updated often.
(2) Print Media			
4	Local newspapers	Newspapers are popular media read among the people, which can provide detailed information. Newspapers can be read again and again and finally could mobilize public opinions.	The various information regarding SWM and a series of educational information articles are shown in leading local newspapers.
5	Local magazines	Local magazines are also popular media read among the people, which can provide detailed information. Magazines can be read again and again and finally could mobilize public opinions.	The various information regarding SWM and a series of educational information articles are shown in local magazines.
6	Posters, leaflets, stickers	These printed media are effective with literate people, tourists, and school children, which can be used many times. Stickers can be attached to various places for publicity including transport vehicles like ships, buses, vans, cabs, tricycles, and pump boats.	The printed medias are distributed to the residents, tourists, business establishments, etc. Various catchy and short messages on SWM are printed and distributed.
(3) Traditional Media			
7	Billboards, banners	Billboards and banners can be seen by the people on a large scale with high visibility, and can be changed from one place to another (mobile).	Billboards and Banners regarding the advantages of proper SWM are set up at strategic points such as ports, mall and core areas.
I-2: Special Events			
8	Public and educational events	Public and educational events can be held by inviting many people with various displays, exhibitions, trade fairs and events.	Not only activities of the 10-year SWM Plan but also related activities of the MOM, NGOs and private sectors are displayed at the events.
II. Interpersonal Communication and Education (ICE)			
1.	School environ-mental education	Children are considered powerful and effective media for transmission of hygiene, sanitation, and environmental messages from school to family members, neighbors and communities.	Education on proper SWM is conducted at schools. During that time, school flag ceremonies, talks, essays, and painting competitions on SWM among school children are also conducted.
2.	Creation or encourage-ment of community groups	In rural areas, community groups such as women's clubs and youth clubs could be created or encouraged to make people aware and convince them regarding SWM. They are expected to play a key role for group recycling activities.	Formation of community groups and training and strengthening of them including exposure visits to other groups with good practices are conducted.
3.	Other local public awareness activities	Local public awareness activities can be conducted as interactive and participatory communication processes so that it encourages people to work together for proper SWM activities.	Multi-sectoral forums, inter-sectoral meetings, public meetings and workshops, rallies and clean-up campaigns are conducted.

Source: JICA Study Team

The above mentioned various IEC programs should be conducted together with the related projects as shown in Table 7.1-4.

Table 7.1-4 Proposed IEC Programs and Projects

Proposed IEC Programs / Proposed Projects	I. Mass Communication and Education (MCE)								II. Interpersonal Communication and Education (ICE)		
	I-1. Mass Media							I-2: Special Events			
	(1) Electronic Media			(2) Print Media			(3) Traditional Media				
	Radio (short message)	Radio (talk programs)	Websites	Local newspapers	Local magazines	Posters, leaflets, stickers	Banners, Billboards	Public and educational events	School environmental education	Creation or encouragement of community groups	Other local public awareness activities
1. Diversion											
1.1 Promotion of Source Reduction											
1.1.1 Introduction of Source Reduction Programs on Boracay Island											
1) Introduction of Waste Reduction (3Bs) Program											
"BALIK BAYONG" Program	◎	○	○	◎	○	◎	◎	◎	○	○	○
"BALIK BOTE" Program	◎	○	○	◎	○	◎	◎	◎	○	○	○
"BALIK BIO-WASTE" Program	◎	○	○	◎	○	◎	◎	◎	◎	◎	○
2) Introduction of Waste Avoidance Program	◎	○	○	◎	○	◎	◎	○	○	○	○
1.1.2 Introduction of Source Reduction Program on the Mainland of Malay	○	○	○	○	○	◎	◎	○	◎	◎	○
1.2 Promotion of Intermediate Reduction at MRFs	○	○	○	○	○	◎	◎	○			
2. Sweeping, Collection and Transport											
2.1.Extention and Improvement of Sweeping			○	○	○	◎	◎	○	○	○	
2.2 Improvement of Collection System on Boracay Island	○	○	○	○	○	◎	◎	○	○	○	
2.3 Introduction of Collection System on the Mainland of Malay			○	○	○	◎	○				
2.4 Transport of Residual Waste											
3. Disposal											
3.1 Development of Kabulihan SLF			○	○	○		◎				
3.2 Rehabilitation of Old Dump Site			○	○	○		◎				
4. Special Waste Management											
4.1 Introduction of HCW Management System on Boracay				○		◎					
4.2 Introduction of HCW Management System on the Mainland of Malay				○		◎					

Note: ◎ : IEC Program essential for the projects
○ : IEC Program may be needed for the projects

Source: JICA Study Team

7.2 Introduction of Incentive Program

Implementing an integrated and sustainable SWM program requires that incentives as economic assistances are initially available to the MOM. Although the MOM has sufficient leeway to source or finance their respective SWM operations through taxes, the EAF as well as the GCF, an initial infusion of funding is still required to assist them during initial start up periods. As a matter of principle, however, the incentive programs should be designed to encourage the use of more recycled or recyclable materials by the government and private users or other economic incentives that best encourage best SWM practices. Various incentive schemes are suggested in RA9003 for the purpose of encouraging LGUs and business establishments including NGOs to develop or undertake effective SWM as follows:

- Fiscal Incentives (for LGU and private sector)
- Non-fiscal Incentives (for private sector)
- Financial Assistance Program (for private sector)
- Extension of grants
- Incentives to host LGU

In addition to the incentive schemes suggested in RA9003, a series of incentive programs is proposed as shown in Table 7.2-1 aiming at of the 10-year SWM Plan.

Table 7.2-1 Proposed Incentive Programs for the 10-year SWM Plan

<table>
<tr><td rowspan="2">Diversion</td><td colspan="2">Waste Generator</td><td colspan="2">Recycler and End User</td><td colspan="2">Management Sector</td></tr>
<tr><td>Resident</td><td>Business Establishment</td><td>Recycler</td><td>Consumers (Residents and Business Establishments)</td><td>Barangay</td><td>LGU</td></tr>
<tr><td>Source Reduction (3Rs)</td><td>3R-Master Training Service (MOM, 2009)</td><td>-</td><td>Low interest loan for Recyclers (MOM, 2011)</td><td>-</td><td rowspan="2">Reward & Penalty (MOM, barangays, 2011)</td><td rowspan="2">-</td></tr>
<tr><td>Recycle/ Composting</td><td>-</td><td>Reward System for Source Separation (MOM, 2009)</td><td>Optimization System for Selling Price (MOM, barangay, 2011)</td><td>-</td></tr>
<tr><td>Green Purchasing</td><td>-</td><td>-</td><td colspan="2">Green & Blue Label System (MOM, barangay, 2011)</td><td colspan="2">Green Procurement (MOM, barangay, 2013)</td></tr>
</table>

Note: 1) Words and numbers in parentheses show bodies in charge of implementation and time of implementation of the incentive programs, respectively.
2) Recycler means junk buyers, distributors and recycling companies which conduct recycling activities

Source: JICA Study Team

(1) Waste Generator

Two incentive programs are proposed for the waste generators. One is prepared for residents and the other for business establishments.

1) "3R-Master" Training Service

It would be expected to be more efficient in the promotion of diversion to disseminate information and its concept from not only public sectors but also private sectors. Therefore, an incentive system is proposed to promote talking about the diversion among residents. The MOM works to increase the number of individuals who promote the diversion activities together with the MOM and the MRFs. The MOM introduces a training system for residents who have a mind to promote diversion. Residents also can take the training course divided into several steps. Residents who achieve the highest rank will be called "3R-Master" and they are expected to play a role to promote 3R activities. It is a type of Non-fiscal Incentive. Therefore, MOM needs to make the training attractive to participants. It is necessary to give them recognition according to their rank with certifications. Participants will be trained through not only classes but also competitions involving how to tell others about SWM and the environment with enthusiasm. They will simultaneously acquire the knowledge of these topics. It is not necessary to secure many participants because they would disseminate much information as spokespersons. Therefore, MOM has to prepare the opportunities for them to show their achievements in public appearances. They can talk directly and through the local radio.

2) Reward System for Source Segregation

At present, waste generators that do not follow the rule of segregation are reminded or imposed a penalty by the monitoring team. However, not only negative incentives but also positive incentives are expected to encourage waste generators to follow the proper segregation. In particular, the proposed program is an incentive to encourage business establishments to separate waste more than now. Reward is given to those business establishments that separate waste well. Those business establishments could be exempt from of the GCF. The evaluation is done regularly by the monitoring team. A map should be used to show good business establishments regarding source separation. It is useful to know which business establishments do not cooperate well for source separation. Monitoring teams can also instruct business establishments based on the map.

(2) Recyclers and End Users

1) Low Interest Loans for Recyclers

There are not very many recyclers which have a firm management foundation on Boracay or the Mainland of Malay. The recyclers depend on the condition of the recyclables' market and the management condition may deteriorate in the future. It is preferable to reinforce their management bases in consideration of the future possibilities. Financial supports lead to reinforcement of their management bases. Low interest loans are to be expected one of the financial supports to promote recycling activities by the private sectors. They could develop the facilities through reducing the burden of the cost by using this system. The source of the loan could be obtained from the EAF or GCF. However, the system should be

introduced only if the MOM has sufficient funds to implement SWM. Guidelines should be prepared regarding targets and criteria of the loan.

2) Optimization of Selling Prices of Recyclables

Since each MRF deals with recyclers without exchanging information among the MRFs, the profits from recyclables might be not maximized. It is necessary to give recyclers an incentive to buy recyclables from MRFs at a high rate by gathering the information in order to derive the maximum profits from the MRF. The MRF should regularly gather the information on selling prices and delivered terms to each recycler. Especially, the MOM should take an initiative to share the information regarding the recyclers among the MRFs. Based on the information a method of selection of contractors should be developed, including bidding. It is expected for recyclers to buy recyclables from MRFs at high rates. However, not only the selling price but also smooth and stable sales of recyclables should be considered because not only profit but also a continuous and dependable market for the recyclable goods is important from the view point of diversion. From the view point of the maximization of profits of MRFs, it is required to manage activities by recyclers properly. According to need, a system for accreditation of recyclers should be considered.

3) Green & Blue Labels System

Even though all biodegradable waste and recyclable waste are properly segregated at the source and collected, the recycling is not completed without use of the products. Therefore, a system will be introduced to encourage consumers to buy compost or agricultural products cultivated by using the compost or products made from collected recyclables. Consumers can get a point when they buy green or blue label products designated by the MOM and they can get a reward with a certain number of points as shown below. The system could be also applied to business establishments that provide green or blue label products.

- Green: compost or agricultural products cultivated using the compost
- Blue: products made from collected recyclables

A list of object products should be prepared, whose products include materials produced at MRFs and commercially-produced goods. Refillable shampoo bottles is one of the object products. According to need, the MOM can gradually increase the number of items.

(3) Municipality of Malay and Barangays

Incentive programs are proposed for the MOM and barangays who also can be costumers of restructured products in some cases. In particular, the programs are considered from the view point of steady implementation of the diversion. It is necessary to study how to apply these kinds of systems to implement them.

1) Reward & Penalty

It is necessary to introduce an incentive system from the view point of the quantity and

quality in order that barangays steadily and properly promote the diversion in accordance with RA9003. The MOM rewards and supports barangays based on recycling rate. In particular, the MOM will implement countermeasures along with the barangay which has the worst recycling rate.

Recycling Ratio

= (Amount of collected recyclable waste + Amount of collected biodegradable waste) / (Amount of collected recyclable waste + Amount of collected biodegradable waste + Amount of collected residual waste)

Quality control of collected biodegradable waste: it is necessary to utilize them for compost and close the loop of recycling of the biodegradable waste. Segregated biodegradable waste is evaluated on quality to secure the quality of compost. The ratio of foreign material in the segregated biodegradable waste is an evaluation index.

Evaluation Index: Amount of Foreign Material / Amount of Collected (= Segregated) Biodegradable Waste

A percentage value will be set as a standard. Barangays which can not achieve the standard are requested to make additional payments, while barangays which achieve the standard could receive the reward of additional payment.

2) Green Procurement

Public sectors have to take the initiative for using products made of composts and recyclables earlier than private sectors in order to disseminate the activity. A municipal ordinance is proposed to enforce use of products made from biodegradable waste and recyclables by the barangays and the MOM. Barangays and the MOM would be obliged to use the products when they implement public works in accordance with the ordinance. It could be taken for instance that products made of polystyrene foam are utilized for materials of construction of public works.

7.3 Implementation of Market Development

Market development is a significant factor to promote diversion smoothly from the view point of material balance. Especially, daily life on Boracay Island depends upon imported products from outside of the island. To optimally practice diversion, developing the markets not only on the island but also outside the island should be addressed.

7.3.1 Market Development Methods

(1) Collected Recyclables and Products Made from Collected Recyclables

Information on the capacity of recyclers to deal with recyclables is to be regularly revised to assist in selling recyclables stably. Especially, the capacity of recyclers is significant information for stable recycling. Selling price also should be monitored in order to confirm the stability of recyclers and to maximize profits of the MRF. The MRFs should pass wine

bottles (they are difficult to recycle) and marketable recyclable waste to the recyclers for recycling. It is desirable to hand them over together with salable recyclables to recyclers as much as possible.

Polystyrene foam, pulverized or crushed glass, and marketable recyclables could be used to produce products at the MRF. The blocks made from polystyrene foam should be promoted to construction contractors for construction from the view point of "Green Procurement". The MRF will make the products attractive and conducts sales activities to secure individual purchasers. The MRF will try to develop goods made from laminated plastics and open a market for them by 2011. Targets for selling flower pots, etc. are hotels, restaurants and tourists. Methods for developing markets are shown for each target in Table 7.3-1.

Table 7.3-1 Methods for Developing Markets for Collected Recyclables and Products made from Collected Recyclables

Recyclables/ Products	Target	Method for Developing Markets
Collected Recyclables	Recyclers	- To revise the information on capacity and selling price of recyclers in order to stably recycle collected recyclables
Products made from recyclables (Polystyrene foam, Glass)	Tourists, Hotels, Restaurants, and Contractors	- Product development (to make products from recyclables fascinating to consumers) - To involve individual purchasers - To introduce a concept of "Green Procurement"

Source: JICA Study Team

(2) Compost and Agricultural Products Cultivated Using Compost

Compost made from biodegradable waste should be promoted to various possible consumers such as farmers, the general public, hotels and resorts (including golf links) both on Boracay Island and the Mainland of Malay. There are around 275ha of rice fields and 10 ha of vegetable fields in the agricultural areas on the Mainland of Malay, while on Boracay Island it is very minor. With approximately 8,000 square meters, the Eco-park on the Mainland of Malay, which is managed by MOM, has already used a portion of the compost from MRFs (Balabag MRF and Manoc-Manoc MRF). It could be a model of using compost and one of the main users of the compost in the future.

The sales promotion to the farmers is to be conducted including the results of quality and comparative tests and experimental uses of the products. In the experimental tests, the MRFs should ask nearby farmers to use the product. Based on the results of the tests, the MOM should expand the market for compost together with the MRFs.

In addition, the MRFs should secure land to cultivate cut flowers and vegetables, etc. The buffer areas between the surrounding environment and the MRFs, (if it is available) could be used for such purpose. The MRFs should invite the general public and related persons and bodies to the demonstration farm and introduce the activities. The compost products could be sold to hotels and restaurants, and the income can be used to manage the MRF's activities.

To the general public, compost should be promoted for not only kitchen gardens but also

gardening. The MRFs should conduct a lecture on gardening for the general public. Compost should be also promoted to large-scale hotels and resorts including the golf link, which has an area of about 120 ha. The sales price may be changed according to the situation of the market. The current price of compost made from biodegradable waste is 5 PhP/kg.

Flowers and agricultural products cultivated in the MRFs and by the farmers who use the compost produced should be promoted to the hotels, resorts and restaurants not only on Boracay Island and the Mainland of Malay but also in Karibo city. A brand name should be given to the compost and products.

Table 7.3-2 Market Development for Compost, Flowers and Agricultural Products

Compost/ Products	Target	Method for Developing Markets
Compost	- Eco-park - Farmers - General public - Hotels - Golf links	- To change the sales price considering the market - To conduct quality tests, comparative testing and experimental use of the compost - To show how to use compost at demonstration farms at the MRF - Dissemination of the reasons to use more compost in gardening - Introduction of a Municipal Ordinance stipulating compost use by large scale hotels and golf links
Flowers and Agricultural Products	- Hotels - Restaurants	- To expand targets from Boracay to Karibo - To give a brand name to the compost, flowers and agricultural products

Source: JICA Study Team

7.3.2 Organization for Market Development

The MOM should try to fill Boracay Island with products made from recyclables and flowers and agricultural products cultivated by using the compost to give it the image of an Eco-Island. To develop the market, the functions of the MRFs should be built up from the view point of product development, involvement of targets and study of reconstruction technologies. The MRFs should have a space to put samples of products and explain them as the basis of sales promotions.

7.4 Legal System Arrangement

The SB has passed a series of ordinances relating to SWM. Corresponding to the proposed 10-year SWM Plan, necessary legal arrangements such as amendments of the existing MOs or publication of new MOs should be conducted. The amendments of the existing MOs are proposed as summarized in Table 7.4-1.

Table 7.4-1 Necessity of Amendment of the Existing Ordinances

Ordinance		Necessity of Amendment	Contents
No.230	Environmental & Admission Fee	Yes	Changed based on basic rules to be decided (such as raising fees)
No.233	Increasing Garbage Fee	Yes	Changed based on basic rules to be decided (such as raising fees)
No.56	Amending 1990 Garbage Disposal	Yes	In accordance with development of the SLF and minor changes
No.72	Prohibition of Spreading of Human Waste	No	-
No.84	Requiring Owners to Clean their Area	No	-
No.86	Cleaning of Rest/Comfort Rooms	No	-
No.100	Penalizing Certain Acts/Sanitation	No	-
No.98-116	Prohibition of Urinating & Defecating	No	-
No.185	Regulating Garbage Disposal	Yes	In accordance with introduction of new source reduction program
No.188	Requiring Restaurants and Commercial Buildings to have Sewerage	No	-

Source: JICA Study Team

7.5 Organizational Set up for Solid Waste Management

7.5.1 Setting-up of Municipal Solid Waste Management Unit

The Environmental Service has been set up at the MOM with attached environmental officers. Currently, an administrative officer has been moved to the Environmental Service and temporary staff have also been attached. However, as the Environmental Service should take care of not only solid waste issues but also the other environmental issues, the time that can be allocated to SWM by these people is limited. Even though outsourcing of some of the works is being considered for implementation the 10-year SWM Plan, there still is a need to set up an independent unit for SWM, namely the Municipal Solid Waste Management Unit (MSWMU) with enough staff in order to handle the increasing solid waste together with the 17 barangays. The main tasks of the proposed MSWMU are as follows:

- Overall supervision of SWM activities of within the jurisdiction of the MOM
- Secretariat of the MSWMB
- Periodical review, and monitoring and evaluation of progress of the 10-year SWM Plan
- Drafting annual activities, estimating the cost and proposing the budgets to the MSWMB and the SB
- Drafting various SWM administrative tools such as drafting MOs regarding SWM, and operation manuals for the MRFs and the SLF
- Data management regarding SWM, development of databases and issuance of annual reports on SWM
- Development and implementation of IEC programs

- Coordination with barangays and other stakeholders on SMW
- Periodic information exchange with junkshops and recyclers

The proposed organizational set up for SWM is shown in Figure 7.5-1.

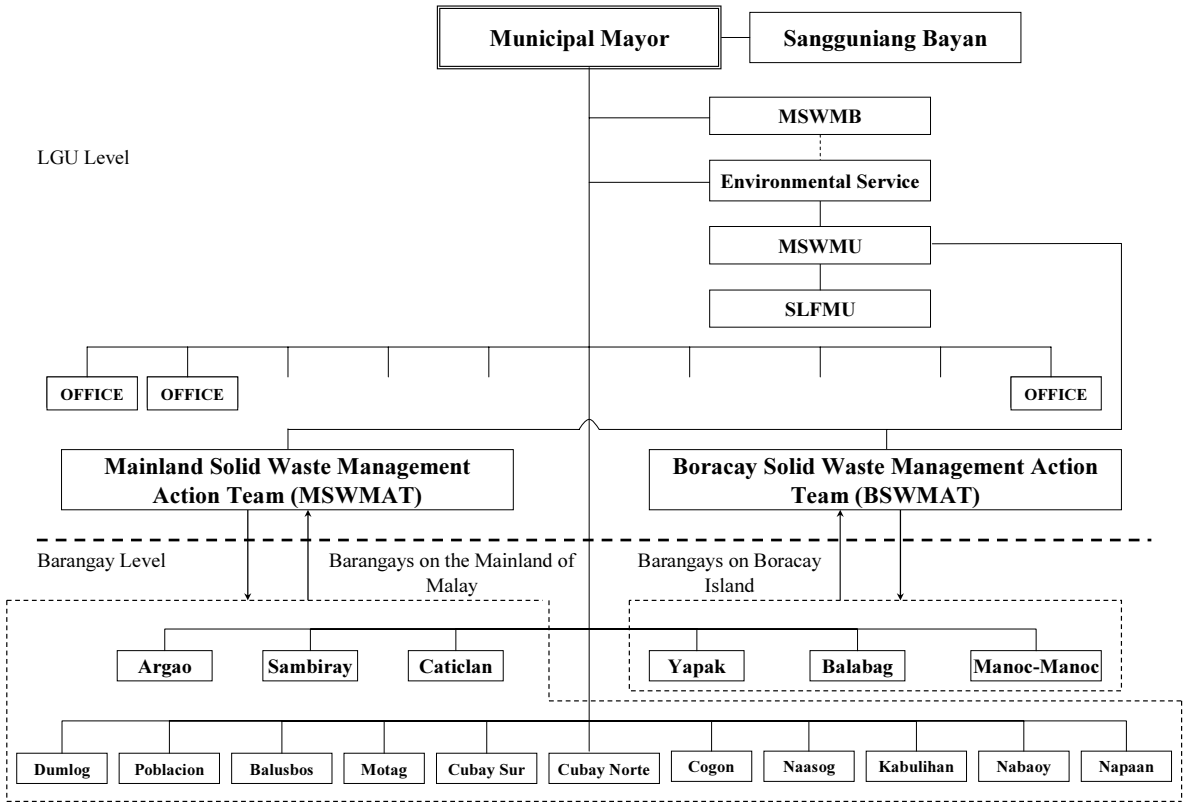

Figure 7.5-1 Proposed Organizational Set-up for Solid Waste Management

Source: JICA Study Team

The SLF Management Unit (SLFMU) is proposed to be set up under the MSWMU. Because a Design Build Operation (DBO) scheme is planned to be used for implementation of this project, the number of members of the unit can be minimal such as a head of unit and staff. The tasks of the unit are to supervise the contractor's works (design, building and operation of the SLF), environmental monitoring and resident correspondences. The Rehabilitation of the Old Dump Site is also to be supervised by the SLFMU.

7.5.2 Setting-up of Special Propose Organizations

(1) Re-Organization of Boracay Solid Waste Action Team

Since other than in order to establish the Manoc-Manoc Centralized MRF, coordination of the barangays on Boracay Island is essential, it is proposed to set up the following organizations to implement these projects smoothly. The Boracay Solid Waste Management Action Team (BSWMAT) has been established under the MSWMB to supervise beach and street sweeping and inspect compliance with the requirement for

segregation at sources, etc. In accordance with the establishment of the Manoc-Manoc Centralized MRF, it is proposed to re-organize the BSWMAT so that the proposed MRF will be managed smoothly. The proposed re-organized BSWMAT is shown in Figure 7.5-2.

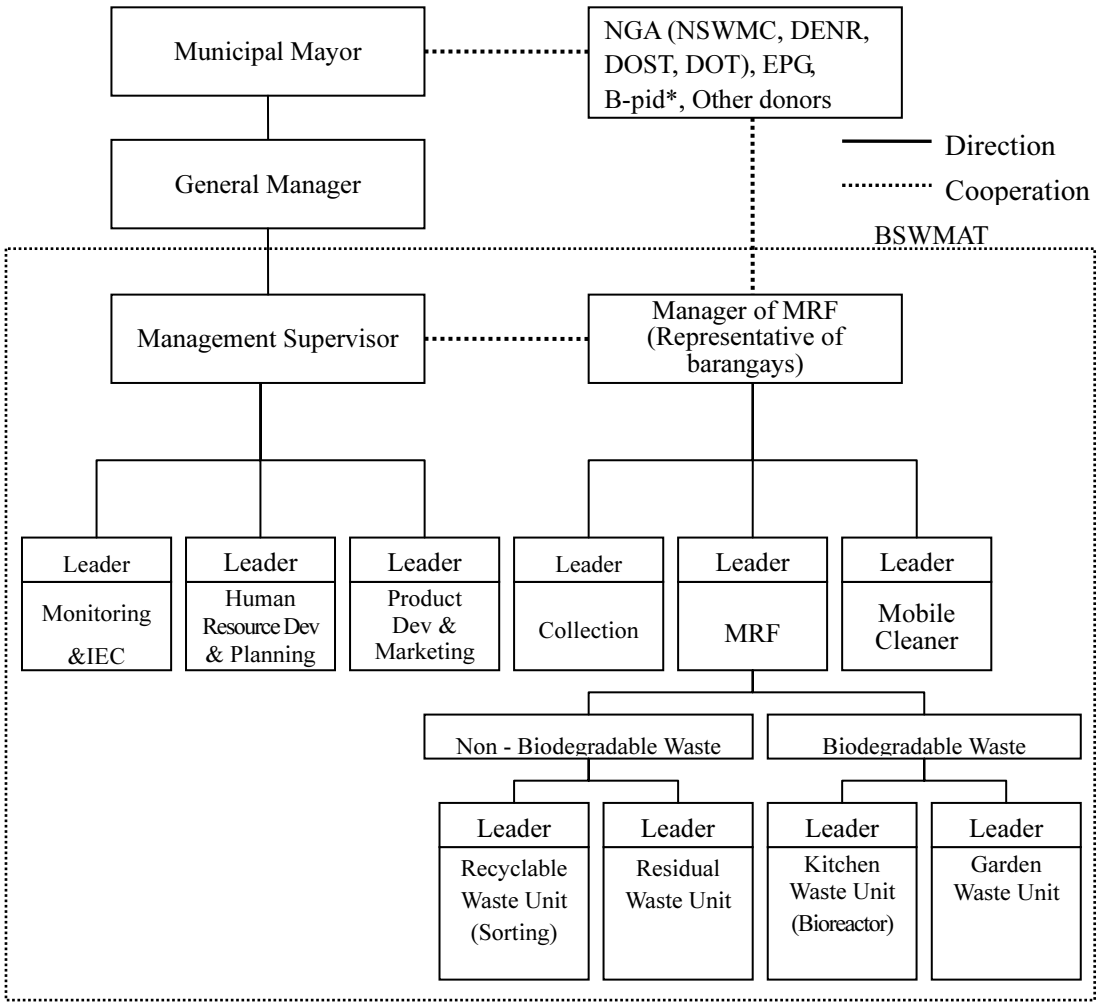

Figure 7.5-2 Proposed Organization of Boracay Solid Waste Management Action Team

Note: 1) B-pid stands for Boracay Private Initiatives for Diversion which is a proposed organization consisting of private sectors on Boracay Island for the environmental conservation activities.
2) Mobile Cleaner means Beach and Street Sweeping.
Source: JICA Study Team

The members of the BSWMAT are drawn from the existing MRFs together with its functions and facilities. The chairperson of the BSWMAT is to be chosen from among the barangays concerned. The functions of the BSWMAT are summarized below and roles of positions are as shown in Table 7.5-1.

- Beach and street sweeping
- Collection of waste (collection of segregated waste from the sources)
- Operation and Management of the MRF

- Monitoring and IEC (monitoring of source segregation and reduction activities, implementation of IEC activities)
- Human Resource Development and Planning (personnel affairs and labor management, accounting, budget control and financial activities, data management and business planning)
- Product Development and Marketing (sales promotion and technology development)

In particular, the Management Supervisor monitors and supports the activities of the Manager of the MRF. Three sections under the management supervisor play the above functions of Monitoring and IEC, Human Resource Development and Planning, and Product Development and Marketing.

Table 7.5-1 Functions of Boracay Solid Waste Management Action Team

Positions	Functions
Mayor	Total management and decisions of Beat activities
General Manager	General supervision and coordination of all aspects of the SWM activities
Manager of MRF (Representative of barangays)	Management of the collection, operation of MRF and beach and street sweeping
Management Supervisor (Person from the MOM)	Overall supervision of other sections
Leaders	Management of each section

Source: JICA Study Team

(2) Establishment of Mainland Solid Waste Management Action Team

Same as the above, it is proposed to establish the Mainland Solid Waste Management Action Team (MSWMAT) under the proposed SWM Section of MOM. The head and members of the MSWMAT are assigned from the MOM and barangays to be involved. The tasks of the MSWMAT are to operate and manage the Caticlan Cluster MRF as well as various SWM activities on the Mainland of Malay such as source reduction by promoting home composting and group recycling, collection and transport of the waste.

7.5.3 Tasks of Organizations Concerned with Solid Waste Management

The MOM has organized the MSWMB as per Executive Order No. 114 dated August 2, 2004. The main roles of the board are to formulate a 10-year SWM Plan and are to oversee the implementation of the plan. The proposed MSWMU is expected to play a role as secretariat of the MSWMB. Although the BSWMAT and MSWMAT are proposed, the LGU Monitors are planned to remain to continue their current tasks. At the barangay level, Barangay Monitors will continue their current tasks as well. The BSWMC, which have been established in some barangays, should be established in each barangay and be encouraged to conduct their tasks. The tasks of organizations concerned with SWM are as shown in Table 7.5-2.

Table 7.5-2 Tasks of Organizations Concerned with Solid Waste Management

Organizations	Tasks	Remarks
Office of Mayor	a) Chairs the MSWMB. Appoints the members of the MSWMB in accordance to with the composition prescribed by RA9003 b) Final approval on recommendations by the MSWMB	
MSWMB	a) Assists the Mayor in preparation and lobbying for approval of budget by the SB b) Assists in decision-making for the direction of SWM c) Makes resolutions for recommendations to the SB	
MSWMU	See above	Newly proposed
BSWMAT	a) Supervises cleanliness and collection of sold wastes generated on Boracay Island b) Supervises establishment and operation of the Manoc-Manoc Centralized MRF	Re-organized
MSWMAT	a) Supervises cleanliness and collection of sold wastes generated on the Mainland of Malay b) Supervises establishment and operation of the Caticulan Cluster MRF and Kabulihan Cluster MRF	Newly proposed
LGU Monitors	a) Orients household owners and checks for compliance by house -to- house inspections b) Monitors compliance of business establishments on a schedule c) Responds to complaints or reports by citizens regarding SWM like burning and dumping by neighbors d) Issues citation tickets to violators and reports to Action Center/MOM e) Coordinates with barangay monitors f) Reports to BSWMAT/MSWMAT manegersmanagers g) Have other tasks as assigned to them by the Mayor	
Barangay Monitors	a) Orients household owners and checks for compliance by house -to- house inspections b) Monitors compliance of business establishments on a schedule c) Responds to complaints or reports by residents regarding SWM like burning and dumping by neighbors d) Issues citation tickets to violators then remits the fines collected to the barangays e) Coordinates with LGU monitors f) Reports to barangay chairman	
Barangay SWM Committee	a) Issues barangay resolutions on SWM b) Arranges MRF workers c) Represents barangay to the MSWMB	

Source: JICA Study Team

7.6 Capacity Development

7.6.1 Implementation of Training Program on Solid Waste Management

All staff members concerned are required to have specific and periodic trainings for the purpose to perform better quality public services on SWM for maintaining cleanliness and sanitation and conserving the living environment. The training is also conducted for those staff that will be attached in newly established organizations, MSWMU and other special purpose organizations including barangays' staffs. The training execution is recorded for

further human resource development and management. The following training courses are proposed to develop human resources to arrange capable staffs of the MOM and barangays as shown in Table 7.6-1.

Table 7.6-1 Training Program on Solid Waste Management

Targets	Training Contents	Methods
MSWMU	- SMW Planning - Annual planning and budgeting (e.g. program based budget) - Supervision of operation of the MRFs and SLF - SW data management - IEC programming and implementation	Off-JT
SLFMU	- Supervision of design, construction, operation, and management of the SLF - SW data management - Payments to contractors, workers, and other expenses (accounting/administration) - Environmental management of the SLF and rehabilitated old dump site including environmental monitoring	OJT and Off-JT
BSWMAT and MSWMAT	- Operational technologies (recycling, and composting) - SW data management - Payments to contractors, workers, and other expenses (accounting/administration) - Environmental management of MRFs including environmental monitoring	OJT and Off-JT

Source: JICA Study Team

7.6.2 Development of Administration Tools for Solid Waste Management

In order to implement the proposed 10-year SWM Plan as well as ordinal SWM operation effectively, a series of administrative tools for SWM is to be developed. The administrative tools consisting of SWM operation manuals and guidelines for the MOM and barangays should be prepared to be used continuously even after the staff/personal change of the MOM and barangays are completed. A solid waste database is also proposed to be developed since various data is expected to be available from the MRFs and the SLF. The collected data should be used for further revision and updating of the 10-year SWM Plan, and consideration of necessary measures. The following administrative tools should be prepared and revised or updated periodically such as every two or three years.

- Solid waste management operational manual for the MOM
- Solid waste management guidelines for the barangays
- Operation and management manuals of the MRFs and SLF
- Solid waste data base of the MOM and at each MRF and SLF (each type of solid waste generated, diversion, collection and transport, and disposal. Inventory of staff, equipment and facilities, etc.)

CHAPTER II-8 IMPLEMENTATION PLAN

8.1 Implementation Plan

8.1.1 Implementation Schedule of the 10-year SWM Plan

(1) Plan Development Stage

The proposed 10-year SWM Plan passes through different stages in its own development, from a modest draft, an official plan in the formative stages of implementation, and to the undertakings that are required to obtain official acceptance from the NSWMC. The following responsibilities are assigned for advancing the 10-year SWM Plan through these stages.

- Plan formulation stage: The MOM and its MSWMB
- Official approval stage: The DENR-Region VI and NSWMC
- Implementation: The MOM and Barangays

The 10-year SWM Plan needs detailed review by the MSWMB and to receive public comments through a series of public hearings to accommodate revisions based on the best judgment and consensus of the board. After adoption by the MOM, the plan should be submitted to the NSWMC for official approval through DENR-Region VI.

(2) Plan Implementation Phase

In order to achieve the targets of the 10-year SWM Plan, the planning period is divided into the following phases:

- 1st Phase: Short-term activities I (2008-2009)
- 2nd Phase Short-term activities II (2010-2011)
- 3rd Phase: Mid-term activities I (2012-2013)
- 4th Phase: Mid-term activities II (2014-2015)
- 5th Phase Long-term activities (2016-2017)

In principle, measures against the current urgent problems identified should be commenced soon as short-term activities. In addition, the activities to encourage on-going measures should also be commenced as short-term ones because they do not need a long preparation time. On the other hand, measures against expected future problems or ones that need preparation for their implementation, such as institutional setting were allocated as mid- and long-term activities.

(3) Implementation Schedule of the 10-year SWM Plan

The proposed 10-year SWM Plan commences with 2008 as the base year and ends in 2017 and it implementation schedule is shown in Table 8.1-1.

Table 8.1-1 (1/2) Implementation Schedule of the 10-year SWM Plan

Strategy	No	Project	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1. Diversion	1.1	**Promotion of Source Reduction**										
	1.1.1	**Introduction of Source Reduction Programs on Boracay Island**										
	1)	Introduction of Waste Reduction (3Bs) Programs										
		"BALIK BAYONG" Program										
		1st Stage: My Bag Campaign										
		2nd Stage Prohibition of Plastic Bag Use										
		"BALIK BOTE" Program										
		"BALIK BIO-WASTE" Program										
	2)	Introduction of Waste Avoidance Program (Prohibition of Specific Package Use)										
	1.1.2	**Introduction of Source Reduction Program on the Mainland of Malay**										
	1.2	**Promotion of Intermediate Reduction at MRFs**										
	1.2.1	**Development of Manoc-Manoc Centralized MRF**										
	1)	Development of Manoc-Manoc Centralized MRF (Phase I)										
		Construction and Equipment Procurement (including Preparatory Works)										
		Operation (including Training of MRF Workers)										
	2)	Development of Manoc-Manoc Centralized MRF (Phase II)										
		Construction and Equipment Procurement (including Preparatory Works)										
		Operation (including Training of MRF Workers)										
	3)	Development of Manoc-Manoc Centralized MRF (Phase III)										
		Construction and Equipment Procurement (including Preparatory Works)										
		Operation (including Training of MRF Workers)										
	1.2.2	**Development of Caticlan Cluster MRF**										
		Construction and Equipment Procurement (including Preparatory Works)										
		Operation (including Training of MRF Workers)										
	1.2.3	**Development of Kabulihan Cluster MRF**										
		Construction and Equipment Procurement										
		Operation (including Training of MRF Workers)										
	1.2.4	**Closure of Existing MRFs (Yapek and Balabag)**										
2 Sweeping and Collection	2.1	**Extension and Improvement of Sweeping**										
	2.2	**Improvement of Collection System on Boracay Island**										
	1)	Revision of Collection Service Area										
	2)	Extension of Primary Collection Service Area										
	3)	Improvement of Source Segregated Collection										
	4)	Improvement of Collection Method										
	5)	Equipment Procurement										
	6)	Human Resources Development										
	2.3	**Introduction of Collection System on the Mainland of Malay**										
	1)	Introduction of Collection Service for the Area of Caticlan Cluster MRF										
	2)	Introduction of Collection Service for the Area of Kabulihan Cluster MRF										
	3)	Procurement of Equipment										
	4)	Human Resources Development										
	2.4	**Transport of Residual Waste**										
	1)	Temporary Transport of Residual Waste										
	2)	Transport of Residual Waste										
3. Disposal	3.1	**Development of Kabulihan Sanitary Landfill**										
	1)	Development of Sub Phase 1A-1										
		D/D, Construction and Equipment Procurement										
		Operation										
	2)	Development of Sub Phase 1A-2										
		D/D, Construction and Equipment Procurement										
		Operation										
	3)	Development of Sub Phase 1B										
		D/D, Construction and Equipment Procurement										
		Operation										
	3.2	**Rehabilitation of Old Dump Site**										
	1)	Rehabilitation Works										
	2)	Environmental Monitoring										

Note: ▬ Projects Implementation (Investment)
▭ Project Operation
┈┈ Project Operation (Patchy Works)

Source: JICA Study Team

Table 8.1-1 (2/2) Implementation Schedule of the 10-year SWM Plan

Strategy	No	Project	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
4. Special Waste Management	**4.1**	**Introduction of Infectious Waste Management System on Boracay Island**										
	1)	Procurement of Equipment										
	2)	Training of Health Care Waste Handlers & Medical Workers										
	4.2	**Introduction of Infectious Waste Management System on the Mainland of Malay**										
	1)	Procurement of Equipment										
	2)	Training of Health Care Waste Handlers & Medical Workers										
5. IEC Program	**5.1**	**Implementation of Public Education and Information**										
	1)	Trainer's Training (include monitors)										
	2)	Campaign and Other Expenses										
	3)	Implementation of IEC Activities										
6. Institutional and Organizational Arrangement	**6.1**	**Introduction of Incentive Program**										
	1)	Incentive Program for Waste Generators										
	2)	Incentive Program for Recyclers and End Users										
	3)	Incentive Program for the MOM and Barangays										
	6.2	**Implementation of Market Development**										
	1)	Training of Trainers for Market Development activities										
	2)	Implementation of Market Development Activities										
	6.3	**Arrangement of Legal System**										
	1)	Amendment of the Existing Ordinances										
	2)	Constitution of New Municipal Ordinances										
	6.4	**Organizational Setting Up**										
	1)	Organizational Setting up at Municipality										
	2)	Re-Organization of Boracay Solid Waste Management Action Team										
	3)	Setting up Mainland Solid Waste Management Action Team										
	6.5	**Introduction of Cost Recovery System**										
	1)	Setting up a Local Common Fund										
		Setting up a Fund and its Basic Rules										
		Operation of the Fund										
	2)	Revision of Garbage Collection Fee System										
		Setting up Basic Rules for Collection (as MO)										
		Enforcement of Garbage Collection Fee Payment (ex. Database)										
		Revision of Collection Fee System (Raising fee, Reward/Introduction to Households)										
	3)	Revision of Environmental & Admission Fee System										
		Setting up Basic Rules of Utilization of Environmental Fee (as MO)										
		Improvement of Fee Collection System										
		Revision of Environmental Fee (Raising fee)										
7. Capacity Development	**7.1**	**Implementation of Training Program on Solid Waste Management**										
	1)	Development of Training Program and Materials										
	2)	Training Program Implementation										
	7.2	**Development of Administration Tools for Solid Waste Management**										
	1)	Development of Solid Waste Management Manual and Guidelines										
	2)	Development of Solid Waste Database										

Note: Projects Implementation (Investment)
Project Operation
Project Operation (Patchy Works)

Source: JICA Study Team

8.1.2 Responsible Organization of the10-year Solid Waste Management Plan

Principal roles of the stakeholders in SMW are discussed in RA 9003 and its IRR. Considering the described roles in the IRR and current SMW practices, the responsible organizations together with supporting organizations which are expected to provide the responsible organizations with their cooperation and contribution are summarized in Table 8.1-2.

Table 8.1-2 Responsible Organizations of the 10-year Solid Waste Management Plan

Project	Responsible Organization	Supporting Organization
1. Diversion		
1.1 Promotion of Source Reduction	MOM/Barangays	DENR, Private sector, residents, tourists
1.2 Promotion of Intermediate Reduction at MRFs		
1.2.1 Development of Manoc-Manoc Centralized MRF	MOM/Barangays on Boracay Island	DOT, DOST
1.2.2 Development of Caticlan Cluster MRF	MOM/Barangays on the Mainland of Malay	DOST
1.2.3 Closure of Existing MRFs (Yapac and Balabag) on Boracay Island	MOM/Barangays on Boracay Island	-
2. Sweeping, Collection and Transport		
2.1.Extention and Improvement of Sweeping	MOM/ Business establishments	-
2.2 Improvement of Collection System on Boracay Island	MOM/Barangays on Boracay Island	Private sector, residents
2.3 Introduction of Collection System on the Mainland of Malay	MOM/Barangays on the Mainland of Malay	ditto
2.4 Transport of Residual Waste	MOM	Private sector
3. Disposal		
3.1 Development of Kabulihan Sanitary Landfill	MOM	NSWMC/DENR
3.2 Rehabilitation of Old Dump Site	MOM	NSWMC/DENR
4. Special Waste Management		
4.1 Introduction of Health Care Waste Management System on Boracay Island	MOM/Hospital and clinics	DENR
4.2 Introduction of Health Care Waste Management System on the Mainland of Malay	MOM/Hospital and clinics	DENR
5. IEC Program		
5.1 Implementation of Public Education and Information	Barangays/MOM	DENR, Private sector, NGOs, schools,etc.
6. Institutional and Organizational Arrangement		
6.1 Introduction of Incentive Program	MOM	Private sector
6.2 Implementation of Market Development	MOM	Private sector
6.3 Arrangement of Legal System	MOM (MSWMB/SB)	-
6.4 Organizational Setting Up	MOM/Barangays	-
6.5 Introduction of Cost Recovery System	MOM	Aklan Province
7. Capacity Development		
7.1 Implementation of Training Program on Solid Waste Management	MOM/Barangays	NSWMC/DENR
7.2 Development of Administration Tools for Solid Waste Management	MOM/Barangays	NSWMC/DENR

Source: JICA Study Team

8.1.3 Monitoring Program

(1) Concept for Monitoring and Evaluation

The proposed 10-year SWM Plan is a long-term strategic plan to be implemented starting in 2008 and running to 2017. In order to ensure the implementation of the plan in an effective and sustainable manner, a monitoring program consisting of monitoring and evaluation needs to be put in place. They should be based on objective information and data collected and recorded regularly to measure against predetermined indicators to assess progress.

1) Monitoring

Monitoring of the plan implementation should be conducted at two levels. First, the targets are calculated and measured to identify the effectiveness of the proposed projects. It is suggested that benchmarks are the targets that they should be achieved by the end of the short, medium and long-terms of the 10-year SWM Plan. Every three or four years, the actual achievement levels should be measured against the targets to assess the progress.

The second level of monitoring of the plan is conducted when the MOM formulate their annual budget. Based on the existing policy priorities, availability of resources, influences from external factors, and lessons learned from the past implementation of the plan, the contents of the plan themselves may be reviewed and modified. This process allows enough flexibility so that the projects stipulated in the 10-year SWM Plan could be changed, dropped or new ones added.

In addition, it is recommended that the results of the monitoring exercises, and any modifications made in the plan should be reported to the MSWMB as well as DENR Region-VI and the NSWMC, so that overall progress of the plan could be kept on track.

2) Evaluation

During the milestone years, which are also the final fiscal years within the short and mid terms, respectively, end of term evaluations are recommended to holistically review the plan's implementation from perspectives such as relevance, effectiveness, efficiency, impact and sustainability of municipal activities. In 2017, the final evaluation should be conducted to examine whether the ultimate targets were achieved, and to draw best practices and lessons learned for future SWM plans.

For the end of term evaluations, it is envisaged that a joint evaluation team be formed for the MOM from among the representatives from the NSWMC, DENR Region-VI, barangays, private sector and NGOs. The results of the evaluation are to be disclosed and shared with other cities and municipalities so that the major lessons learned and recommendations could be shared with a wider audience.

(2) Milestones

The milestones in implementation of the 10-year SWM Plan to be discussed are the ones to be used for checking the achievement levels of the targets or drastic changes of the SWM system. They include introduction of new programs such as source reduction, establishment of the MRFs, and commencement of operation of the SLF. Collection and transport includes the milestones of improving or changing collection systems. Table 8.1-2 shows conceivable milestones of the 10-year SWM Plan.

Table 8.1-3 Milestone of the 10-year SWM Plan

Category	Milestone	Year
Diversion	Commencement of new source reduction programs	2008
	Commencement of full-scale operation of the Manoc-Manoc Centralized MRF	2012
	Commencement of operation of the Caticlan Cluster MRF	2010
Collection and Transport	Commencement of the revised collection system on Boracay Island	2009
	Commencement of a new collection system on the Mainland of Malay	2011
Disposal	Commencement of operation of the Kabulihan SLF	2009

Source: JICA Study Team

(3) Monitoring Program

The diversions that were set as targets in the 10-year SWM Plan should be monitored. However, considering the technical and financial constraints of the MOM, a simple and practical monitoring method of the diversions is required. In this context, two types of measurement and calculation methods of the diversions are proposed. One is proposed to be used for the first level monitoring which should be conducted in the milestone years or the long-term intervals, and the other is for the second level monitoring in the short-term intervals.

1) First Level Monitoring

For the first level monitoring, it is recommended to conduct the monitoring by calculating diversion ratios based on the following formula:

[WDR] = {[QWRS] + [QWRM]} / [QWG]

where:

WDR : Waste Diversion Ratio

QWRS : Quantity of Waste Reduced at Source (sold to junkshops, home composting and livestock feeding)

QWRM : Quantity of Waste Reduced at the MRFs (recycled, composted and provided to the farmers for livestock feeding)

QWG : Quantity of Waste Generated

In order to calculate the diversion by this formula, the parameters should be measured or estimated as follows:

QWRS : Interview survey with questionnaires and field survey

QWRM : Measurement at the MRFs (by a weighbridge at the Manoc-Manoc Centralize MRF)

QWG : Survey at generation sources

2) Second Level Monitoring

Since it may take time and expense to grasp the QWG, a simple and easy monitoring method is recommended for the second level monitoring which should be conducted in the short term intervals. Relatively easily available data are the population, the number of tourist arrival, the amount of collected waste which can be measured at the MRFs (by a weighbridge at the Manoc-Manoc Centralize MRF), and the amount of residual waste which can be measured at the MRFs or the SLF. The population data and tourist arrivals can be utilized for estimation of the QWG. The subtraction of the residual waste measured at the MRFs from the total waste collected measured at the MRFs can be used for estimation of the QWRM. In this context, a simple method of diversion calculation is proposed as follows, although increase of collection rate or self-disposal at the source is not considered in this calculation which affects the value of WDR.

$$[WDR\_S] = \{([QWG\_by] \times [TPT\_ty] / [TPT\_by] - [QWC]) + ([QWC]-[QWL])\} / ([QWG\_by] \times [TPT\_ty] / [TPT\_by])$$

where:

WDR_S : Waste Diversion Rate (simple version)

QWC : Quantity of Waste Collected to be measured at the MRFs

QWL : Quantity of Waste Landfilled to be measured at the MRFs or the SLF

TPT_ty : Total Population and Number of Tourists of the Monitoring Year

TPT_by : Total Population and Number of Tourists of the Base Year when First Level Monitoring is conducted

QWG_by : Quantity of Waste Generated of the Base Year

The procedure of diversion calculation is shown in Figure 8.1-1.

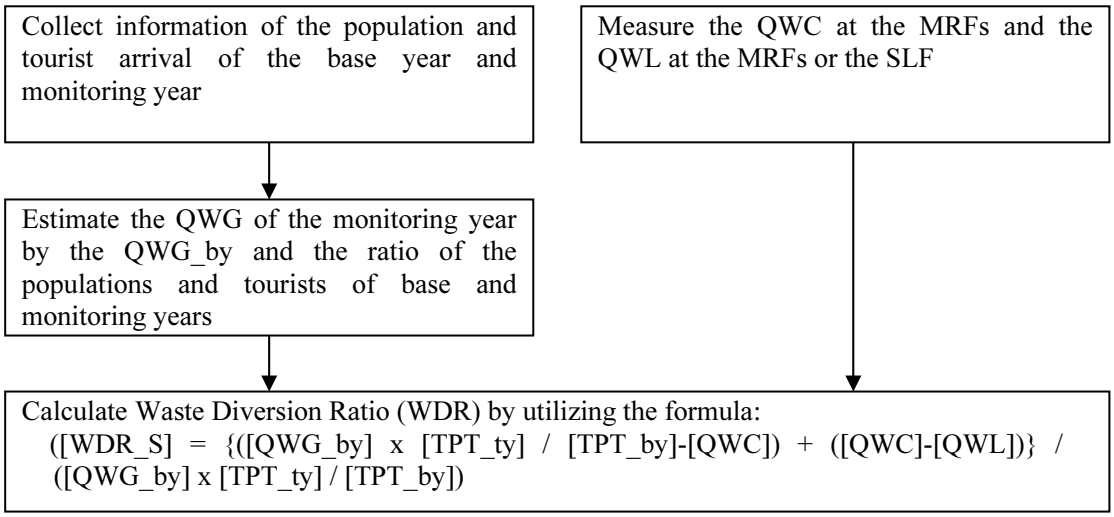

Figure 8.1-1 Procedure of Diversion Calculation Based on the Sampling Data

Source: JICA Study Team

On the other hand, there is no weighbridge available at the MRFs before the full-scale operation of the Manoc-Manoc Centralized MRF. In this period, a relatively easy monitoring method without a weighbridge should be adopted. The following easy monitoring method is proposed.

- Each sack of residual waste is measured by sampling method beforehand.
- During the monitoring, each sack of the residual waste should be counted.
- Multiply the number of the sacks with the amount of a sack which is measured beforehand.

8.2 Priority Projects

Out of the entire 10-year SWM Plan, the priority projects were selected, which are considered to be of urgent need of implementation. The projects are also expected to be a key to open the new era in which the MOM and barangays would promote SWM to the highest level ever achieved by its own capacity. For the implementation of the selected priority projects, the feasibility studies (F/Ss) of them were conducted (see Part III). In the case of the Development of Manoc-Manoc Centralized MRF, the Improvement of the Collection System on Boracay Island was taken into consideration in the F/S because the collection system on Boracay Island needs to be adjusted or improved corresponding for centralizing three MRFs.

8.2.1 Development of Kabulihan SLF

Since the candidate site in Kabulihan barangay on the Mainland Malay has been given from the DENR, the MOM has put the highest priority on developing a sanitary landfill there. However, although the utilization of old dump site on Boracay Island has been suspended except for emergency cases, the sanitary landfill has not been developed yet. The residual waste transported from Boracay Island has been accumulated at the site without proper

measures. Consequently, there are rising concerns about the environmental impacts from the accumulated residual waste such as water pollution and breaking out of vectors as suggested by the residents. As for the MRFs on Boracay Island, they have been having difficulty in coping up with the daily accumulations of residual wastes and a sizeable portion of the MRFs is being spent for the temporal storage of the residual wastes. Therefore, the development of a sanitary landfill is urgently needed to recive the residual waste properly. Accordingly, "Development of Kabulihan Sanitary Landfill was selected as a priority project.

8.2.2 Rehabilitation of Old Dump Site

The previous final disposal site (open dump site) which was closed in January 2006 is located next to a sightseeing spot on Boracay Island. However, the proper closure and rehabilitation has not been conducted and the site has been left unattended. Because it also has been posing potential risks to the surrounding environment, especially on the ground water quality as revealed by the water quality survey of the Study in addition to the degradation of landscape from the sightseeing spot, its rehabilitation is urgently required. Therefore, "Rehabilitation of the Old Dump Site" was selected as a priority project.

8.2.3 Development of Manoc-Manoc Centralized MRF

As the waste generation is expected to increase especially on Boracay Island, handling of increased waste generation would be a burden not only to the MOM but also to the barangays. In order to achieve an integrated and sustainable SWM system, source reduction should be tackled as much as possible. However, even after the attempt of source reduction, further waste reduction is still needed. Since the operational conditions of the existing three MRFs have to be improved against the increased waste on Boracay Island and producing tangible achievements by the source reduction may take time, the development of centralized MRF can not be waited. Therefore, "Development of a Centralized MRF on Boracay" was selected as a priority project.

CHAPTER II-9 COST ESTIMATE AND FINANCIAL ASPECT

9.1 Cost Estimate of the 10-year SWM Plan

9.1.1 Basic Condition of Cost Estimate

The investment costs of the 10-year SWM Plan were estimated based mainly on the design concept for the proposed projects. Prior to the preparation of unit cost breakdowns, material prices, work methodology, qualities and quantities of works, goods and services and assumptions were investigated to ensure that the established unit prices for the various work items are as realistic and accurate as possible including examination of the work conditions (see Appendix II 9.1-1). The basic conditions for the investment cost estimates are as follows:

- Procurement of construction works to be executed through competitive bidding
- Unit prices based on the price level as of July 2007
- Costs of each work item estimated on a unit price basis, except for some work items estimated on a lump sum or percentage basis
- Foreign currency conversion rates:
  USD1.00 = PhP 40.4 = JPY105.3 (as of February 29, 2008)

9.1.2 Unit Price Analysis

(1) Component of Unit Price

The unit prices of construction works consist of direct costs consisting of material, equipment and labor, and indirect costs including overhead expenses, unforeseen contingencies, etc. and profit, and Value Added Tax (VAT) as shown in Figure 9.1-1.

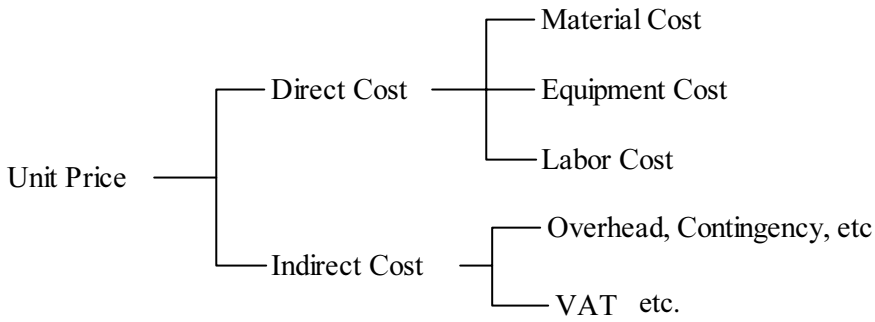

Figure 9.1-1 Components of Unit Price

Source: JICA Study Team

(2) Direct Costs

The costs of construction materials and supplies including the delivery cost to the site were canvassed from the nearest commercial establishments at the proposed construction sites and through suppliers or dealers in Metro Manila for the materials which are not available at the site.

The hourly operated rental rates issued by the Associated Construction Equipment Leasers were applied for the equipment rental rates. The rental rates include the operation cost of the equipment i.e., operators' wages, spare parts, repair, fuel and oil. The labor rates are estimated based on the cost indexes established by the Department of Labor and Employment. The labor wages used in the cost estimate include leaves, bonuses, social security system, Philhealth, Employees' Cost of Living Allowance and employees' compensation.

(3) Indirect Costs

The contractor's indirect expenses were computed as a percentage of the estimated direct costs. These expenses were set as twenty percent (25%) of the direct cost of work items. The indirect cost covers the following items:

- Overhead expenses (supervision, transportation allowances, office expenses, contractor's all risk insurance, financing cost)
- Unforeseen Contingencies
- Miscellaneous Expenses
- Contractor's Profits

VAT is included in the unit prices of the construction works. Twelve (12) percent of labor and equipment costs were counted as VAT in the unit prices. VAT for materials, however, was already included in the unit prices of the materials since they are paid directly by the suppliers.

(4) Basic Estimation Assumptions for the Unit Price Analysis

The daily production of each work was estimated in each breakdown of unit costs. The allowance for waste and inventory loss of materials is estimated in terms of percentage of quantities as follows:

- Cement, Asphalt 3 %
- Processed Materials 5 %
- Reinforcing Steel 3 %
- Others 5 %

The costs for hand tools and small items of a non-mechanized nature as well as miscellaneous cost whose details can not be quantified is included in the unit prices of the construction works. The cost for minor tools is counted as 5 to 15 % of labor cost, while 5 to 25 % of the major materials are used for miscellaneous costs.

9.1.3 Estimate of Investment Cost

The investment costs for the implementation of the 10-year SWM Plan were estimated based on the results of the unit price analysis for work items as shown in Table 9.1-1.

Table 9.1-1 Investment Cost Estimate Method

Component	Estimate Method
1. Construction	Based on the calculated quantities from the preliminary /conceptual design drawings against the computed unit prices
2. Equipment Procurement	Based on the quotations from the equipment distributors
3. Engineering Service (field investigation, detailed design engineering, assistance in tendering and construction supervision, etc.)	5% of construction cost
4. Administration Cost	5% of total cost of construction and E/S
5. Physical Contingency	10% of total costs of construction, E/S and administration, and 5% of equipment procurement cost
6. Price Escalation	5% per year (based on annual growth ratio of Consumer's Price Index from 2000 and normal manner of cost estimate in the Philippines)
7. Investment Cost	Sum of 1-6

Note: See Appendix II-9.1.2 for unit prices
Source: JICA Study Team

The estimated investment cost for the 10-year SWM Plan from 2008 to 2017, which will be categorized as the capital outlay of the MOM budget, is summarized in Table 9.1-2. The investment cost includes the approved 2008 budget of the MOM as the capital outlay (PhP 3,050,000).

Table 9.1-2 Investment Cost for the 10-year SWM Plan (2008-2017)

(Unit: x10^3 PhP)

Project	Investment Cost
1. Diversion	
1.1 Promotion of Source Reduction	0
1.2 Promotion of Intermediate Reduction at MRFs	
1.2.1 Development of Manoc-Manoc Centralized MRF	40,786
1.2.2 Development of Caticlan Cluster MRF	1,555
1.2.3 Development of Kabulihan Cluster MRF	*
1.2.4 Closure of Existing MRFs (Yapac and Balabag) on Boracay Island	2,024
Sub-Total of 1. Diversion	44,365
2. Sweeping, Collection and Transport	
2.1 Improvement of Collection System on Boracay Island	1,948
2.2 Introduction of Collection System on the Mainland of Malay	580
Sub-Total of 2. Sweeping, Collection and Transport	2,529
3. Disposal	
3.1 Development of Kabulihan Sanitary Landfill	56,087
3.2 Rehabilitation of Old Dump Site	8,136
Sub-Total of 3. Disposal	64,223
4. Special Waste Management	
4.1 Introduction of Health Care Waste Management System on Boracay	348
4.2 Introduction of Health Care Waste Management System on the Mainland of Malay	348
Sub-Sub-Total of 4. Special Waste	696
Total (1-4)	111,812
5. Price Escalation	21,546
Grand Total (1-5)	133,358

Note: 1) * Investment cost for the Kabulihan Cluster MRF is included in the cost of the Kabulihan SLF.
2) No investment cost is required for implementation of the IEC program, Institutional Arrangement and Capacity Development.
3) Physical contingency is included in each project investment cost.

Source: JICA Study Team

9.2 Annual Cost of the 10-year SWM Plan

The annual cost for the implementation of the 10-year SWM Plan from 2008 to 2017 is estimated on the basis of the implementation schedule. Since the budget of SWM in 2008 has been approved by the SB of the MOM as PhP 18 million, the annual cost of 2008 was allocated from the 2008 budget for investment cost (capital outlay) and O&M cost, respectively. The annual cost is summarized in Table 9.2-1.

Table 9.2-1 Annual Cost of the 10-year SWM Plan

(Unit: $x10^3$ PhP)

Project	Total	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1. Diversion											
1.1 Promotion of Source Reduction											
1) O&M	1,002	97	155	43	135	88	93	161	106	87	37
Subtotal of 1.1	1,002	97	155	43	135	88	93	161	106	87	37
1.2 Promotion of Intermediate Reduction at MRFs											
1.2.1 Development of Manoc-Manoc Centralized MRF											
1) Investment	40,786	0	4,262	10,365	23,534	0	0	2,625	0	0	0
2) O&M*	50,362	4,166	5,038	6,081	6,223	4,516	4,577	4,612	4,980	5,046	5,123
Subtotal of 1.2.1	91,148	4,166	9,300	16,446	29,757	4,516	4,577	7,237	4,980	5,046	5,123
1.2.2 Development of Caticlan Cluster MRF											
1) Investment	1,555	0	0	0	1,555	0	0	0	0	0	0
2) O&M	3,405	327	330	333	336	339	342	345	348	351	354
Subtotal of 1.2.2	4,960	327	330	333	1,891	339	342	345	348	351	354
1.2.3 Development of Kabulihan Cluster MRF											
1) Investment	-	-	-	-	-	-	-	-	-	-	-
2) O&M	-	-	-	-	-	-	-	-	-	-	-
Subtotal of 1.2.3	-	-	-	-	-	-	-	-	-	-	-
1.2.4 Closure of Existing MRFs on Boracay Island											
1) Investment	2,024	0	0	0	0	2,024	0	0	0	0	0
2) O&M	0	0	0	0	0	0	0	0	0	0	0
Subtotal of 1.2.4	2,024	0	0	0	0	2,024	0	0	0	0	0
Total of 1. Diversion											
1) Investment	44,365	0	4,262	10,365	25,089	2,024	0	2,625	0	0	0
2) O&M	54,769	4,590	5,523	6,457	6,694	4,943	5,012	5,118	5,434	5,484	5,514
Total of 1	99,134	4,590	9,785	16,822	31,783	6,967	5,012	7,743	5,434	5,484	5,514
2. Collection and Transport (Including Sweeping)											
2.1 Improvement of Collection System on Boracay Island											
1) Investment	1,948	0	278	580	232	0	278	580	0	0	0
2) O&M	59,697	4,861	4,982	5,835	5,906	5,848	5,890	5,933	6,785	6,825	6,832
Subtotal of 2.1	61,645	4,861	5,260	6,415	6,138	5,848	6,168	6,513	6,785	6,825	6,832
2.2 Introduction of Collection System on the Mainland of Malay											
1) Investment	580	0	0	0	580	0	0	0	0	0	0
2) O&M	5,033	481	484	488	494	503	506	511	516	522	528
Subtotal of 2.2	5,613	481	484	488	1,074	503	506	511	516	522	528
Total of 2. Sweeping, Collection and Transport											
1) Investment	2,528	0	278	580	812	0	278	580	0	0	0
2) O&M	64,730	5,342	5,466	6,323	6,400	6,351	6,396	6,444	7,301	7,347	7,360
Total of 2	67,258	5,342	5,744	6,903	7,212	6,351	6,674	7,024	7,301	7,347	7,360
3. Disposal											
3.1 Development of Kabulihan Sanitary Landfill											
1) Investment	56,087	5,579	26,099	6,155	1,087	0	15,508	0	1,659	0	0
2) O&M	61,379	7,070	7,474	8,125	8,132	5,743	5,418	5,032	4,837	4,773	4,775
Subtotal of 3.1	117,466	12,649	33,573	14,280	9,219	5,743	20,926	5,032	6,496	4,773	4,775
3.2 Rehabilitation of Old Dump Site											
1) Investment	8,136	222	517	5,289	2,108	0	0	0	0	0	0
2) O&M	900	0	100	100	100	100	100	100	100	100	100
Subtotal of 3.2	9,036	222	617	5,389	2,208	100	100	100	100	100	100
Total of 3. Disposal											
1) Investment	64,223	5,801	26,616	11,444	3,195	0	15,508	0	1,659	0	0
2) O&M	62,279	7,070	7,574	8,225	8,232	5,843	5,518	5,132	4,937	4,873	4,875
Total of 3	126,502	12,871	34,190	19,669	11,427	5,843	21,026	5,132	6,596	4,873	4,875
4. Special Waste Management											
4.1 Introduction of Infectious Waste Management System on Boracay Island											
1) Investment	348	0	0	0	0	348	0	0	0	0	0
2) O&M	744	0	0	0	0	180	184	88	93	97	102
Subtotal of 4.1	1,092	0	0	0	0	528	184	88	93	97	102
4.2 Introduction of Collection System on the Mainland of Malay											
1) Investment	348	0	0	0	0	0	0	348	0	0	0
2) O&M	536	0	0	0	0	0	0	178	182	86	90
Subtotal of 4.2	884	0	0	0	0	0	0	526	182	86	90
Total of 4. Special Waste Management											
1) Investment	696	0	0	0	0	348	0	348	0	0	0
2) O&M	1,280	0	0	0	0	180	184	266	275	183	192
Total of 4	1,976	0	0	0	0	528	184	614	275	183	192

Project	Total	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
5. IEC Program											
5.1 Implementation of Public Education and Information											
1) O&M	716	134	101	111	0	125	0	120	0	125	0
Total of 5	716	134	101	111	0	125	0	120	0	125	0
6. Institutional Arrangement											
6.1 Introduction of Cost Recovery System											
1) O&M	3,216	48	192	192	192	432	432	432	432	432	432
Subtotal of 6.1	3,216	48	192	192	192	432	432	432	432	432	432
6.2 Introduction of Incentive System											
1) O&M	3,700	0	500	400	400	400	400	400	400	400	400
Subtotal of 6.2	3,700	0	500	400	400	400	400	400	400	400	400
Total of 6. Institutional Arrangement											
1) Construction	0	0	0	0	0	0	0	0	0	0	0
2) O&M	6,916	48	692	592	592	832	832	832	832	832	832
Total of 6	6,916	48	692	592	592	832	832	832	832	832	832
7. Capacity Development											
7.1 Organization Setting Up											
1) O&M	0	0	0	0	0	0	0	0	0	0	0
Subtotal of 7.1	0	0	0	0	0	0	0	0	0	0	0
7.2 SWM Training											
1) O&M	1,200	100	200	0	300	0	300	0	0	300	0
Subtotal of 7.2	1,200	100	200	0	300	0	300	0	0	300	0
7.3 SWM Administrative Tool											
1) O&M	400	0	100	0	100	0	100	0	0	100	0
Subtotal of 7.3	400	0	100	0	100	0	100	0	0	100	0
Total of 7. Capacity Development											
1) O&M	1,600	100	300	0	400	0	400	0	0	400	0
Total of 7	1,600	100	300	0	400	0	400	0	0	400	0
8. Total											
1) Investment	111,812	5,801	31,156	22,389	29,096	2,372	15,786	3,553	1,659	0	0
2) O&M	192,290	17,284	19,656	21,708	22,318	18,274	18,342	17,912	18,779	19,244	18,773
3) Price Escalation	82,617	1,154	5,208	6,951	11,080	5,704	11,607	8,738	9,758	10,610	11,806
Total	386,719	24,239	56,020	51,048	62,494	26,350	45,735	30,203	30,196	29,854	30,579

Note: O&M cost of the Manoc-Manoc Centralized MRF includes the cots of O&M of Yapak and Balabag MRFs while these MRFs are operating.

Source: JICA Study Team

9.3 Funding Options

9.3.1 Possible Revenue Sources

The MOM should arrange necessary budget to implement the 10-year SWM Plan steadily. Several kinds of revenue sources can be considered to implement the 10-year SWM Plan as shown in Table 9.3-1. In principle, it is proposed that the general taxes and incomes of the MOM and barangays which go into the General Fund should be used for SWM with the highest priority as stable revenue sources. The Internal Revenue Allotment (IRA) of the MOM and barangays could also be considered as sources for repayment of loans if necessary. However, it is expected that not all necessary costs for SWM can be covered by the General Fund only; therefore, other possible revenue sources such as the GCF, the EAF, and the MRF's revenue should be considered.

Table 9.3-1 Possible Revenue Sources for the 10-year SWM Plan

Sources	Outline
General taxes and incomes of the MOM and barangays	In principle, the General Fund should be a source to cover the necessary costs for SWM.
Internal Revenue Allotment (IRA) of the MOM and barangays	The IRA is sourced from the development fund of the national government. It can be considered as a source for repayment of a loan.
Garbage Collection Fee (GCF)	The GCF is collected from the business entities. This could be utilized as one of the sources to implement the plan. In addition, the GCF from households (HHs) could be considered.
Penalty charges	Penalty charges to violators could be a source. However, it can not be expected as a main source because of the limited amount.
Profit from sales of recyclables and compost products	The collected recyclables are to be sold at the MRFs and revenue from the sale could be considered as one of the sources. In addition, compost and products made at the MRFs could be sold and the incomes can become one of the sources.
Environmental and Admission Fees (EAF)	Considering the amount of the EAF, it is expected to be used as a source to implement the plan.
Grants	The MOM and barangays have received grant assistance such as the equipment of the MRFs provided by the DOT. Although it could be considered as a source, it is difficult to count on grants in the plan.
Donations from the private sector	The MOM and barangays have received donations of equipment from the private sector such as collection vehicles and some equipment of the MRFs. Although it is expected to be a source, it is difficult to quantify secure donations in the plan.

Source: JICA Study Team

9.3.2 Arrangement of Loan

(1) Necessity of Loan

Several relatively large scale investments (construction of facilities and procurement of equipment) are proposed in the 10-year SWM Plan, i.e. development of the SLF, establishment of centralized MRF and rehabilitation of the old dump site. These investments require relatively large budgets which increase the total amount of costs for SWM, especially during the first half of the plan period as shown in Figure 9.3-1. However, it would be difficult to cover these costs with only the annual revenues of the MOM and barangays; therefore, the amount of cash needed to cover the annual costs should be arranged through loans for investments.

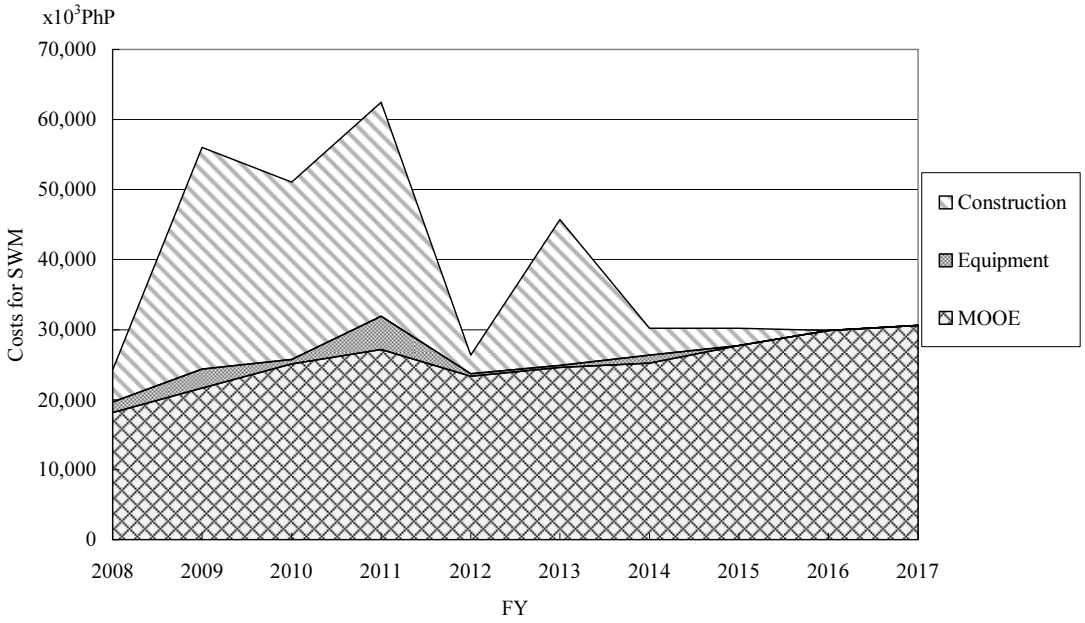

Figure 9.3-1 Total Cost for SWM for the 10-year SWM Plan

Note: MOOE: MOOE stands for Maintenance, Operation and Other Expenses
Source: JICA Study Team

(2) Arrangement of Loans

Two possible local funding banks have been identified, i.e. the Land Bank of the Philippines (LBP) and the Development Bank of the Philippines (DBP). Both funding entities are Government Owned and Controlled Corporations (GOCCs) and commit themselves in partnership with the LGUs. However, as prescribed in their respective policies and procedures, they have different criteria or requirements for lending. The conditions of the LBP and DBP as possible funding sources are shown in Table 9.3-2.

Table 9.3-2 Possible Funding Sources for Solid Waste Management

Funding Agency	LOCAL Land Bank of the Philippines (LBP)	Development Bank of the Philippines (DBP)
Eligible Borrowers	- LGUs (Municipalities, Cities and Provinces) - Public utilities and private operators providing local infrastructure services (in partnership with the LGUs)	- LGUs - Private enterprises (with at least 70% Filipino ownership) - Government Owned and Controlled Corporations (GOCC)
Eligible Projects for Financing	- Construction, upgrading and rehabilitation of basic local infrastructure facilities such as: - Waste collection, treatment and disposal - Solid waste management facilities including construction of SLF, etc. - Procurement of equipment in support of the infrastructure Services	- ^Waste collection and transport including collection vehicles and other equipment - Facilities for waste treatment and processing - Construction of SLFs including acquisition of equipment for waste disposal and treatment - Closure and rehabilitation of existing dump sites - Consulting services for project preparation and implementation
Max. Loan Amount	- Based on the requirements of the project but not more than the net borrowing capacity of the borrower - For public utilities and private operators providing local infrastructures services the Max. Loan Amount shall be based on the projected sub-project cost flow but shall not exceed PhP 500 million	- Not exceeding 90% of the total project cost (LGU and GOCCs) - Not exceeding 80% of the total project cost for Private Enterprises
Lending Terms/Commitment Fee	- 0.75% on undisbursed sub-loan amount - 1% Front End Fee at signing of loan agreement	- 0.25% per annum on undisbursed loan amount
Interest Rate	- Special financing rates fixed for the term of the loan	- Prime, fixed rate based on market rates and total project cost evaluation at the time of the loan (9.5-12%, according to the information gathered from DBP)
Repayment Period	- Not to exceed 5 years and based on the cash flow status	- 12 years Maximum with 3 years grace period

Source: LBP and DBP

It is recommended that the DBP is preferable and suitable to arrange loans for the 10-year SWM Plan because of the following reasons:

- Sustainable Solid Waste Management Program (SWMP) is in place
- Commitment fee is lower compared to the LBP
- Repayment period is more convenient for the LGU compared to the LBP with a difference of seven years
- Willingness to offer step by step (or project by project) financial assistance to the LGUs for the SWM projects

(3) Estimation of Costs for SWM with Loan

The costs for SWM with loans from DBP are estimated under the following conditions as shown in Figure 9.3-2. As it is seen in the figure, total cash to cover the annual cost can be

reduced in 2009 and 2010. However, total costs for SWM increase at a rate of approximately 5% due to the necessary interests for the loans.

Targets of Loan

- Development of Kabulihan Sanitary Landfill in 2009 and 2010 (35,899x10^3PhP, excluding 10% of minimum equity participation)

Criteria for Loan

- To complete the repayment of the loan within the plan period
- To minimize the amount of repayment per year as much as possible
- To minimize the total amount of the repayment

Repayment Conditions

- Repayment term: five years (to minimize the amount of repayment per year within the plan period)
- Grace period: three years (to relieve the burden of expenses in 2009, 2010 and 2011))
- Payment method: Amortization method. Equal principal repayments (to minimize the amount of interest, the amount of payment in this method is less than in the method of equal principal and interest repayments.)
- Interest:11%
- Equity participation: 10% of the loanable amount according to a requirement of DBP

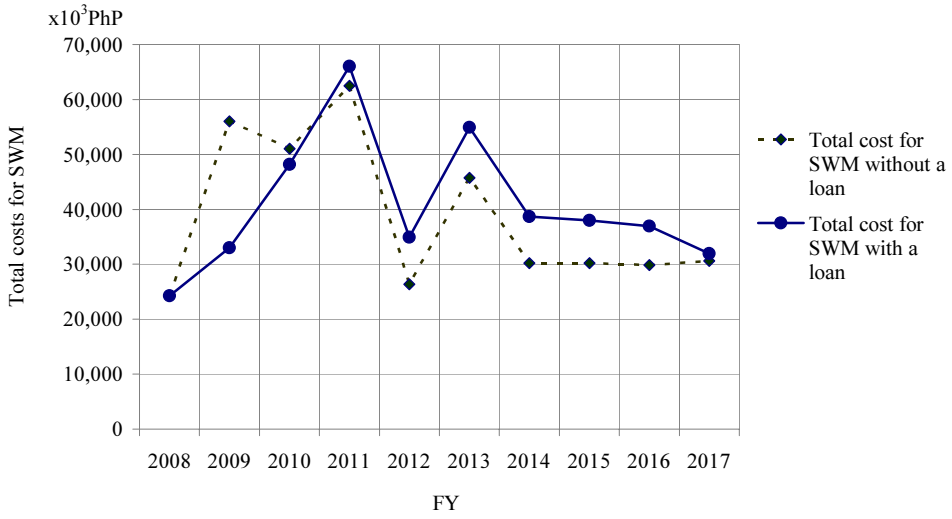

Figure 9.3-2 Comparison of Total Costs for SWM with and without a Loan

Source: JICA Study Team

(4) Self-Sustaining Fund and Loan

It is necessary to consider which costs should be applied to the DBP and also which should be covered by self-sustaining fund. The funding sources can be broken down into the self-sustaining funds and the loans using the DBP. The MOM should absorb 10% of the total cost of eligible projects for financing according to the DBP. On the other hand, since

the following items can not be covered by the DBP, the MOM has to arrange the self-sustaining funds for 100% of those costs.

- Purchase of land
- Cost of taxes and duties
- General administrative expenses

(5) Principle Cost Recovery with Funding Options

When the MOM applies for a loan, the cost recovery should be considered for the repayment of the loan including the interest in addition to the other costs for implementation of the 10-year SWM Plan. In principle, investment costs including the repayment of the loan and disposal costs could be sourced from the General Fund and other sources. However, the IRA can be allocated in order to repay the loan, and therefore, it is proposed to use the IRA prior to the other sources. Recurring costs including O&M costs related to the collection and processing at MRFs, which are the responsibility of the barangays, could be sourced from the GCF, penalty charges and profits from sales of recyclables and compost products. If they are not enough to cover the O&M costs, general taxes or incomes of the MOM and barangays (General Fund) could be allocated. The costs relating to biodegradable waste and recyclables should be covered by the barangays while the residuals should be covered by the MOM. Subsidies from the national government agencies (NGAs) and private sectors are expected for the facilities construction and equipment procurement as well as various IEC programs. Regarding promotion of source reduction, institutional and organizational arrangements and capacity development, these costs should be basically sourced from the general fund. The proposed principle funding options for each SWM cost are discussed in Table 9.3-3.

Table 9.3-3 Principle Funding Options for Each Cost

Items \ Revenues		GCF	Profit from sales of Compost and Recyclables	IRA of Barangays	IRA of MOM	General taxes or incomes of Barangays	General taxes or incomes of MOM	EAF	Grants/ Donations
Biodegradable waste and Recyclables	Construction	●		●				●	●
	Equipment	●		●				●	●
	O&M	●	●			●			
Residuals and Special waste	Construction	●			●			●	●
	Equipment	●			●			●	●
	O&M	●					●		
IEC Program		●	●			●	●	●	●
Promotion of Source Reduction, Institutional Arrangements, Capacity Development		●				●	●		
Others		●				●	●		

Note: ● means that the revenue is a main source for the items of expenditures.
Source: JICA Study Team

9.4 Cost Sharing

9.4.1 Basic Concept of Cost Sharing

(1) Amount of Waste Generated from Major Waste Generators

In order to recovery the necessary costs for the 10-year SWM Plan, it is proposed to share the costs among the related bodies. Normally, it is preferable that all cost for SWM is borne by the general budgets (general fund) of the MOM and barangays. However, if this is difficult, waste generators may be requested to bear some costs based on the amount of waste generated in accordance with the polluter pays principle (PPP).

Considering possible cost sharing systems, major waste generators are divided into residents and business establishments. This is because the GCF is being collected from the business establishments at present and possibly the GCF could be imposed on the residents as well. Table 9.4-1 shows the projected amount of waste generated from the residents and business establishments at the target year (2017) of the 10-year SWM Plan. About 30% of the waste is projected to be generated from the residents while 70% will be from business establishments in 2017. This ratio between the residents and business establishment would not be changing during the period of the 10-year SWM Plan.

Table 9.4-1 Amount of Waste Generated by Major Waste Generators

Category	Amount of Waste Generated (ton/day)		Major Waste Generators	Amount of Waste Generated in 2017 (ton/day)	
	2007	2017		Residents	Business Establishments
Households	6.1 (32%)	10.0 (34%)	Residents	10.0	-
Institutions	0.1 (1%)	0.1 (0%)	Business Establishments	-	0.1
Streets/Beaches	0.2 (1%)	0.3 (1%)	Residents/ Tourists	0.15	0.15
Shops/Markets	4.9 (26%)	8.4 (24%)	Business Establishments/ (Residents/Tourists)	-	8.4
Restaurants	2.9 (15%)	5.0 (14%)	Business Establishments/ (Tourists)	-	5.0
Hotels	4.9 (26%)	8.9 (26%)	Business Establishments/ (Tourists)	-	8.9
Total	19.1 (100%)	32.7 (100%)	-	10.2 (31%)	22.6 (69%)

Source: JICA Study Team

(2) Possible Cost Sharing Cases

Based on the above discussion for cost sharing and the condition below, the cost sharing cases are proposed as shown in Figure 9.4-1.

- The MOM and barangays should cover the costs for SWM from the General Fund sourced from general taxes and IRA as a base source as much as possible. It is assumed that approximately 15 % of the General Fund could be appropriated for the costs for SWM. The ratio of 15% General Fund of the MOM is set out considering the ratio of SWM expenditures to the total amount of the General Fund in 2006 (14%). The ratio 5% of IRA of barangays is set out considering their affordability.
- A certain amount of profits from the sale of recyclables and compost products could be also considered as part of the base source.
- Residents and business establishments should bear the remaining costs as much as possible if the MON and barangays can not cover the all costs for SWM.
- The EAF from tourists would be appropriated to the costs for SWM if the other sources could not cover the all costs. EAF should be a final resource to cover the costs.

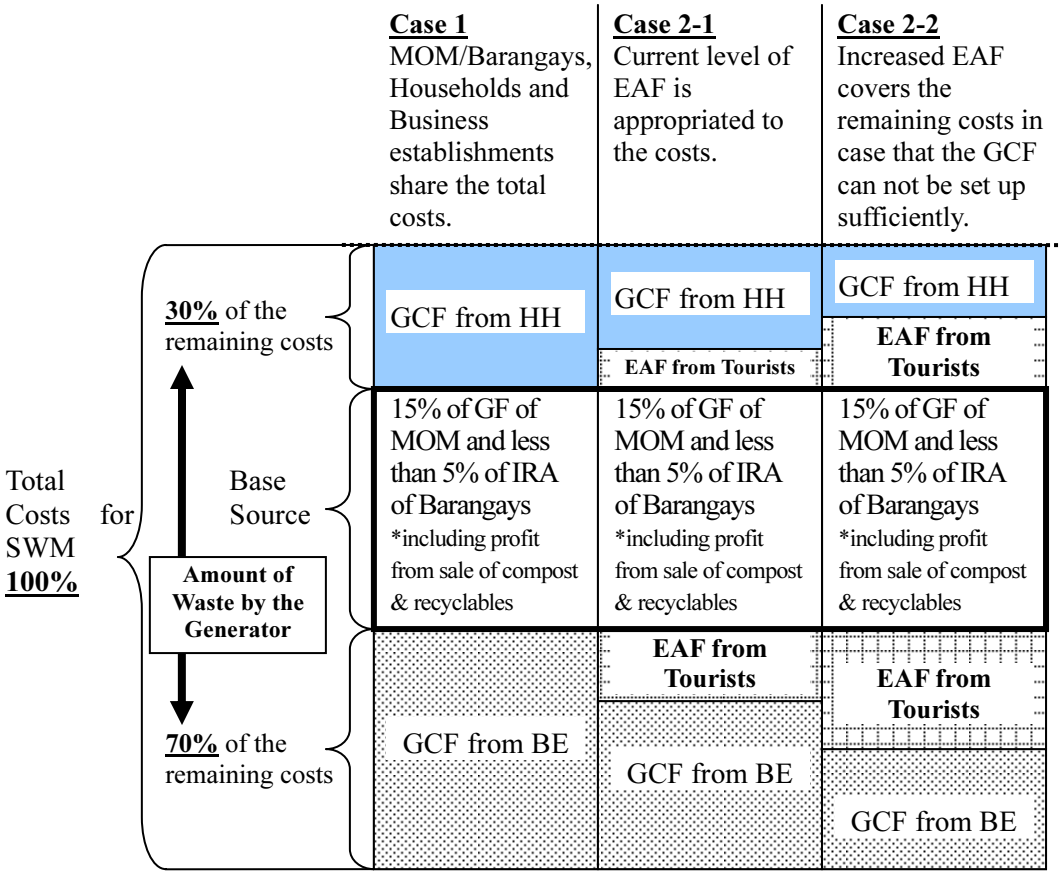

Figure 9.4-1 Cost Sharing Options

Note: GF: General Fund, HH: Household
Source: JICA Study Team

9.4.2 Amount of Costs to be Shared

Based on the concept of cost sharing and estimated costs for SWM with loans, the costs to be shared among the related bodies are calculated as shown in Table 9.4-2.

Table 9.4-2 Average Shared Costs by Related Bodies

($x10^3$PhP)

Cases / Source & Bodies	Case 1		Case2-1		Case2-2	
	Amount per year	%	Amount per year	%	Amount per year	%
GCF from HH	7,826	19	3,545	9	1,208	3
15% of General Fund of the MOM and less than 5% of IRA of Barangays	10,738	26	10,738	26	10,738	26
Profit from Sale of Compost/ Recyclables at MRFs	3,857	9	3,857	9	3,857	9
EAF from Tourists	-	-	14,272	35	16,817	41
GCF from BE	18,261	45	8,271	20	8,063	20
Total Costs for SWM	40,682	100	40,682	100	40,682	100

Note: 1) Individual costs may not add to totals due to rounding.

2) GCF from HH in Case 2-2 is estimated under the condition that it is introduced in October 2008 on Boracay Island and January 2012 (Year of the commencement of operation of Cluster MRF) on the Mainland of Malay (Caticlan, Argao, Sun Viray) and collection rates rise from 60% at the beginning to 80% at the end of term of the SWM Plan.

3) Future amounts of general fund of the MOM and IRA of Barangays are estimated based on IRA/General Taxes from the MOM and Barangays. The amount of general fund of the MOM is estimated under the condition that it is increased according to the increase in the number of tourists because items of their incomes are closely related to the tourists and economic prosperity. The linear least-squares method is used for the estimation. $y = 61.52x + 15410971.24$ ($R^2 = 0.95$)

4) IRA of barangays is estimated under the condition that they increase according to the ratio of the increase in the amount of GF of the MOM. The IRAs of barangays on Boracay Island and Mainland of Malay are counted from 2008 and 2011 (Year of the construction of cluster MRF), respectively.

5) Profit from Sale of Compost/ Recyclables at MRF is estimated on the assumption that half of the compost produced could be sold at PhP 5/kg and recyclables at an average of PhP 1.5/kg. It is assumed that 50% of produced compost sell and the remaining is provided to users with free of charge. In case of the Mainland of Malay, the profit is counted from 2012.

6) EAF in Case 2-1 is estimated under the condition that collection rate of the fee is raised at 75% in 2008, 80% in 2009 and 90% in 2010. The same condition is applied to Case 2-2. Share of the province, 15% of EAF collected at Jetty Port is excluded in this calculation for all cases, and 50% of share of Municipality at current fee of 50 PhP is excluded because it is appropriated to tourism.

7) GCF from BE in Case 2-2 is estimated under the condition that the fee is raised twice, once in 2011 and once in 2016 according to inflation (Annual average of inflation is 5%). In case of the Mainland of Malay, the fee is counted from 2012.

8) These amounts include inflation costs and costs for a loan.

Source: JICA Study Team

The following explains the results of each case in the above table.

(1) Case1

In this case, the MOM/Barangays, households and business establishments would cover the total costs. The MOM and Barangays could cover 26 % with their budget of 15% of GF of

MOM and less than 5% of IRA of Barangays. Profit from sale of compost and recyclables will cover 10% of total costs in all cases. A total of 30% of the remaining cost is for households and 70% is for business establishments. However, unit price of the GCF should be nearly PhP 200 per household per month, and the GCF from business establishments should be raised to about three times the current fee.

These above conditions are not considered to be practical taking into account the current situation because approximately PhP 50 -100 per household per month could be expected based on the result of the public awareness survey. The situation is the same for business establishments. The GCF from business establishments could be raised to 1.6 times the current fee by the end of the term of the 10-year SWM Plan according to the inflation ratio.

(2) Case 2-1

The EAF from tourists should be expected to be appropriated to the costs. However, the current EAF would be kept at the current level of PhP 50 per tourist, and the collection rate of the EAF should be raised to 90% by improvement of the collection method. The remaining costs that total SWM costs minus 15% of GF of MOM and less than 5% of IRA of Barangays, profit from sale of compost and recyclables and EAF equals should be sourced from the GCF. Households and business establishments should share the remaining costs based on the ratio of the amount of waste. As a result, unit price of the GCF should be approximately PhP 90 per household per month. Same as Case 1, it may be difficult for households to share the cost.

(3) Case 2-2

The EAF should be raised to cover the remaining costs under the condition that the GCF from households would be PhP 30 per household per month, while the GCF from business establishments would be raised to approximately 1.6 times the current fee in 2011 and 2016 by the end of the term of the 10-year SWM Plan according to the inflation ratio. In this case, it is necessary to raise annual average of the EAF up to PhP 60 per tourist. However, EAF should be raised to approximately PhP 100 per tourist in order to recover the investment costs during the first four years of the 10-year SMW Plan.

(4) Selected Case for Cost Sharing

Based on the above discussions, Case 2-2 is considered to be the most practical and preferable case. It might be difficult to secure the 15% of the General Funds; however, the ratio of 15% should be a target to implement as an obligation of the public sector. Details of cost sharing based on Case 2-2 are shown in Figure 9.4-2. The mount of PhP shown in the figure is the average value during the period of the 10-year SWM plan. It is proposed that cost sharing should be implemented not annually but for the total period of ten years in order to avoid fiscal rigidity.

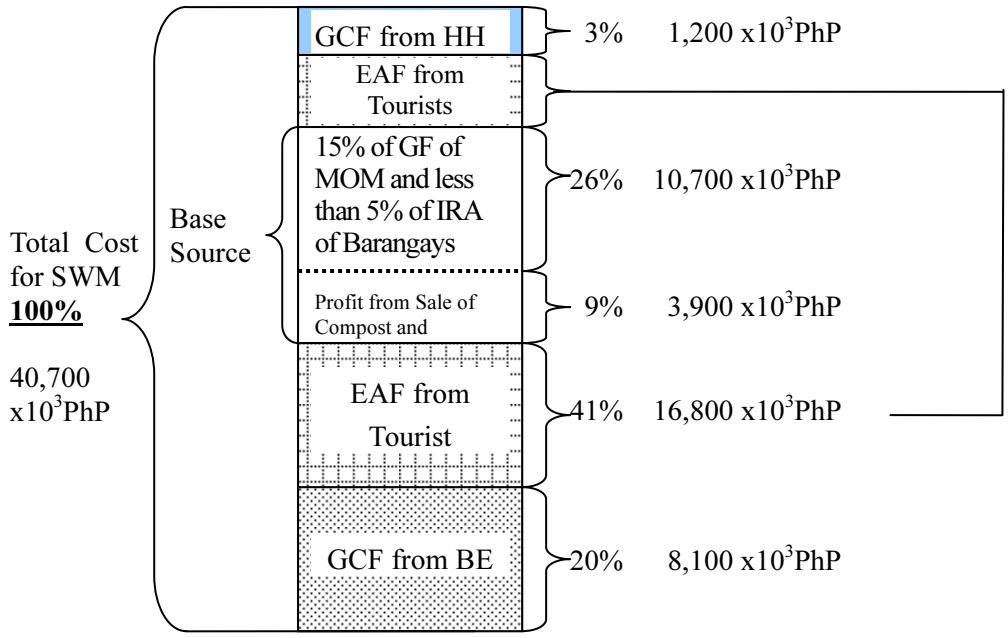

Figure 9.4-2 Cost Sharing Based on Case 2-2

Note: Data in the above figure is not equal to data of the Case2-2 in Table 9.4-2 due to simplicity of the data.
Source: JICA Study Team

9.5 Setting up Local Common Fund

9.5.1 Financial Issues to be Considered

The way that the MOM, barangays, and other concerned bodies, such as donors, manage funds for SWM based on the above cost sharing is also is a key issue. The current main resources, the GCF and EAF are appropriated to SWM expenses separately by the General Fund and the Trust Fund of the MOM. Profits from the sale of compost and recyclables are treated by the MRFs. Each income and expense is treated discretely.

In order to implement the 10-year SWM Plan, especially Maintenance, Operation and Other Expenses (MOOE) of the proposed Manoc-Manoc Centralized MRF, the following issues should be solved in terms of financial aspects:

- How to share the resources for the operation: At present, the MOM is responsible for the collection of residual waste while it is the barangays that are responsible for recyclables and biodegradables in accordance with RA9003. The GCF could be one of the main sources of funds and it is necessary to share the costs between the MOM and the barangays. The question is whether the revenue should be put into either fund.
- How to share the costs for SWM: It should be considered to share the cost for SWM among the barangays or between the MOM and the barangays for operation of the proposed centralized MRF.
- How to simplify the financial management for SWM: Resources for SWM are diversifying such as the GCF and EAF. Donation and grants are expected in addition to the loan to implement the 10-year SWM Plan. Therefore, it is necessary to establish how to allocate such incomes to the implementation.

The unification of the accounting system related to SWM is necessary to solve the above-mentioned financial issues of SWM. The unified accounting system would make the incomes and expenditures of SWM clear and transparent.

9.5.2 Establishment of Local Common Fund

A local common fund could be thought of as a method for the integration of the accounting system. A local common fund (LCF) is proposed as the common fund locally and commonly managed by concerned bodies and the related financial resources are expected to be put into the fund and the expenditures specified. This is also recommended in RA9003. It is proposed that the LCF should be established under the General Fund of the MOM as a special account as shown in Figure 9.5-1.

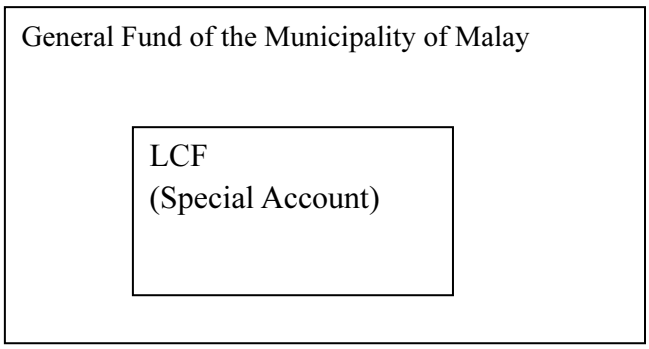

Figure 9.5-1 Image of Establishment of LCF
Source: JICA Study Team

A SB resolution, barangay resolutions and memorandum of agreements are necessary to establish the fund. The special account requires the reporting on financial statements and audits. The advantages of the proposed LCF are as follows:

- To secure resources for specified expenditures
- To secure the transparency of income and expenditures
- To establish the basis for loans and receiving of donations
- To implement partnerships in management among concerned bodies
- To share the costs and benefits among the concerned bodies through the fund
- To simplify the funding system to implement integrated SWM

A Local Common Fund Management Committee (LCFMC) is proposed to be established to approve or decide the management of the fund and forward it to the MSWMB as recommendations. Basically, the following decision-making process should be established as shown in Figure 9.5-2. A guideline for detailed operation and management of the fund should be prepared in cooperation with the concerned bodies.

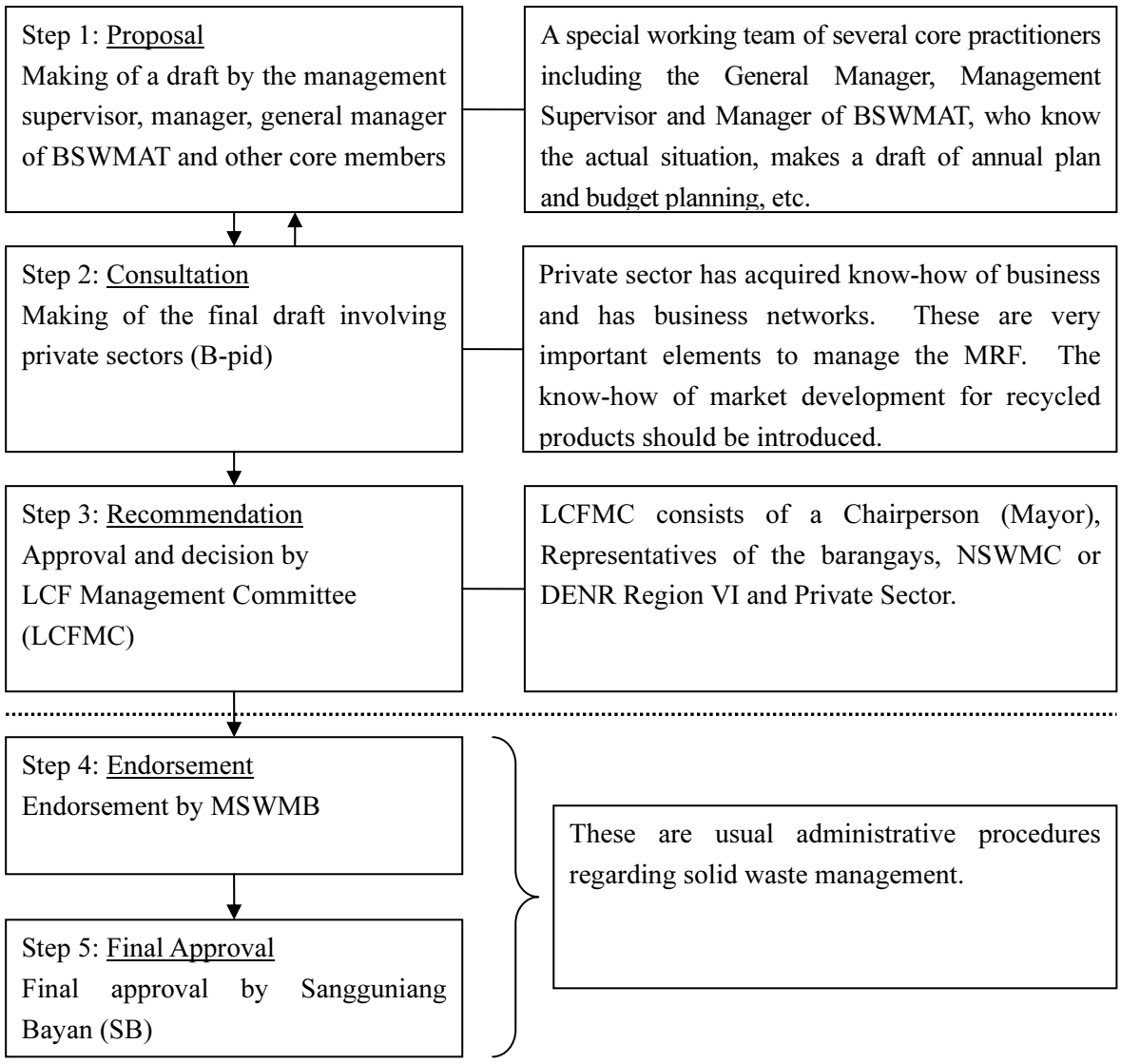

Figure 9.5-2 Proposed Decision Making Process for the LCF

Note: Members of the special team also include Municipal Planning and Development Officer, Municipal Accountant, Department of Interior and Local Government Officer,
Source: JICA Study Team

(3) Management of Local Common Fund

The proposed LCF should be managed mainly for the following points. Especially, the IRA is required to be appropriated to payment of a loan according to a collateral requirement of the DBP. Making of an action plan and evaluation of the projects are necessary in order to manage them.

- Handling of money received and their disbursement
- Evaluation of financial statements
- Decisions on the annual budget
- Undertake resource generating activities

Based on a concept of "Shared Responsibility", both the MOM and barangays have to provide resources for the fund. The amount of IRA that barangays have to provide for the fund would be decided according to each amount of the IRA sourced from the development fund of the national government. It is necessary to decide which type of revenue should be appropriated for a particular expense item. It should be also considered to give an incentive for the MRF members to promote recycling activities. Profits from sales of recyclables, compost and recycling products should be given to them as a bonus (Bonus System).

Two options can be considered for management of the LCF as shown in Figure 9.5-3 and 9.5-4. In the case of donations, it should be decided whether the donation is treated in the LCF (Option 1) or a separate account (Option 2) according to the donor's intention. The process should also be decided based on agreement with the donor. In both options, savings from General Fund and other funds would be considered as a source for LCF after complementation of specified projects.

Table 9.5-1 shows the estimated costs for SWM in each category based on the items of LCF in the Figure9.5-3. The amount in the figure shows shared costs in the Figure 9.4-2. Income based on the cost sharing and expenses would be integrated through the LCF with transparency and simplicity.

Table 9.5-1 Average Annual Costs for SWM

($x10^3$PhP)

Items		Amount of Expenses (per year)
Collection, and Development and O&M of the MRFs		26,328
	Personnel and MOOE	20,666
	Capital Outlay	5,663
Development and O&M of the SLF		12,981
	Personnel and MOOE	3,298
	Capital Outlay	9,684
IEC, Marketing Development, Capacity Development		1,372
Total		40,682

Note: Individual costs may not add to the total due to rounding.
Source: JICA Study Team

Several types of the lines

Each type of income should be used for a specified expense. Therefore, several types of lines are used to clarify the relation between incomes and expenses in the following figure. In case that a type of the line out an income is the same as a type of the line into an expense, the income can be used for the expense.

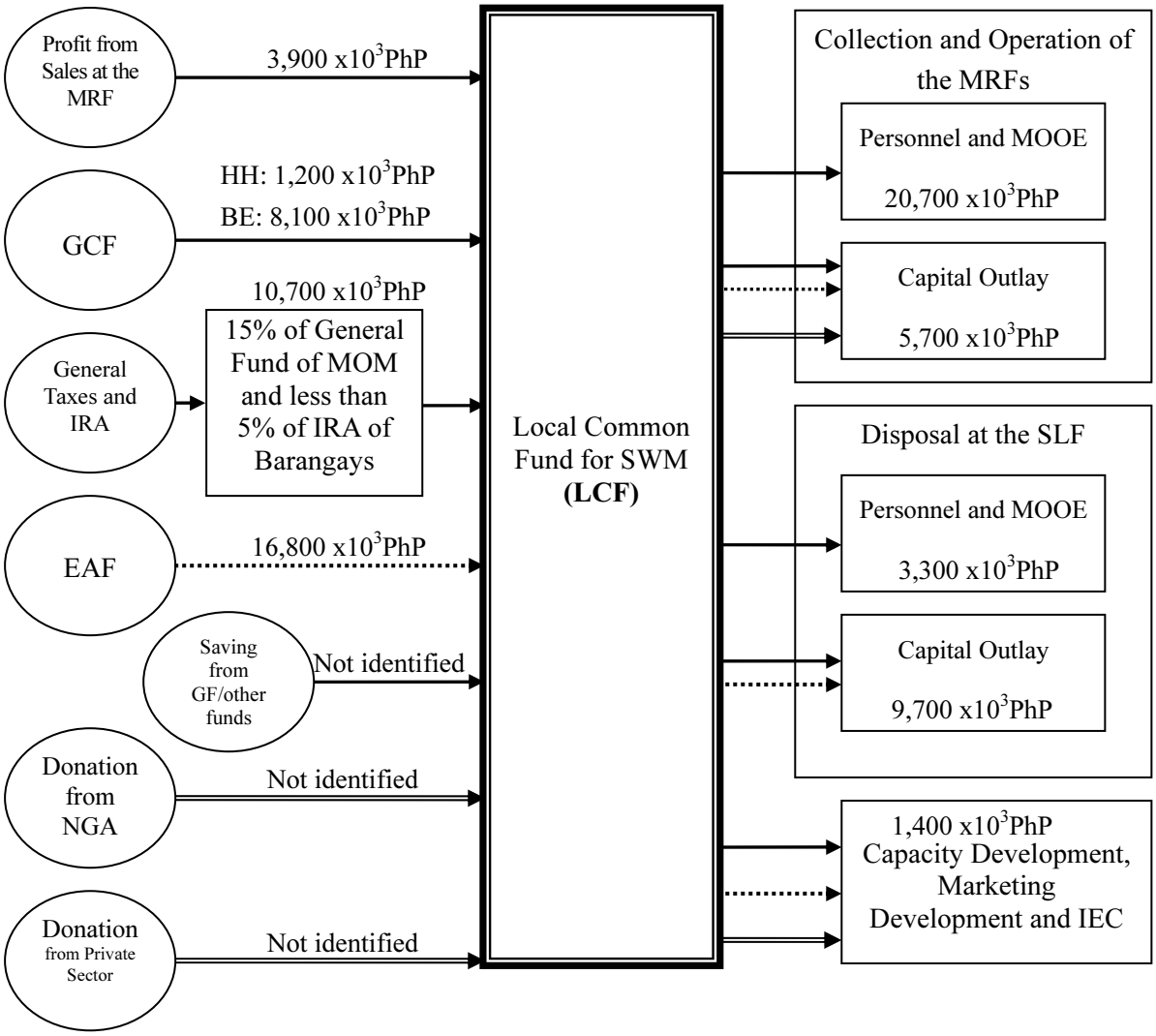

Figure 9.5-3 Management of LCF (Option 1)

Note: 1) Numbers in the above figure show average annual costs.
2) Individual costs may not add to totals due to rounding
3) The MOM has managed SWM with funds from the GCF, the EAF and general tax. In the next 10 years, they should properly manage it based on new principles and appropriate general tax to cover the costs that the waste generators can not pay. IRA should also be positively appropriated to repayment of loans. Barangays are responsible for treatment of biodegradable waste and recyclables in accordance with RA9003. However, they have not contributed to SWM costs yet. It is necessary for them to share the costs that can not be covered by general tax and IRA. Other governmental agencies, such as the DOT, that can share the costs of SWM whether directly or indirectly should be identified.
4) Costs of disposal at the SLF include costs for special waste management.
5) MOOE: Maintenance, Operation and Other Expenses

Source: JICA Study Team

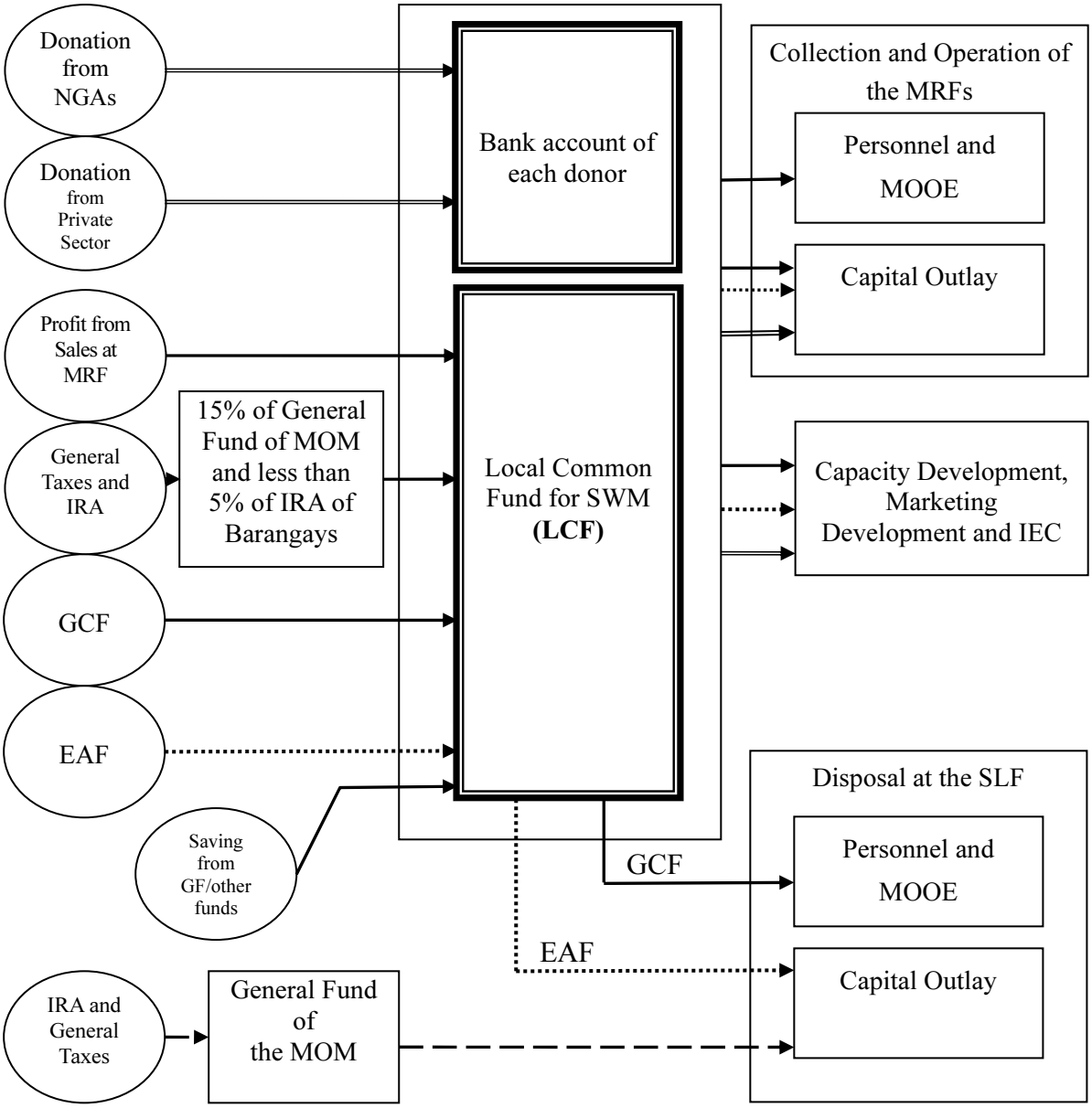

Figure 9.5-4 Management of LCF (Option 2)

Source: JICA Study Team

9.6 Cost Recovery

In the previous section, it was discussed that total cost for SWM during the term of the 10-year SWM Plan would be recovered based on the concept of cost sharing. In this section, it is also discussed if the annual cost for SWM could be recovered and how the MOM could arrange the funds.

9.6.1 Annual Cost Recovery

The EAF is expected to cover the costs other than the costs to be covered by the General Fund and the GCF, etc. If the EAF is increased to PhP 60 per tourist from the current PhP 50, total costs for SWM could be recovered as discussed above. However, since investments for the MRF and SLF are proposed during the first four years of the 10-year SMW Plan, the EAF should be raised to approximately PhP100 per tourist considering the recovery of the costs from 2009 to 2011. Especially in 2009, it will be necessary to raise the EAF to recover the costs. Surplus of the EAF excluding appropriation for the cost recovery should be reserved as capital. Figure 9.6-1 shows the annual cost recovery with 15% of the General Fund of the MOM and less than 5% of IRA of barangays, the GCF from households and business establishments and the EAF from tourists.

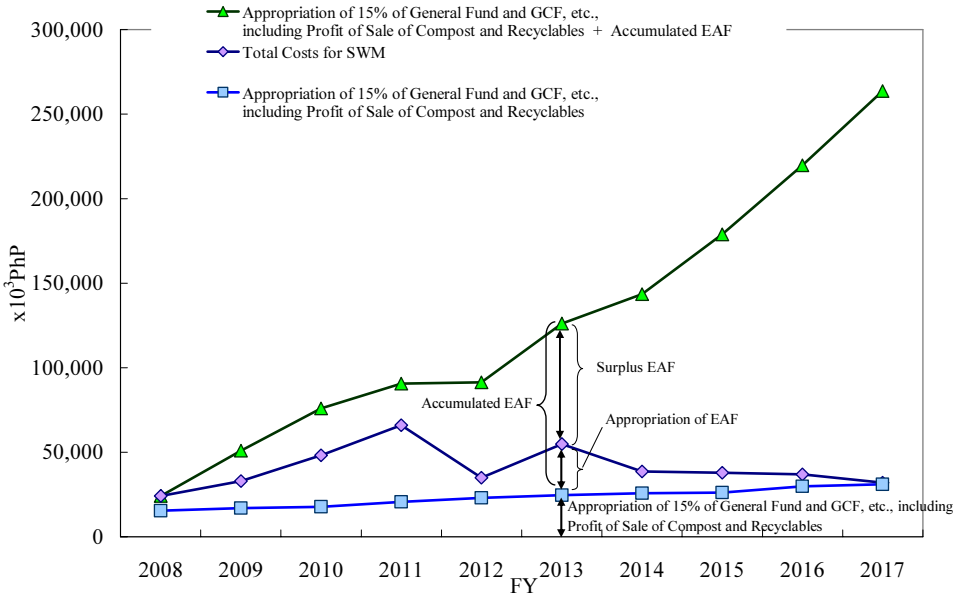

Figure 9.6-1 Cost Recovery during the 10-year SWM Plan (in case of EAF at PhP100)
Note: "15% of General Fund" includes "less than 5% of IRA of barangays" in the above figure.
Source: JICA Study Team

9.6.2 Funding Plan

Table 9.6-1 shows cash flow of the 10-year SWM Plan. "Income from Loan Payable" in cash inflows is appropriated to "Investment sourced from a Loan". "Cash at the End of the Period" means surplus of the EAF. Table 9.6-2 shows a plan for borrowing and repayment based on the repayment conditions set above.

Table 9.6-1 Cash Flow of the 10-year SWM Plan

(x10³PhP)

			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cash Inflows		A	24,240	76,761	64,393	62,677	66,730	69,644	72,264	73,879	78,581	80,898
	GCF from HH		-	677	708	798	1,322	1,446	1,555	1,696	1,820	1,905
	IRA/General Taxes from MOM and Barangays		24,240	8,954	9,305	9,762	10,049	10,310	10,547	10,763	10,962	11,145
	Profit from Compost/ Recyclables at MRFs, etc.		-	1,526	1,742	2,443	3,698	4,468	5,227	5,022	5,732	6,498
	GCF from BE		-	5,764	6,003	7,627	7,973	8,244	8,406	8,630	11,163	11,401
	EAF from Tourists		-	33,944	40,223	42,047	43,689	45,176	46,529	47,768	48,904	49,948
	Income from Loan Payable		0	25,897	6,412	0	0	0	0	0	0	0
Cash Outflows		B	24,240	58,868	54,599	66,046	34,888	54,937	38,696	37,977	36,925	31,956
	Investment Sourced from Self-Sustaining Fund		6,091	8,455	19,504	35,365	3,027	21,155	4,999	2,451	0	0
	MOOE		18,148	21,668	25,129	27,128	23,323	24,579	25,205	27,745	29,855	30,581
	Payment of Principal on Loan Payable		0	0	0	0	5,179	6,462	6,462	6,462	6,462	1,282
	Interest		0	2,849	3,554	3,554	3,359	2,741	2,030	1,319	608	93
	Investment sourced from a Loan		0	25,897	6,412	0	0	0	0	0	0	0
Net Increase in Cash		C=A-B	0	17,893	9,794	-3,369	31,843	14,707	33,568	35,902	41,656	48,942
Cash at Beginning of the Period		D	0	0	17,893	27,686	24,318	56,160	70,867	104,436	140,338	181,994
Cash at End of the Period		F=C+D	0	17,893	27,686	24,318	56,160	70,867	104,436	140,338	181,994	230,936

-

Note: GCF from BE and HH and EAF from Tourists commencing in the later period of 2008 is added in 2009
Source: JICA Study Team

Table 9.6-2 Plan for Borrowing and Repayment

(x10³PhP)

		Total	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cost for the Target Projects	A	35,899	0	28,774	7,125	0	0	0	0	0	0	0
Minimum Equity Participation (10%)	B=A*0.1	3,590	0	2,877	712	0	0	0	0	0	0	0
New Borrowings (90%)	C=A*0.9	32,309	0	25,897	6,412	0	0	0	0	0	0	0
Repayment	D	32,309	0	0	0	0	5,179	6,462	6,462	6,462	6,462	1,282
Outstanding Balance	E	161,544	0	25,897	32,309	32,309	27,129	20,668	14,206	7,744	1,282	0
Interest	F	20,107	0	2,849	3,554	3,554	3,359	2,741	2,030	1,319	608	93
Necessary Expenditures for a Loan	G=B+D+F	56,005	0	5,726	4,266	3,554	8,538	9,203	8,492	7,781	7,070	1,375

Source: JICA Study Team

9.6.3 Revision of GCF and EAF Systems for Cost Recovery

(1) Revision of GCF System

1) Introduction of GCF to Households

As discussed above, it is proposed to introduce the GCF to households at the rate of PhP 30 per household per month in 2008 on Boracay and 2012 on the Mainland of Malay (Caticlan, Argao, and Sun Viray). Based on the approval by the SB in 2006, it should be discussed to establish basic rules of the collection. As shown in Table 9.6-3, two options are proposed, i.e. door-to-door collection and collection through the media of designated bags to discharge waste.

Table 9.6-3 Comparison of GCF Collection Methods from Households

Items	Option 1 (Door-to-Door Collection)	Option 2 (Collection through a media of designated bags to discharge waste)
How to collect	Members of a monitoring team would collect the GCF door-to-door. Or leaders of communities would be asked to collect GCF from the community according to need.	The designated bags with the fee added on the price would be sold at the retail shops and the shops would pay the fee to the municipality.
Advantages	The collection method is simple. It could be done to raise awareness of waste generators at the time of the collection.	It is expected that the collection ratio would rise if the MOM does not collect those wastes which are not properly discharged. It could ensure equity of the burden of the costs among the waste generators because they would pay the costs according to the amount of waste that they discharged.
Disadvantages	Personnel to collect the fees are necessary. It would not ensure equity of the burden of the costs among the waste generators. A lower collection ratio is expected.	There would be costs to produce the designated bags and deliver them (or the MOM and waste generators have to pay the costs). It would be necessary to count the stock of the bags regularly to determine the number of bags sold.

Source: JICA Study Team

It would be the first priority to recover the costs of SWM as much as possible through the GCF collected while ensuring equity between the residents and business establishments. Therefore, a simple collection system is preferable. Based on these ideas, Option 1, door-to-door collection is proposed as the first target for the moment. Option 2 would be the next target in order to ensure equity of the burden of the costs among the waste generators.

2) Revision of GCF System of Business Establishments

It is proposed to raise the GCF from business establishments twice, once in 2011 and once in 2016 according to inflation (Annual average of inflation is 5%). Collection rate of the GCF from business establishments is considered to be high, however, enforcement of the GCF payment should be considered according to need. GCG on Mainland of Malay is proposed to be transferred to LCF beginning in 2012.

(2) Revision of EAF System

1) Improvement of Collection System of the EAF

The collection ratio of the EAF is comparatively low mainly because of the complicated fee collection system. There are three fee counters at the Caticlan jetty port to collect the EAF, terminal fees and boat fees and three kinds of tickets are issued for each of the fees. There is also an EAF collection booth at the exit of the airport. Consequently, arriving tourists hardly understand how to pay three kinds of fees when they are disembarking on Boracay

Island. It also often happens that, especially when many tourists arrive at once, tourists (especially Filipinos) are hard to identify compared with the local residents, and also the persons in charge of inspection of fee payment can not check all tourists at the entrance. Considering these situations, the following methods are proposed in order to improve the collection system of the EAF.

- Dissemination of information on the EAF: It is necessary to let tourists recognize the necessity for payment of the EAF through travel agencies and at the entrance of each port with advertisements.
- Integration of three ticket counters: It is necessary to secure the convenience of tourists and simplify the system to easily recognize the payment. It is also necessary to cooperate with the Province of Aklan that is responsible for collection of terminal fees and the private sector for the boat fees.
- Integration of the three kinds of tickets: Simultaneously with the integration of the ticket counters, it is necessary to integrate the three kinds of tickets so that tourists can pay all fees at once. In this case, the persons in charge of inspection could easily check the ticket at the entrance. There are two options to integrate the tickets. One is to issue tickets made of paper that show information on the three kinds of payment. Second is to hand a ticket made of plastic to tourists as a proof of the payments. Tourists would hand it back to the person in charge of monitoring at the entrance and this kind of ticket could be used repeatedly. However, it is necessary to secure the system to count how many tickets to sell per day in the case of the plastic ticket.

2) Raising Fee of EAF

As discussed above, it is proposed to raise EAF to PhP 100 per tourist in 2009. Basic rules of utilization of EAF should be reconsidered when LCF is established.

9.7 Cost Evaluation and Comparison

9.7.1 Cost for Solid Waste Management

The O&M cost used for cost evaluation includes the costs for the regular services, but it does not include investment costs or management costs such as the IEC program. The cost data is considered for the decade of the period of the 10-year SWM Plan. The cost was calculated in consideration of current value, changing prices and interest of which the conditions are as follows:

- Inflation Rate 5.0%
- Interest Rate on Deposit 6.5%
- Discount Rate 1.5% (Interest Rate – Inflation Rate)

The annual cost during the plan duration is capitalized with a discount rate. Present value costs are shown in Table 9.7-1. Unit cost per weight is estimated at approximately PhP 2,300/ton and annual average cost per resident is PhP 411.

Table 9.7-1 Cost of Solid Waste Management during the 10-year SWM Plan Period

Items	Total Present Value Cost for a decade A	Total Amount of Waste for a decade B	Unit Cost C=A/B	Total Number for a decade D	Annual Average Cost per Resident E=A/D
	PhP	Ton	PhP/Ton	Persons	PhP/Person
Collection& Transportation	95,358,232	74,014	1,288	406,632	235
Processing	49,529,761	74,014	669	406,632	122
Disposal	22,146,442	41,500	534	406,632	54
Total	167,034,435	74,014	2,257	406,632	411

Note: 1) The above costs do not include investment costs or management costs such as the IEC program.
2) Transport cost for the residual waste is included in "Collection & Transportation".
3) Disposal cost includes costs for special cell of health care waste. It does not include running cost of rehabilitation of Old Dump Site.

Source: JICA Study Team

9.7.2 Comparison of Costs for each Component of Solid Waste Management

Figure 9.7-1 shows the cost for each component for the plan duration including costs for regular services and also investment for human resources. The type of cost includes costs for the promotion of source reduction, the IEC program, institutional and organizational arrangements and capacity development. The amount of the cost for collection and transportation is the biggest, and operation and maintenance is bigger than capital investment. Regarding the MRFs' development, operation and maintenance cost is almost the same as capital investment. In the case of disposal, capital investment is bigger than O&M.

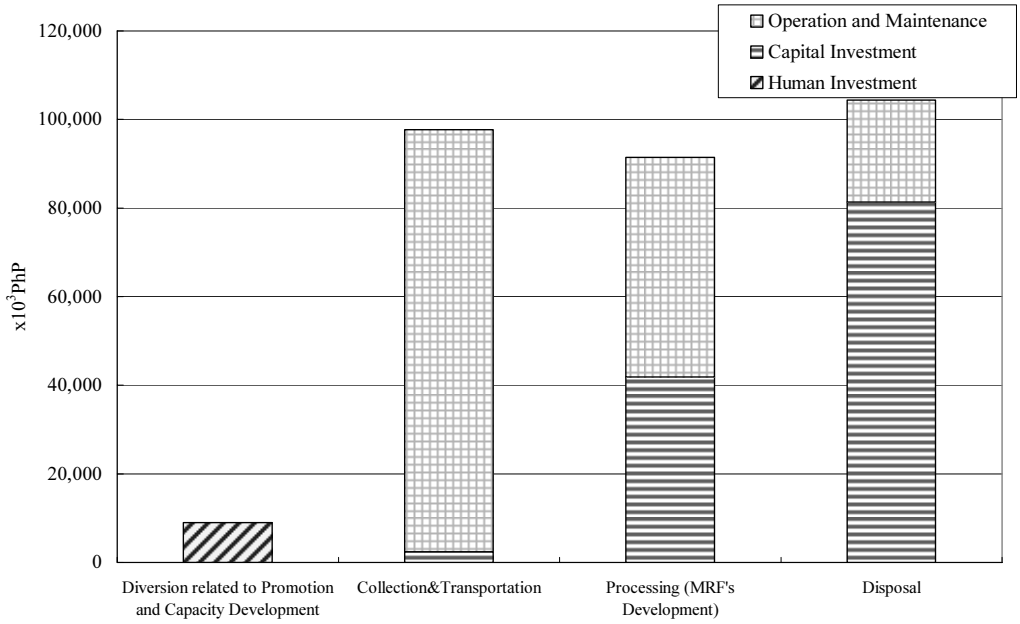

Figure 9.7-1 Sectoral Cost for the Project Duration

Note: 1) The costs in the graph are calculated as present values assuming that interest rate on deposit adopted is 6.5% and inflation rate is 5%.
2) The cost includes cost from a loan for an investment of Development of Kabulihan SLF in 2009 and 2010.
3) MRFs' cost originally is classified into diversion in the proposed 10-year SWM Plan, but it was separated from diversion into processing.
4) Transport cost for the residual waste is included in "Collection & Transportation".
5) Processing costs include costs for Closure of Existing MRFs (Balabag, Yapak).
6) Disposal costs include disposal costs of special waste (health care waste) and costs of Rehabilitation of Old Dump Site.
7) In deed, processing and disposal contain a human resources investment and are included in a part of the costs of collection, processing and disposal.

Source: JICA Study Team

CHAPTER II - 10 SOCIAL AND ENVIRONMENTAL ASPECTS

The formulation of the 10-year SWM Plan is of great significance in the introduction of a suitable SWM system in the MOM. SWM projects proposed in the 10-year SWM Plan include development of facilities which may have both positive and negative impacts on the social and environmental aspects. These social and environmental issues should be taken into consideration for the implementation of the 10-year SWM Plan.

10.1 Environmental Policy Framework in the Philippines

10.1.1 National Policy Objectives

Philippine Agenda (PA) 21 - The national environmental objectives are set out in the Philippine Agenda on Sustainable Development (PASD, 1996), the nation's blueprint for sustainable development. Ecosystem-based action agendas are laid out in the document for forests and uplands, coastal and marine areas, urban areas, freshwater bodies, lowlands and agricultural land, minerals and biodiversity. PA 21 also sets the stage for a paradigm shift in environmental governance, with emphasis on participatory decision making and local-level implementation.

Medium Term Philippine Development Plan (MTPDP) - For the medium term (2004-2010), the environmental sector will pursue ecologically sound development and management of natural resources. The major thrust is the creation of a healthier environment for the population by protecting land, air and water resources, which is also consistent with the 10-Point Agenda of the Arroyo administration and the Millennium Development Goal (MDG 2015) of ensuring environmental sustainability.

10.1.2 Legal and Regulatory Framework

The country has an extensive body of legislation and regulations that provide the legal basis for ensuring that programs and projects are implemented in a sustainable manner. These include the following:

The Philippine Constitution - The country's environmental policy and basic framework for environmental governance is enshrined in Section 16, Article 11 of the 1987 Constitution. It stipulates that the State shall protect and advance the people's right to a balanced and healthy ecology;

Presidential Decree No. 1151 - The Philippine Environmental Policy (1978) makes it a continuing policy for the State (a) to create, develop, maintain, and improve conditions under which man and nature can thrive in productive and enjoyable harmony with each other, (b) to fulfill the social, economic and other requirements of present and future generations of Filipinos, and (c) to insure the attainment of an environmental quality that is conducive to a life of dignity and well-being. In order that the exigencies of socio-economic undertakings can be reconciled with the requirements of environmental protection, the policy lays down

the basic requirement for environmental impact statements (EIS) in the implementation of all government and privately initiated projects;

Presidential Decree No. 1152 - The Philippine Environmental Code (1978) provides the basic guidelines to protect and improve the quality of land, water, air and the natural resources that depend on them. It also defines the guidelines for surveillance and mitigation of pollution incidence;

Presidential Decree 984 - The Pollution Control Law (1976) provides the guidelines for the control of pollution from industrial sources and sets penalties for violations;

Presidential Decree No. 1586 - Enacted in 1979, this law serves as the basic regulatory framework for implementing the Philippine EIS system. PD 1586 mandates that all Environmentally Critical Projects (ECPs) and projects that are located in environmentally critical areas (ECAs) shall not proceed without first securing an Environmental Compliance Certificate (ECC). The ECC shall be issued by the President or his duly authorized representative only upon review and evaluation of the Environmental Impact Assessment (EIA) by the National Environmental Protection Council. NEPC Resolution No. 4 revised the implementing rules and regulations of PD 1586.

Presidential Proclamation 2146 - This proclamation enumerates the projects that are categorized either as ECPs or located in ECAs. Further technical definitions and scope of ECPs and ECAs were embodied in the NEPC Office Circular No. 3 of 1983.

DENR Administrative Order No. 21 - In 1992, DAO 21 abolished the National Environmental Protection Council and placed the responsibility for implementing the EIS system under the DENR-EMB. DAO No. 40 in 2002 rationalized the implementation of the EIS system and clarified the authority for granting or denying of ECC by the EMB Director and the Regional Directors.

DENR Administrative Order No. 37 - DAO 37, Issued in 1996, further strengthens the Philippine EIS system and streamlines the procedures for the conduct of EIA. The new guidelines clarified that ECPs or projects that have a high potential for negative environmental impact are to be subject to a full-scale EIA. Projects in ECAs, on the other hand, are required to go through an Initial Environmental Examination (IEE).

DENR Administrative Order No. 05 - DAO 05 of 2000 introduces a special environmental assessment procedure known as Programmatic EIA for industrial projects located in contiguous areas. Memorandum Circular No. 01 of 2001 provided the scope and guidelines of the programmatic EIS compliance.

10.1.3 EIS System

DAO No. 30, issued in 2003, supersedes DAO 96-37 and revises the Implementing Rules and Regulations (IRR) of the Philippine EIS system. As provided for in DAO 03-30, the following are the categories of projects and undertakings under the EIS system:

- Category A: ECPs with significant potential to cause negative environmental impacts;

- Category B: Projects that are not categorized as ECPs, but which may cause negative environmental impacts because they are located in ECAs;
- Category C: Projects intended to directly enhance environmental quality or address existing environmental problems not falling under Category A or B;
- Category D: Projects unlikely to cause adverse environmental impacts.

For Category A or B projects, the revised procedure for undertaking an EIA study consists of three stages: pre-EIA study, EIA study proper and post-EIA study.

For Category A projects, the pre-EIA stage starts with reconnaissance and pre-scoping meetings between the proponent and the EIA study team. Then, a first-level scoping is held with the DENR-EMB to agree on the scope and level of EIA evaluation (whether EIA or IEE, etc.), potential impacts that should be addressed and key stakeholders who should be consulted. The second-level scoping is conducted on-site through a public consultation with the affected communities and representatives of relevant agencies. The objective is to arrive at a consensus as to the focus of the study as well as the major issues and concerns affecting the stakeholders that should be addressed. The first stage culminates in the preparation of a Scoping Report.

The EIA Study begins with the preparation of a comprehensive environmental profile that will adequately reflect the baseline geo-physical, biological and socio-economic conditions in the receiving and immediate environment. This is done through the collection, collation of and analysis of as much relevant secondary and primary data as would relate to the foreseen potentially significant impacts of the proposed project or undertaking. The main components of the assessment are the identification, prediction and evaluation of the significance of the potential impacts on the profiled environment. The evaluation of environmental impacts under the "without project scenario" is attempted at this point as a comparative reference for management decisions. The evaluation is captured in the Draft EIS Document.

The post-EIA Study stage is characterized by reiterative review and evaluation of the EIS document by the EIA Review Committee, which DENR-EMB convenes for that purpose. The stage is now also set for reiterative public consultations to disclose the findings of the EIA Study to the concerned stakeholders and to incorporate their feedback until all issues and concerns are fully satisfied. This process paves the way to securing the public endorsements (resolutions interposing no objection), which will satisfy the social acceptability criteria necessary prior to final acceptance of the EIS document. Upon the recommendation of the EIARC, the ECC may now be granted (or denied, as the case may be) by the approving DENR authority.

For Category B projects with less significant impacts, the same procedure as outlined above is followed in the preparation of IEE documents but with lesser attention to detail. Also, the scoping exercise is usually skipped. The premise is that the degree and magnitude of potential impacts are deemed to be of lesser significance. However, when actual assessment confirms otherwise, the DENR-EMB may recommend the conduct of a full-scale

EIA.

Category C and D projects would normally need only an IEE Checklist. For typical projects, a checklist document is usually provided by the DENR, to be accomplished by the proponent. All other activities not covered by the EIS system may have the option to secure a Certificate of Non-Coverage (CNC).

DAO 30 also allows for amendment of the ECC conditions, minor or major, depending on the nature of the request. Major alterations in project detail, i.e. a proposal to add new infrastructures or to drastically change the project design and/or the implementation procedures, may require processing of ECC amendments or the conduct of another EIA or IEE study, depending on the nature of potential environmental impacts anticipated due to such changes.

DAO 10, issued in 2006, promulgates the guidelines on the categorization of final disposal facilities or SLFs, in support of Republic Act 9003. There are four categories based on the potential net residual waste generation. The guideline clarifies the ECC requirement for each category, namely: an IEE Checklist for Categories 1 and 2, IEE for Categories 3 and 4 and full-scale EIS for SLFs with a capacity of 1,000 MTPD. DAO 09, issued in 2006, promulgates closure requirements and a schedule of rehabilitation activities. The LGU shall undertake the preliminary closure assessment and must submit the closure plan to the DENR/EMB Regional Office for the Authority to Close (ATC).

The institutional framework for the environment in the Philippines is summarized in Appendix II-10.1.1.

10.2 Social and Environmental Aspects

10.2.1 Summary of Social Aspects

(1) Enhancing 3Rs Activities

The notion of segregation, recycling and composting (all 3Rs activities) is common and, as a rule, they are being practiced on both Boracay Island and the Mainland of Malay. The proposed 10-year SWM Plan would have a positive effect to improve and promote these activities.

In addition to the 3Rs activities, the proposed Manoc-Manoc Centralized MRF could achieve more stringent and efficient segregation. Local junkshops could easily access the well segregated recyclable materials such as cartons and plastics at the centralized MRF. Additionally, junkshops can buy a bigger volume of recyclable materials at a time. This could be cost effective for them. As a result, the centralized MRF could attract more junkshops and contribute to recycling market development.

(2) Considerations on Junkshops and Waste Pickers

On the Mainland of Malay, there is currently no waste collection system except for Barangay

Caticlan and along the main road. Junkshops and waste pickers can take the valuable waste at the sources. However, once the new collection system is established, they may lose their opportunities to pick up the recyclable materials at the sources. The cluster MRF, which will be developed at Caticlan, could be a new place where the junkshops can access the recyclable materials more efficiently. In addition, the cluster MRFs may provide employment opportunities for the waste pickers.

(3) Job Opportunities at the Kablihan SLF

Based on the interview during a social survey by the JICA Study Team, most of the residents around the proposed Kablihan SLF are in favor of the project. They understand that there is no room for the waste disposal on Boracay Island and the SLF is an urgent need. Most of the residents have worked on Boracay Island and benefited from the booming tourist industry. This is the reason why most of the residents support the SLF project. However, they expressed their expectation for employment opportunities which may be created by the SLF. A strategic employment climate for local residents could contribute to the local economy.

(4) Job Opportunities at Manoc-Manoc Centralized MRF

In the course of the development of Manoc-Manoc Centralized MRF, the closure of existing MRFs in Barangays Yapac and Barabag on Boracay Island is inevitable. The workers at the existing MRFs are planned to be employed at the centralized MRF as much as possible. However, the MOM should give support to finding alternative jobs without any loss of income for those who may lose their jobs at the centralized MRF.

10.2.2 Summary of Environmental Aspects

(1) Environmental Improvement by Expansion of Waste Collection

The limited waste collection system on the Mainland of Malay results in the waste being disposed of in backyards or illegal pits. The waste collection is an essential service to secure sanitary and environmental conditions. The waste collection service proposed in the 10-year SWM Plan to cover some barangays on the Mainland of Malay is expected to improve the sanitary and environmental conditions.

(2) Environmental Impacts by Development of the Kablihan SLF

Currently, the residual waste is gathered at the MRFs on Boracay Island and the proposed SLF site on the Mainland of Malay without proper measures. It a concern that it could cause environmental impacts such as groundwater, surface water and soil contamination and bad odors. The development of the new SLF would be an effective measure to prevent this environmental deterioration.

Along with the positive impacts of the new SLF, it has potential risks of causing negative environmental impacts. The contamination of Malay River due to leachate from the SLF is

the biggest concern because the residents along the Malay River catch fish and shrimp, and use the water for their households. To mitigate any possible adverse environmental impacts, an environmental management and monitoring plan (EMMP) and appropriate engineering technologies are critical. The SLF should meet the following essential requirements: i) to minimize the movement of leachate off the site proper sealing of the base and sides of the landfill is necessary; ii) appropriate mechanisms and operations for leachate collection and its treatment must be provided; iii) collection trenches for surface water around the boundaries of the site must be provided; iv) daily or final cover must be provided to minimize rainwater infiltration, smells, and direct contact with the public and animals.

(3) Environmental Impacts by Rehabilitation of the Old Dump Site

Since the suspension of the operation in January 2006, no practical measures have been taken for the old dump site. This has caused groundwater contamination around the site, though they are not serious. In addition, the scenery of the old dump site is not good for the tourists. The rehabilitation of the old dump site would have positive impacts on the environment there.

(4) Environmental Impacts by Development of the Centralized MRF

Offensive odors which may be caused by the waste collected at the centralized MRF or by the composting activities there is one of the biggest concerns of the local residents regarding development of the centralized MRF. Especially, poor handling of bio-degradable waste could be a possible source of odor. It is necessary to consider the proper location of composting machinery (the bioreactor and curing area for the compost) as well as proper handling of biodegradable waste should be considered to minimize the odor impacts on the surrounding area.

10.3 Initial Environmental Examination (IEE)

10.3.1 Target Projects for IEE

Among the several projects proposed in the 10-year SWM Plan, the following projects in Table 10.3-1 were selected for the IEE exercises. All of the selected projects are associated with facility development.

Table 10.3-1 Screening of Target Projects for IEE

Target Project	Location	Screening	IEE Check list
Development of Kabulihan SLF	Mainland of Malay	Some environmental and social impacts are expected such as odors and waste pollution	Prepared
Rehabilitation of Old Dump Site	Boracay Island	ditto	Prepared
Development of Manoc-Manoc Centralized MRF	Boracay Island	Some environmental and social impacts are expected such as odors and water pollution	Prepared
Closure of existing MRFs in Barangays Yapak and Balabag	Boracay Island	No serious environmental and social impact is expected.	Not necessary
Development of Caticlan Cluster MRF	Mainland of Malay	No serious environmental and social impact is expected.	Not necessary

Source: JICA Study Team

10.3.2 Examination Results

IEEs for the respective target projects were conducted based on available environmental and social data and information, and site reconnaissance. The components of the environmental and social considerations were selected referring to the JICA's Guidelines for Environmental and Social Considerations issued in 2004. Tables 10.3-2 to -4 show the results of the IEEs.

Table 10.3-2 IEE Checklist for Development of Kabulihan SLF

Environmental and Social Components	Evaluation	Possible Environmental Impacts	Conceivable Mitigation Measures
Air pollution	B	− During the construction phase, construction equipment may cause air pollution, though the impact will be in a limited area. − Though traffic volume will not be large, waste transportation vehicles may deteriorate air quality. − Landfill gas may be generated.	− Regular maintenance of the equipment and waste transportation vehicles will be conducted during both construction and operation phases. − A gas ventilation system will be installed in the landfill. − Landfill gas will be monitored regularly.
Water pollution	A	− Leachate from the SLF may pollute the quality of groundwater and surface water, especially in Malay River.	− A leachate control system is required to prevent the leachate from flowing out of the site. Retention and recirculation facilities associated with aeration of the leachate will be installed. − In order to reduce the percolation of the leachate to groundwater, a liner system on the bottom of the landfill will be installed. − Peripheral drainage system will be installed for isolation of storm water runoff from the outside of the SLF. − Malay River, groundwater and leachate will be monitored regularly.

Environmental and Social Components	Evaluation	Possible Environmental Impacts	Conceivable Mitigation Measures
Soil pollution	B	− If hazardous waste becomes mixed in with the waste, the soil in/around the landfill site may be contaminated.	− Hazardous waste will not be disposed of in the landfill. − Only, the properly-treated HCW will be disposed of in a separated special cell.
Waste	-	− To improve the solid waste management is the purpose of the project.	-
Noise and vibration	B	− During the construction phase, construction equipment may cause noise and vibration, though the impact will be in a limited area. − Though traffic volume will not be large, waste transportation vehicles may cause noise and vibration.	− Regular maintenance of the equipment will be conducted during both construction and operation phases. − The transportation vehicles will obey a speed limit.
Ground subsidence	N	− There is no plan for large scale groundwater extraction at the site.	-
Offensive odors	A	− The waste disposed of in the SLF may cause bad odors.	− Regular cover soil will be conducted for prevention of bad odors. − Aeration of the leachate retention pond is necessary. − Regular monitoring of odor condition in and around the landfill is recommended.
Geographical features	B	− Geographical features will be changed due to the construction of the landfill.	− Excessive land clearance will be avoided.
Bottom sediment	N	− There is no activity that could cause any impact on bottom sediment.	-
Biota and ecosystem	B	− The ecosystem is diverse in and around the landfill.	− Excessive site clearance will be avoided. − Same measures as for water pollution will be taken.
Water usage	B	− There is no plan for water resource exploitation. − Surface water and groundwater pollution due to the leachate from the SLF could affect the water utilization by local residents.	− Same measures as for water pollution will be taken.
Accidents	B	− There would be a risk of accidents during the construction phase. − The risk of traffic accidents would be increased due to waste transportation vehicles.	− Safety measures in transportation and construction will be taken.
Global warming	N	− Contribution to the global warming is expected to be small.	-
Involuntary resettlement	B	− Involuntary resettlement is not expected. − A private owner insists that the holds entitlement to 1.2 ha out of the 6.2 ha of the proposed area.	− Appropriate procedures should be taken for the acquisition of the land.
Local economy	B	− Employment opportunities can be expected during construction and operation. − The SLF would not attract scavengers because it will receive only residual waste.	− The local people will hired for the construction and operation as much as possible.
Land use and utilization of local resources	N	− The local farmers already cancelled their rights to community based forest management on the SLF site.	−
Social institutions	N	− No impacts on infrastructure or local decision making processes are expected.	-
Existing social infrastructures and services	N	− No impacts are expected.	-

Environmental and Social Components	Evaluation	Possible Environmental Impacts	Conceivable Mitigation Measures
The poor, indigenous or ethnic people	N	− There are no specific issues related to the poor, indigenous or ethnic people.	-
Unbalanced distribution of benefits and damages	N	− Benefits of the local development works will be evenly distributed as long as consultations for the stakeholders are secured.	-
Local conflicts of interest	B	− Local concerns could be raised regarding developing the site unless the consultations with local communities are well organized.	− Consultations among the stakeholders such as developers, operators and local communities are crucial to build mutual understanding and acceptance for the project.
Gender	N	− There are no specific issues related to gender.	-
Children's rights	N	− There are no specific issues related to children's rights.	-
Cultural heritage	N	− There are no specific issues related to cultural heritage.	-
Infectious diseases such as HIV/AIDS	B	− Inflow of new workers for the construction might spread infectious diseases. − If HCW would not be properly treated beforehand, it could cause risk of infectious diseases.	− Precautionary measures such as health education will be conducted to minimize potential impacts. − The SLF will receive only properly-treated HCW.
Others	B	− Propagation of disease vectors such as flies may annoy workers and residents of the surrounding areas.	− Suitable preventive measures such as soil cover will be taken.
Requirement for ECC	Although an ECC was already issued by the DENR-EMB Regional Office on June 2007, the amendment of the ECC is necessary.		

A: serious negative impact is predicted
B: negative impact is predicted to some extent
N: no negative impact is predicted
Source: JICA Study Team

Table 10.3-3 IEE Checklist for Rehabilitation of the Old Dump Site

Environmental and Social Components	Evaluation	Possible Environmental Impacts	Conceivable Mitigation Measures
Air pollution	B	− During the rehabilitation phase, construction equipment may cause air pollution, though the impact will be in a limited area.	− Regular maintenance of the construction equipment will be conducted during the rehabilitation phase.
Water pollution	A	− Leachate which percolates through the old dump site may pollute groundwater, surface and sea water.	− Proper measures to reduce leachate volume, such as a soil cap and installation of storm water drainage system, will be applied. − Sea water and groundwater will be monitored regularly.
Soil pollution	B	− If hazardous waste was mixed in the wastes, the soil in and around the old dumping site may become contaminated.	− Same measures as for water pollution will be taken
Waste	-	− To improve the solid waste management is the purpose of the project.	-
Noise and vibration	B	− During the rehabilitation phase, construction equipment may cause noise and vibration, though the impact will be in a limited area.	− Regular maintenance of the construction equipment will be conducted during the rehabilitation phase.
Ground subsidence	N	− There is no plan for groundwater extraction at the site.	−

Environmental and Social Components	Evaluation	Possible Environmental Impacts	Conceivable Mitigation Measures
Offensive odors	B	− The waste disposed of in the old dump site may cause bad odors.	− The rehabilitation is essential for prevention of bad odors. − Odor condition in and around the site is monitored if necessary.
Geographical features	N	− There may be a positive impact. Geographical features may improve through the rehabilitation of the site.	-
Bottom sediment	N	− There is no activity that could cause any impact on bottom sediment.	-
Biota and ecosystem	N	− The ecosystem is considered to be generally poor and due consideration will be paid to the surrounding forests and biota along the seacoast.	-
Water usage	N	− There are no plans for water resource exploitation.	-
Accidents	B	− There could be a risk of accidents during the rehabilitation phase.	− Safety measures during the rehabilitation will be taken.
Global warming	N	− Contribution to the global warming is expected to be small.	-
Involuntary resettlement	N	− Involuntary resettlement is not expected.	-
Local economy	B	− Employment opportunities are expected by the rehabilitation activities. − Waste pickers used to work at the old dump site. However, owing to employment opportunities at the existing MRFs, there are now few waste pickers at the site and the impact on them would not be significant.	− Although the impact on waste pickers would not be significant, the MOM will monitor waste pickers' movement and take measures such as provision of job opportunities at the centralized MRF if necessary.
Land use and utilization of local resources	B	− There could be a impact on land use and utilization of local resources by obtaining cover soil for the rehabilitation.	− ECC was issued for obtaining cover soil for the rehabilitation on October 2006.
Social institutions	N	− No impacts on infrastructure or local decision making processes are expected.	-
Existing social infrastructures and services	N	− No impacts are expected.	-
The poor, indigenous or ethnic people	N	− There are no specific issues related to the poor, indigenous or ethnic people.	-
Unbalanced distribution of benefits and damages	N	− No impacts are expected.	-
Local conflicts of interest	N	− No impacts are expected.	-
Gender	N	− There are no specific issues related to gender.	-
Children's rights	N	− There are no specific issues related to children's rights.	-
Cultural heritage	N	− There are no specific issues related to cultural heritage.	-
Infectious diseases such as HIV/AIDS	B	− Inflow of new workers for the rehabilitation might spread infectious diseases.	− Proper health education for the workers will be conducted.
Requirement for ECC	An ECC is not necessary. Only the Authority to Close (ATC) is required.		

A: serious negative impact is predicted
B: negative impact is predicted to some extent
N: no negative impact is predicted
Source: JICA Study Team

Table 10.3-4 IEE Checklist for Development of Manoc-Manoc Centralized MRF

Environmental and Social Components	Evaluation	Possible Environmental Impacts	Conceivable Mitigation Measures
Air pollution	B	− During the construction phase, construction equipment may cause air pollution, though the impact will be in a limited area. − Though traffic volume will not be large, waste transportation vehicles may deteriorate air quality.	− Regular maintenance of the equipment and waste transportation vehicles will be conducted during both construction and operation phases.
Water pollution	B	− Water discharged from the site may include some pollutants such as oil and grease. Especially during the rainy season, rain water may run off from the site to surrounding areas.	− To prevent water and rain water from running off, appropriate engineering measures will be applied.
Soil pollution	B	− If hazardous waste would become mixed in with the waste, the soil in and around the site may become contaminated.	− Hazardous waste will not be transported into the Centralized MRF. − Only, the properly-treated HCW will be handled at the Centralized MRF.
Waste	B	− Construction activities will generate a certain amount of construction waste which might lead to illegal dumping.	− Construction waste including waste transfer, disposal and recycling (if practical), will be managed properly.
Noise and vibration	B	− During the construction phase, construction equipment may cause noise and vibration, though the impact will be in a limited area. − Though traffic volume will not be large, waste transportation vehicles may cause noise and vibration.	− Regular maintenance of the equipment will be conducted during both construction and operation phases. − The transportation vehicles will obey a speed limit.
Ground subsidence	N	− There is no plan for groundwater extraction at the site.	− -
Offensive odors	A	− The waste brought to the centralized MRF may cause bad odors. − Composting activities could cause bad odors.	− The location of composting machinery will be decided in consideration of minimizing the offensive odors in the surrounding areas. − Biodegradable waste will be composted as soon as possible. − The residual waste will be transported to the SLF with appropriate frequency. − Odor condition in and around the centralized MRF will be monitored regularly.
Geographical features	B	− Since most of the site is already cleared for the existing MRF, the impacts on geographical features would be small.	− Excessive land clearance will be avoided.
Bottom sediment	N	− There is no activity that could cause bottom sediment.	− -
Biota and ecosystem	N	− The ecosystem in and around the site is poor.	− -
Water usage	N	− There is no plan for water resource exploitation. − Tap water serves the area.	− -
Accidents	B	− There could be a risk of accidents during the construction phase. − The risk of traffic accidents could increase due to waste transportation.	− Safety measures in transportation and construction will be taken.
Global warming	N	− Contribution to the global warming is not expected.	− -
Involuntary resettlement	B	− Several households exist within the site.	− Appropriate procedures will be taken and compensation given for the resettlement.

Environmental and Social Components	Evaluation	Possible Environmental Impacts	Conceivable Mitigation Measures
Local economy	B	− Since existing MRFs in Barangays Yapak and Balabag will be closed, some of their current workers, 15 at Barabag MRF and 12 at Yapak MRF, may lose their jobs. − Employment opportunities are expected by the construction activities. − Employment opportunities at the centralized MRF are expected. − Since waste pickers' activities are hardly seen at the existing MRFs, the impact on them would not be significant.	− Employment opportunities will be provided to the workers who will lose their jobs during the construction as well as at the centralized MRFs as much as possible. − Alternative job opportunities or support to find new job opportunities will be also provided by the MOM. − Although the impact on waste pickers would not be significant, the MOM will monitor waste pickers' movement and take measures such as provision of job opportunities at the centralized MRF if necessary.
Land use and utilization of local resources	N	− Since most of the site is already cleared for the existing MRF, the impacts on land use would not be significant.	−
Social institutions	N	− No impacts on infrastructure or local decision making processes are expected.	−
Existing social infrastructures and services	N	− No impacts are expected.	−
The poor, indigenous or ethnic people	N	− There are no specific issues related to the poor, indigenous or ethnic people.	−
Unbalanced distribution of benefits and damages	N	− Factors that could create unbalanced distribution of benefits and damages are very unlikely.	−
Local conflicts of interest	B	− Local concerns could be raised regarding developing the site unless the consultations with local communities are handled properly.	− Consultations among the stakeholders such as developers, operators and local communities are crucial to achieve good understanding and mutual acceptance for the project.
Gender	N	− There are no specific issues related to gender.	−
Children's rights	N	− There are no specific issues related to children's rights.	−
Cultural heritage	N	− There are no specific issues related to cultural heritage.	−
Infectious diseases such as HIV/AIDS	B	− Inflow of new workers for the construction might spread infectious diseases. − If HCW would not be properly treated beforehand, it could cause risk of infectious diseases.	− Precautionary measures such as health education will be conducted to minimize potential impacts. − The centralized MRF will receive only properly-treated HCW.
Other	A	− Propagation of disease vectors such as flies annoy workers in the centralized MRF and residents in the surrounding areas.	− Suitable preventive measures, such as spraying of insecticide and cleaning the site, will be taken.
Requirement for ECC	An ECC is not necessary, but a CNC is necessary for establishing of the Centralized MRF.		

A: serious negative impact is predicted
B: negative impact is predicted to some extent
N: no negative impact is predicted
Source: JICA Study Team

CHAPTER II-11 EVALUATION

11.1 Technical Aspect

The technical system proposed in the 10-year SWM Plan is summarized along with the solid waste flow. For "diversion", the promotion of composting at generation sources, and again composting and recycling at MRFs are proposed. Proposed composting methods to be used at generation sources are home composting (by home compost bins) and pit composting which have been used in this region and the Philippines. Bioreactors which have been used at the existing MRFs are used continuously. For recycling at the MRFs, basically technologies which have been used previously in the Philippines are planned. As for collection and transport of the garbage, the proposed projects are the extension of the current system in principle. The SLF to be developed at Barangay Kabulihan is designed based on the DAO 10, Series of 2006, which are the principle guidelines to be adopted for sanitary landfills in the Philippines.

From the above discussions, the 10-year SWM Plan is evaluated as technically viable.

11.2 Social Aspect

One of the key social issues of the 10-year SWM Plan is involvement of the residents and business sectors to conduct various SWM activities. It is expected that the plan could encourage tourists as well as local people, and business sectors to cooperate in diversion through source reduction by recycling and composting, and also segregation of the waste for better diversion activities at MRFs. Since these activities have already been conducted in this area, the plan is expected to be accepted by them. On the other hand, introduction of new source reduction systems and institutional arrangements such as setting up a local common fund, revisions of the EAF and GCF are to be conducted step-by-step so that these activities can be accepted by the stakeholders.

As for the facilities development, the MRFs and SLF, careful consultations are planned in order to facilitate implementation of the projects. Especially regarding the development of Manoc-Manoc Centralized MRF, consensus among stakeholders, including workers of the existing MRFs, the junkshops, farmers, and residents near the proposed site are essential. The cooperation of the landowner of the site is also prerequisite. On the other hand, the SLF was designed taking into consideration the people living downstream including a consultation process as part of the ECC.

Consequently, the 10-year SWM Plan is evaluated socially acceptable as a whole but there is still a need to obtain social acceptance, especially for the facilities development.

11.3 Environmental Aspect

Since the closure of the old dump site on Boracay Island, the residual wastes collected have been stored in the exiting MRFs and proposed SLF. Especially at the MRFs, the accumulated residual waste has been causing environmental problems in the areas

surrounding the MRFs. The proposed MRFs and SLF should contribute to mitigate the impacts and accomplish proper handling of the collected waste. The improvement of collection systems are also expected to contribute to mitigate the environmental degradation which has been/may be caused by the uncollected wastes. On the other hand, some environmental impacts would be expected by the facilities development, i.e. the Manoc-Manoc Centralized MRF and Kabulihan SLF. In order to mitigate the environmental impacts, careful considerations of the environment are planned to be conducted. The Kabulihan SLF has been designed based on the DAO 10, Series of 2006.

As a result, the 10-year SWM Plan is evaluated as environmentally sound since no serious adverse impacts are expected.

11.4 Financial Aspect

The cost estimate of the 10-year SWM Plan shows that the necessary costs for the implementation of the plan may be beyond the current financial capability (budget) of the MOM and it requires an increase in revenue. For this, the arrangements of a loan and institutional system for cost sharing are also proposed in the plan and the necessary costs could thereby be covered by the MOM. Therefore, the plan is evaluated as financially feasible.

11.5 Economic Aspect

The implementation the 10-year SWM Plan is expected to contribute to the environmental conservation of the plan area especially on Boracay Island. The environmental conservation of Boracay Island could keep attracting the tourists continuously and also leads to promote further tourism development. Moreover, this could improve the economic situation of the region. Actually, the attractive Boracay Island with the well conserved beautiful environment could be said to be a world heritage. Additionally, it is expected that the environmental conservation especially regarding the sanitation condition relating to solid waste may contribute to decrease the related diseases in the area. Therefore, the 10-year SWM Plan is evaluated as economically feasible.

11.6 Overall Evaluation

The 10-year SWM Plan aims at establishing “A Sustainable and Integrated Solid Waste Management” for the MOM. The proposed plan covers seven major fields to archive the vision. The corresponding projects have been proposed to attain the specific targets of diversion, collection and disposal. It is expected that the implementation of the proposed 10-year SWM Plan could contribute to make all areas of the MOM clean and attractive especially Boracay Island. Considering the above series of evaluations from the technical, social, environmental, financial, and economic aspects, the plan is evaluated as viable as a whole.