



THE REPUBLIC OF THE PHILIPPINES
MUNICIPALITY OF MALAY



NATIONAL SOLID WASTE MANAGEMENT
COMMISSION



JAPAN INTERNATIONAL COOPERATION
AGENCY

THE MASTER PLAN ON SOLID WASTE MANAGEMENT

FOR BORACAY ISLAND
AND MUNICIPALITY OF MALAY
FINAL REPORT
(VOLUME I: EXECUTIVE SUMMARY)



March 2008

NIPPON KOEI CO., LTD.

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AND MUNICIPALITY OF MALAY
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NIPPON KOEI CO., LTD.

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PREFACE

In response to a request from the Government of Republic of the Philippines, the Government of Japan decided to conduct a study on "The Master Plan on Solid Waste Management for Boracay Island and Municipality of Malay" and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Toshiyuki UJIIE of NIPPON KOEI Co., Ltd. between March 2007 and February 2008. In addition, JICA set up the advisory committee supported by Mr. Shiro AMANO and Mr. Taizo YAMADA, Senior Advisor belongs to the Institute for International Cooperation, JICA, which examined the study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of Republic of the Philippines and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

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

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Republic of the Philippines for their close cooperation extended to the study.

March 2008

Ariyuki MATSUMOTO
Vice President
Japan International Cooperation Agency

March 2008

Mr. Ariyuki MATSUMOTO
Vice President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

Dear Sir,

We are pleased to submit herewith the final report of “The Master Plan on Solid Waste Management for Boracay Island and Municipality of Malay”.

The Government of the Republic of the Philippines established the Ecological Solid Waste Management Act, namely RA9003, in 2001 in order to tackle solid waste problems which were becoming year by year. In accordance with RA9003, the local government units (LGUs) shall prepare respective 10-year solid waste management plans. However, since no plan has been approved by the National Solid Waste Management Commission so far, it is necessary to enhance the implementation of RA9003 generating the best practice model.

With this background, the Study aimed at formulating a best practice model for 10-year solid waste management plan for the Municipality of Malay under the collaboration of communities, the LGU, the national level government and the other stakeholders. The proposed plan is expected to be utilized as a reference guide for formulation of the 10-year solid waste management plan of LGUs with similar local conditions in the Philippines.

The proposed plan covers a wide spectrum of issues related to solid waste management on Boracay Island and the Mainland of Malay such as diversion, collection and transportation, final disposal, public awareness, and organizational and institutional arrangements including the cost recovery system which is necessary to implement the plan. The continuous collaboration of the organizations concerned is essential to implement the activities proposed in the plan.

We wish to express our sincere appreciation to the officials of JICA, the Ministry of Foreign Affairs, the Ministry of Environment, the Embassy of Japan for the Philippines, and JICA Philippine Office for their continuous support throughout the Study. Also, we would like to express our great appreciation to all Philippine organizations concerned, especially the members of the Steering Committee for their active participation in the Study.

Finally, we hope that the outputs of the Study will contribute greatly to improve solid waste management not only in Municipality of Malay but also in the local government units of the Philippines, and to foster a long lasting partnership and friendship between the two nations of Japan and Philippines.

Yours faithfully,

Toshiyuki UJIIE
Leader for JICA Study Team



Location Map

VOLUME I : EXECUTIVE SUMMARY

Table of Contents

SUMMARY OF SUMMARY

	Pages
<u>PART I: GENERAL</u>	
1.1 Background of the Study	I-1
1.2 Objectives of the Study	I-1
1.3 Study Area	I-1
1.4 Target Waste	I-2
<u>PART II: PROPOSED 10-YEAR SOLID WASTE MANAGEMENT PLAN FOR THE MUNICIPALITY OF MALAY</u>	
CHAPTER II-1 INTRODUCTION	II-1
1.1 Purpose	II-1
1.2 Approach	II-1
CHAPTER II-2 PROFILE OF MALAY MUNICIPALITY	II-2
CHAPTER II-3 CURRENT CONDITIONS OF SOLID WASTE MANAGEMENT	II-3
3.1 Institutional Arrangements	II-3
3.2 Solid Waste Characterization	II-3
3.3 Technical Aspects.....	II-4
3.4 Identified Key Issues on Solid Waste Management.....	II-5
CHAPTER II-4 FUTURE FRAMEWORK	II-6
4.1 Socio-Economic Framework.....	II-6
4.2 Projected Solid Waste Generation.....	II-7
CHAPTER II-5 PLAN STRATEGY	II-8
5.1 Vision and Goals	II-8
5.2 Targets.....	II-8
5.3 Strategies.....	II-9
5.4 Future Solid Waste Flow	II-10
CHAPTER II-6 TECHNICAL SYSTEM OF FOR SOLID WASTE MANAGEMEMENT ...	II-11
6.1 Source Reduction	II-11
6.2 Sweeping, Collection and Transportation	II-12
6.3 Intermediate Reduction at MRF.....	II-12
6.4 Disposal.....	II-13
6.5 Special Waste	II-14
CHAPTER II-7 INSTITUTIONAL AND ORGANIZATIONAL SYSTEM FOR SOLID WASTE MANAGEMENT	II-15
7.1 Information, Education and Communication (IEC).....	II-15

7.2	Introduction of Incentive Program	II-15
7.3	Implementation of Market Development	II-15
7.4	Legal System Arrangements	II-16
7.5	Organizational Set up for Solid Waste Management	II-16
7.6	Capacity Development.....	II-18
CHAPTER II-8 IMPLEMENTATION PLAN		II-19
8.1	Implementation Plan	II-19
8.2	Priority Projects	II-23
CHAPTER II-9 COST ESTIMATE AND FINANCIAL ASPECT		II-24
9.1	Cost Estimate of the 10-year SWM Plan	II-24
9.2	Annual Cost of the 10-year SWM Plan	II-24
9.3	Funding Options.....	II-25
9.4	Cost Sharing.....	II-26
9.5	Setting up Local Common Funds.....	II-27
9.6	Cost Recovery	II-29
9.7	Cost Evaluation and Comparison.....	II-29
CHAPTER II 10 SOCIAL AND ENVIRONMENTAL ASPECTS		II-31
10.1	Environmental Policy Framework in the Philippines	II-31
10.2	Social and Environmental Aspects.....	II-31
10.3	Initial Environmental Examination (IEE).....	II-32
CHAPTER II-11 EVALUATION.....		II-34
11.1	Technical Aspect	II-34
11.2	Social Aspect.....	II-34
11.3	Environmental Aspect.....	II-34
11.4	Financial Aspect.....	II-34
11.5	Economic Aspect	II-34
11.6	Overall Evaluation	II-34

PART III FEASIBILITY STUDY FOR THE PRIORITY PROJECTS

CHAPTER III-1 FEASIBILITY STUDY FOR THE KABULIHAN SANITARY		
	LANDFILL	III-1
1.1	Site Conditions.....	III-1
1.2	Planning Concept	III-1
1.3	Conceptual Design of the SLF	III-2
1.4	Operation and Management Plan.....	III-4
1.5	Implementation Plan	III-4
1.6	Cost Estimate	III-5
1.7	Financial Analysis	III-5
1.8	Social and Environmental Considerations	III-6
1.9	Evaluation and Conclusion	III-6
CHAPTER III-2 FEASIBILITY STUDY FOR THE REHABILITATION OF THE OLD DUMP		
	SITE	III-7
2.1	Site Condition	III-7
2.2	Planning Concept	III-8

2.3	Concept Design	III-9
2.4	Facility and Equipment Plan	III-10
2.5	Operation and Management Plan	III-11
2.6	Implementation Plan	III-11
2.7	Cost Estimate	III-11
2.8	Financial Analysis	III-12
2.9	Environmental and Social Considerations	III-12
2.10	Evaluation and Conclusion	III-13

CHAPTER III-3 FEASIBILITY STUDY FOR CENTRALIZED MATERIAL RECOVERY FACILITY.....

3.1	Site Condition	III-14
3.2	Planning Concept	III-14
3.3	Conceptual Design	III-15
3.4	Facilities and Equipment Plan.....	III-16
3.5	Operation and Management Plan.....	III-18
3.6	Implementation Plan	III-19
3.7	Cost Estimate	III-20
3.8	Financial Analysis	III-20
3.9	Social and Environmental Considerations	III-21
3.10	Evaluation and Conclusion	III-21

PART IV: RECOMMENDATIONS

CHAPTER IV-1 RECOMMENDATIONS FOR THE MUNICIPALITY OF MALAY

1.1	Practical Implementation of the 10-year Solid Waste Management Plan	IV-1
1.2	Tourism Management for Environmental Conservation.....	IV-5

CHAPTER IV-2 RECOMMENDATIONS FOR OTHER LGUS AND NSWMC

2.1	Structure of the 10-year Solid Waste Management Plan.....	IV-6
2.2	Recommended Calculation Method for Diversion	IV-6
2.3	Development of Sanitary Landfills in the Philippines	IV-7

List of Tables

PART II: MASTER PLAN STUDY

Table 2.1-1	Profile of Municipality of Malay	II-2
Table 3.4-1	Identified Issues and Countermeasures of Solid Waste Management.....	II-5
Table 4.1-1	Projected Population of Malay Municipality	II-6
Table 4.1-2	Projection of Yearly Annual Tourist Arrivals in on Boracay Island.....	II-6
Table 4.1-3	Future Commercial Sector Projection.....	II-6
Table 4.2-1	Unit Generation Rate (UGR) of Solid Waste	II-7
Table 4.2-2	Future Solid Waste Generation Projection (t/day).....	II-7
Table 5.1-1	Goals of the 10-year SWM Plan	II-8
Table 5.2-1	Targets of the 10-year SWM Plan for Boracay Island	II-8
Table 5.2-2	Targets of the 10-year SWM Plan for Mainland of Malay.....	II-9
Table 5.3-1	Strategies of SWM	II-9
Table 6.1-1	Description of Source Reduction Programs.....	II-11
Table 6.2-1	Collection and Transportation System in 2017	II-12
Table 6.3-1	Development of MRFs.....	II-13
Table 6.4-1	Development of New Sanitary Landfill Site.....	II-13
Table 7.2-1	Proposed Incentive Programs.....	II-15
Table 7.3-1	Market Development.....	II-16
Table 7.6-1	Training Program on Solid Waste Management.....	II-18
Table 8.1-1	Implementation Schedule of the 10-year SWM Plan	II-20
Table 9.1-1	Investment Cost for the 10-year SWM Plan (2008-2017)	II-24
Table 9.2-1	Annual Cost of the 10-year SWM Plan.....	II-24
Table 9.7-1	Cost of Solid Waste Management during the 10-year SWM Plan Period.....	II-30
Table 10.3-1	Screening of Target Projects for IEE.....	II-33

PART III: FEASIBILITY STUDY FOR THE PRIORITY PROJECTS

Table 1.2-1	Design Requirements for Category 1 Landfill	III-2
Table 1.4-1	Estimated Minimum Staff Requirements for Site Operations.....	III-4
Table 1.6-1	Annual Investment and O&M Costs of Kabulihan Sanitary Landfill Site.....	III-5
Table 1.7-1	Cash Flow of Development of Kabulihan Sanitary Landfill.....	III-6
Table 2.2-1	Comparison of Options for Rehabilitation of the Old Dump Site.....	III-8
Table 2.4-1	Facility and Equipment Plan	III-10
Table 2.5-1	Monitoring and Frequency Parameters for the Old Dump Site.....	III-11
Table 2.7-1	Annual Investment and O&M Costs of the Rehabilitation of the Old Dump Site.....	III-12
Table 2.8-1	Cash Flow of the Rehabilitation of the Old Dump Site	III-12
Table 3.2-1	Selected Waste Handling Procedures	III-15
Table 3.4-1	Facilities and Equipment Proposed for the Manoc-Manoc Centralized MRF	III-16
Table 3.7-1	Annual Investment and O&M Costs of the Manoc-Manoc Centralized MRF.....	III-20
Table 3.8-1	Cash Flow of SWM including Development of the Centralized MRF and Collection and Transport on Boracay Island	III-21

List of Figures

PART I: GENERAL

Figure 1.3-1	Study Area	I-2
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PART II: MASTER PLAN STUDY

Figure 3.2-1	Solid Waste Flow of the Municipality of Malay in 2007	II-4
Figure 5.4-1	Future Waste Flow in 2017	II-10
Figure 7.5-1	Proposed Organizational Set-up for Solid Waste Management.....	II-17
Figure 7.5-2	Proposed Organization of Boracay Solid Waste Management Action Team.....	II-17
Figure 9.3-1	Total Cost for SWM for the 10-year SWM Plan	II-25
Figure 9.3-2	Comparison of Total Costs for SWM with and without a Loan	II-26
Figure 9.4-1	Cost Sharing	II-27
Figure 9.5-1	Management of LCF.....	II-28
Figure 9.6-1	Cost Recovery during the 10-year SWM Plan (in case of EAF at PhP100 of EAF).....	II-29

PART III: FEASIBILITY STUDY FOR THE PRIORITY PROJECTS

Figure 1.3-1	Development Plan of Sub-Phase 1A of Landfill Area	III-2
Figure 1.3-2	Development Plan of Sub-Phase 1B of Landfill Area	III-3
Figure 2.1-1	Area Where Solid Waste was Dumped at the Old Dump Site	III-7
Figure 2.3-1	Rehabilitation Plan for the Old Dump Site.....	III-10
Figure 3.3-1	Layout Plan of Manoc-Manoc Centralized MRF Phase III.....	III-15
Figure 3.5-1	Operational Organization of the Manoc-Manoc Centralized MRF	III-19

Abbreviations

<Organizations>

B-pid	Boracay Private Initiative for Diversion
BSWMAT	Boracay Solid Waste Management Action Team
DBP	Development Bank of the Philippines
DENR	Department of Environment and Natural Resources
DENR-EMB	DENR Environmental Management Bureau
DOE	Department of Education
DOST	Department of Science and Technology
DOT	Department of Tourism
EMB	Environmental Management Bureau
EPG	Eminent Person's Group
JICA	Japan International Cooperation Agency
LBP	Land Bank of the Philippines
LCF	Local Common Fund
LCFMC	Local Common Fund Management Committee
LGU	Local Government Unit
MGB	Mines and Geosciences Bureau
MOB	Municipality of Buruanga
MOM	Municipality of Malay
MSWMAT	Mainland Solid Waste Management Action Team
MSWMB	Municipal Solid Waste Management Board
NGAs	National Government Agencies
NSO	National Statistical Office
NSWMC	National Solid Waste Management Commission
PTA	Philippines Tourism Authority
SLFMU	SLF Management Unit
SWMAT	Solid Waste Management Action Team

<Metric Units>

cc	Cubic centimeter
cm	Centimeter
dB(A)	Decibel
g	Gram
ha	Hectare
hr(s)	Hour(s)
kg	Kilogram
km	Kilometre
km ²	Square kilometer
L	Liter
m	Meter
mg	Milligram
min	Minute
mm	Millimeter
m ³	Cubic meter
sec	Meter per second

t or ton(s)	Ton(s)
°C	Centigrade
%	Percentage

<Currency>

JPY	Japanese Yen
PhP	Philippines Peso
USD	US Dollar

<Others>

3Rs	Reduce, Reuse, Recycle
A&D	Alienable and Disposal
ATC	Authority to Close
ASL	Above Seaside Level
BOD	Biochemical Oxygen Demand
CH ₄	Methane
CNC	Certificate of Non-Coverage
CO ₂	Carbon Dioxide
DAO	DENR Administrative Order
DBO	Design-Build-Operate
DO	Dissolved Oxygen
EAF	Environmental and Admission Fee
EC	Electric Conductivity
ECA	Environmental Critical Area
ECC	Environmental Compliance Certificate
ECP	Environmentally Critical Project
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMMP	Environmental Management and Monitoring Plan
F/S	Feasibility Study
GCF	Garbage Collection Fee
H ₂ S	Hydrogen Sulfide
HCW	Health Care Waste
ICE	Interpersonal Communication and Education
IEC	Information, Education and Communication
IEE	Initial Environmental Examination
IRA	Internal Revenue Allotment
IRR	Implementation Rule and Regulation
LCF	Local Common Fund
LGU	Local Government Unit
MCE	Mass Communication and Education
MO	Municipal Ordinance
MOB	Municipality of Buruanga
MOM	Municipality of Malay
MOOE	Maintenance, Operation and Other Expenses

MRF	Material Recovery Facility
MOOE	Maintenance, Operation and Other Expenses
MTPDP	Medium Term Philippine Development Plan
O&M	Operation and Maintenance
PCM	Post Closure Management
RA	Republic Act
RC	Reinforced Concrete
SB	Sangguniang Bayan
SLF	Sanitary Landfill
SRR	Source Reduction Ratio
SPT	Standard Penetration Test
SWM	Solid Waste Management
UGR	Unit Generation Rate
WACS	Waste Analysis and Characterization Survey

SUMMARY OF THE STUDY

1. General

1.1 Background

Boracay Island belongs to Municipality of Malay (MOM) in Aklan Province and has been developed as most popular tourist resort in the Philippines. Since the number of tourists has increased year by year, the amount of solid waste generated has rapidly increased. Consequently, the solid waste management (SWM) of the MOM has been in critical situation. Under these backgrounds, the 10-year Solid Waste Management for Municipality of Malay (10-year SWM Plan) has been formulated in order to conserve natural environment and tourism resources and to improve public sanitation for the residents based on Ecological Solid Waste Management Act (RA9003).

1.2 Objectives of the Study

The overall goal of the Study is to enhance the implementation of RA9003 generating the best practice model at the MOM under the collaboration of communities, the LGU, the national level government and the other stakeholders. The proposed plan is expected to be utilized as a reference guide for formulation of the 10-year SWM plan of LGUs with similar local conditions in the Philippines. Under the above overall goal, the Study was conducted with the following objectives.

- 1) To formulate a 10-year SWM Plan for the MOM
- 2) To conduct a feasibility study (F/S) for priority projects
- 3) Through the course of the Study, to strengthen the capacity for SWM of the staffs of the MOM and the NSWMC

1.3 Study Area

The study area covers the entire jurisdiction of the MOM, which has 17 barangays with total area of 6,731 ha.

1.4 Target Waste

The target wastes of the study are municipal solid waste and infectious waste as defined in RA9003 which is generated from the jurisdiction of the MOM.

2 Approaches of the Study

The following approaches have been taken into consideration during the Study.

Approach 1: Consistency with RA9003 and other Requirements

Approach 2: Grasping and Consideration of Actual Solid Waste Management Condition

Approach 3: Stakeholder Involvement

Approach 4: Consideration of Urgent Requirements

Approach 5: Proper Social and Environmental Considerations
Approach 6: Involvement of C/P in the Study for Capacity Development

3. Proposed 10-year Solid Waste Management Plan

3.1 Vision

A vision of the 10-year SWM Plan has been set as **“A Sustainable Integrated Solid Waste Management System is Developed”**.

3.2 Future Framework

Future solid waste generation per day (t/day) is projected as follows:

Future Solid Waste Generation Projection (t/day)

Area	Barangay	2007	2017
Boracay Island	Yapac	1.4	4.6
	Balabag	11.1	18.0
	Manoc-Manoc	6.5	10.1
	Sub-total	19.0	32.7
Mainland of Malay	Urban barangays	3.5	7.5
	Semi-urban barangays	2.1	3.0
	Rural barangays	0.8	1.1
	Sub-total	6.4	11.6
Total		25.4	44.3

Source: JICA Study Team

3.3 Targets

Targets of the 10-year SWM Plan have been set for the target year (2017) for Boracay Island and the Mainland of Malay respectively as shown in the table below:

Targets of the 10-year Solid Waste Management

Category	Component	Boracay Island		Mainland of Malay	
		Present (2007)	Target Year (2017)	Present (2007)	Target Year (2017)
Diversion	Source Reduction Ratio (SRR)	23%	35%	51%	54%
	Intermediate Reduction Ratio	20%	53%	38%	40%
Collection	Service Coverage	86%	100%	78%	90%
Disposal	Sanitary Disposal	0%	100%	0%	100%
	Safe Closure of Old Dump Site	0%	100%	-	-

Note: Source Reduction Ratio (SRR) = Waste Reduced at Source / Waste Generated
 Intermediate Reduction Ratio = Waste Reduced at MRFs / Waste Collected
 Service Coverage = Waste Collected/ Waste Discharged
 Sanitary Disposal = Residual Waste Landfilled in a sanitary way/ Total Residual Waste

3.4 Technical System of Solid Waste Management

The proposed technical system of SWM is summarized in the table below:

Proposed Technical System of Solid Waste Management

Category	Technical System of Solid Waste Management
Source Reduction	<p>1) <u>Boracay Island</u>: Introduction of new source reduction programs</p> <ul style="list-style-type: none"> - Introduction of 3Bs programs <ul style="list-style-type: none"> BALIK BAYONG: reduction/prohibition plastic shopping bags BALIK BOTE: Introduction of deposit system for returnable waste BALIK BIO-WASTE: Home composting promotion - Introduction of waste avoidance program (prohibition of specific package use) <p>2) <u>Mainland of Malay</u>: Introduction of new source reduction program (group collection of recyclables)</p>
Sweeping	<p>1) <u>Main road</u>: Manual sweeping except the areas cleaned by residents or business establishments</p> <p>2) <u>Beach</u>: Manual cleansing except the areas cleansed by residents or business establishments</p>
Collection and Transport	<p>1) <u>Collection Area</u></p> <ul style="list-style-type: none"> - Boracay Island : almost 100% collection service - Mainland of Malay: collection service corresponding to development cluster MRFs <p>2) <u>Collection Method</u></p> <ul style="list-style-type: none"> - Segregated collection (Biodegradable, Recyclable, Residual and Special wastes) - In-house and in-business establishment segregation - Segregated discharge using by transparent plastic bags <p>3) <u>Collection Frequency</u></p> <ul style="list-style-type: none"> - Boracay Island: everyday for biodegradable and three times a week for other wastes - Mainland of Malay: everyday for biodegradable and three times a week for other wastes, or twice a week for biodegradable and once a week for other wastes <p>4) <u>Collection and Transport System (Generation source to MRF)</u></p> <ul style="list-style-type: none"> - Boracay Island: Curbside/door to door/primary and station - Mainland of Malay: Primary and station/curbside <p>5) <u>Collection Vehicle</u></p> <ul style="list-style-type: none"> - Boracay: Dump trucks, Push carts, Tri-cab - Mainland of Malay: Dump trucks, Push carts <p>6) <u>Transport of Residual Waste</u></p> <ul style="list-style-type: none"> - Land transportation: Dump truck - Marine transportation : Pump boat
Material Recovery (Composting and Recycling at MRFs)	<p>1) <u>Establishment of MRFs</u></p> <ul style="list-style-type: none"> - Boracay: Maonc-Manoc Centralized MRF - Mainland of Malay: Caticlan Cluster MRF, Kabulihan Cluster MRF <p>2) <u>Methods</u></p> <ul style="list-style-type: none"> - Biodegradable waste: Composting by bioreactor and charcoal production - Recyclable waste: Manual sorting and selling to junkshops - Residual waste: To be transported to sanitary landfill
Disposal	<p>1) <u>Sanitary landfill</u>: leachate treatment system and other environmental measures</p> <p>2) <u>Old dump site</u>: Safe closure by rehabilitation</p>
Special Waste (Health Care Waste)	<p>1) <u>Boracay Island</u></p> <ul style="list-style-type: none"> - Treatment at the centralized MRF by autoclave - Disposal: Sanitary landfill site <p>2) <u>Mainland of Malay</u></p> <ul style="list-style-type: none"> - Treatment at the Public Health Center by autoclave - Disposal: Sanitary landfill site

Source: JICA Study Team

3.5 Institutional System of Solid Waste Management

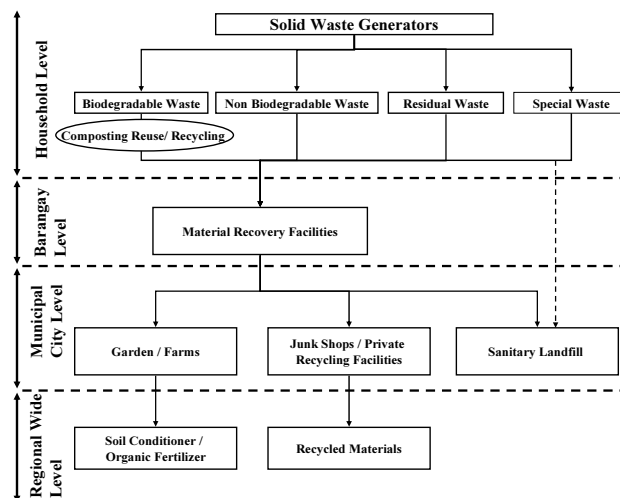
The institutional and organizational arrangements have been proposed in order to realize smooth implementation of the 10-year SWM Plan.

- Implementation of IEC programs (mass communication and education, interpersonal communication and education)
- Introduction of incentive programs (waste generators, recyclers and end user, the MOM and barangays)
- Implementation of Market Development (compost products, recyclables, etc.)
- Arrangement of legal system (amendment of the existing Municipal Ordinances and constitution of new Municipal Ordinances)
- Organizational setting up (Municipal Solid Waste Management Unit, Unit for development and operation of Kabulihan Sanitary Landfill)
- Re-organization of Boracay Solid Waste Management Action Team (BSWMAT) and establishment of Mainland Solid Waste Management Action Team (MSWMAT)

A series of training programs on SWM and its implementation, and development of administrative tools for SWM such as manuals, guidelines and database are also proposed for capacity development.

3.6 Implementation Framework

The implementation framework of the 10-year SWM Plan is based on the RA9003 following a SWM hierarchy. The framework covers the entire range of activities involved in SWM starting from source reduction and ending with the final disposal of waste. The hierarchy also matches the levels of governance starting from households up to the national level.



3.7 Cost Estimate and Financial Aspect

The proposed 10-year SWM Plan and the estimated total investment and O&M costs are summarized in the following table: In order to cover the total costs, the following financial measures including cost recovery are proposed.

- Sharing the costs among stakeholders based on the amount of waste generated in accordance with Polluters Pay Principle (PPP)
- Establishment of Local Common Fund (LCF) in order to manage various financial sources
- Revision of Garbage Collection Fee (GCF) including imposing the GCF on the residents

- Revision of Environmental and Admission Fee (EAF) including improvement of collection system
- Identification of funding sources such as the Development Bank of the Philippines

Proposed 10-year SWM Plan and Total Project Cost (2008-2017)

(Unit: x10³ PhP)

Projects	Investment Cost	O&M Cost
1. Diversion		
1.1 Promotion of Source Reduction	0	1,002
1.2 Promotion of Recycling and Composting at MRFs		
1.2.1 Development of Manoc-Manoc Centralized MRF	40,786	50,362
1.2.2 Development of Caticlan Cluster MRF	1,555	3,405
1.2.3 Development of Kabulihan Cluster MRF	*	
1.2.4 Closure of Existing MRFs on Boracay Island	2,024	0
Total of 1. Diversion	44,365	54,769
2. Collection and Transport		
2.1 Improvement of Collection System on Boracay Island	1,948	59,697
2.2 Introduction of Collection System on the Mainland of Malay	580	5,033
Total of 2. Collection and Transport	2,528	64,730
3. Disposal		
3.1 Development of Kabulihan Sanitary Landfill	56,087	61,379
3.2 Rehabilitation of Old Dumping Site	8,136	900
Total of 3. Disposal	64,223	62,279
4. Special Waste Management		
4.1 Introduction of Health Care Waste Management System on Boracay Island	348	744
4.2 Introduction of Health Care Waste Management System on Mainland of Malay	348	536
Total of 4. Special Waste	696	1,280
5. IEC Program		
5.1 Implementation of Public Education and Information	0	716
Total of 5. IEC Program	0	716
6. Institutional and Organizational Arrangement		
6.1 Introduction of Incentive System	0	3,700
6.2 Implementation of Market Development	0	-
6.3 Arrangement of Legal System	0	-
6.4 Organization Setting Up	0	-
6.5 Introduction of Cost Recovery System	0	3,216
Total of 6. Institutional Arrangement	0	6,916
7. Capacity Development		
7.1 Implementation of Training Program on SWM	0	1,200
7.2 Development of Administration Tools on SWM	0	400
Total of 7. Capacity Development	-	1,600
Total of 1-7	111,812	192,290
8. Price Escalation		
	82,617	
Grand Total	386,719	

Note: * Investment and O&M costs for the Kabulihan Cluster MRF are included in the costs of the Kabulihan SLF.

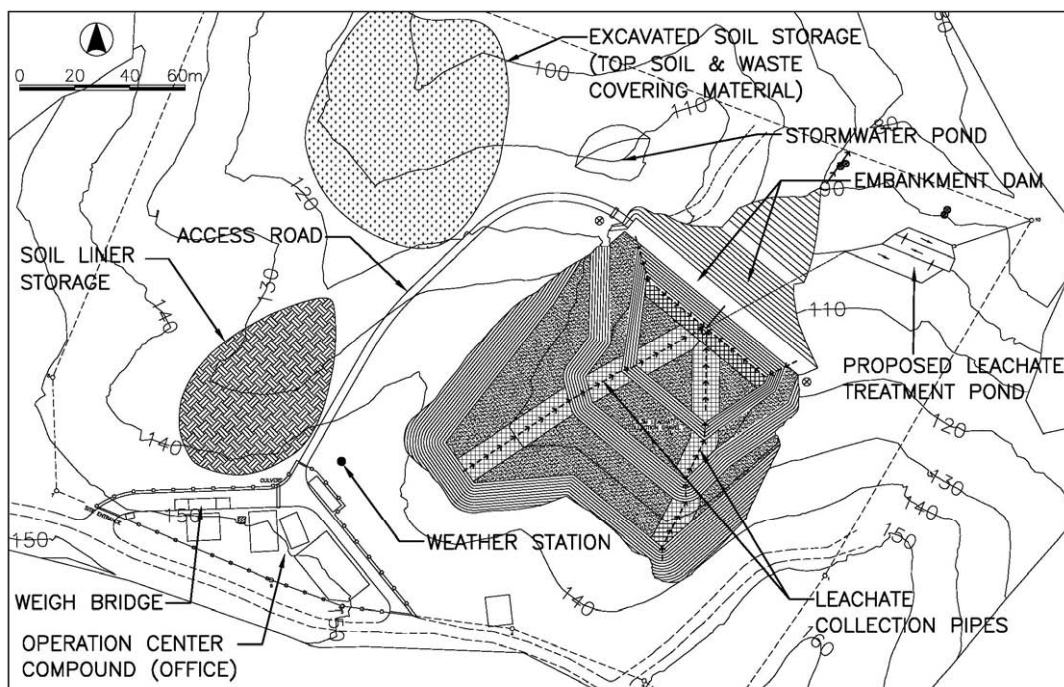
Source: JICA Study Team

4 Feasibility Study

4.1 Development of Kabulihan Sanitary Landfill

It is proposed that the landfill site be developed progressively in order to minimize the initial investment costs as well as the amount of leachate. The site will be developed in two phases. Phase 1 will be developed under the 10-year SWM Plan, while Phase 2 will be developed in the final year of filling of Phase 1 which would be after the 10-year SWM Plan period. Since the amount of residual waste received is estimated 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 Phase 1 area is also developed progressively. The Sub-Phase 1B of the landfill area of Phase 1 is shown in the figure below. This area accommodates approximately eight years waste. The capacity summed up the Sub-Phase 1A (1A-1, 1A-2) and 1B is enough to receive the total waste hauled during the 10-year SWM Plan period.



Development Plan of Sub-Phase 1B of Landfill Area

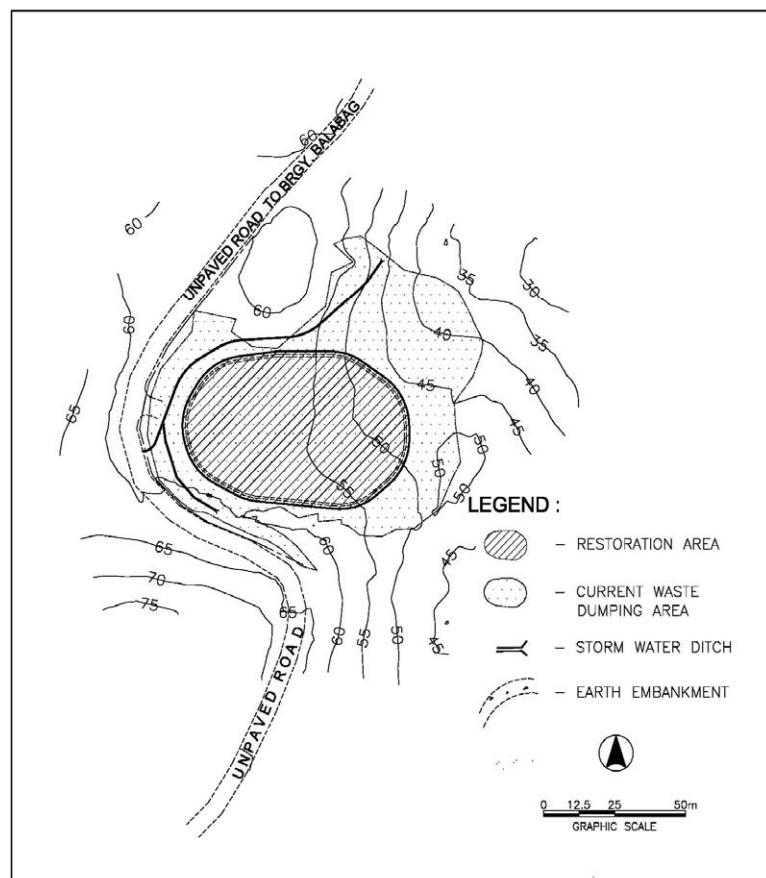
Source: JICA Study Team

Careful considerations have been given to the social and environmental impacts in development plan of the proposed SLF based on DAO 10. The SLF aims to dispose of the residual waste in a sanitary way so that the environmental degradation which has been brought about by the waste dumped other than the SLF can be minimized. As for the financial aspect, investment and O&M costs for the SLF can be recovered by the MOM including arrangement of a loan. As a result of a series of evaluations from the technical, social, environmental, financial aspects, the Development of the SLF is evaluated as viable as a whole.

4.2 Rehabilitation of Old Dump Site

The planning concept for the rehabilitation of the old dump site was considered based on the results of the site condition surveys as well as DAO 09 Series 2006. One of the most critical environmental issues which should be taken into consideration is contamination of groundwater in and around the old dump site.

In the rehabilitation works, reshaping of the dumped waste and providing an earth embankment along the bottom slope of the site are proposed. The area covered by the dumped waste is to be concentrated and the eastern margin of the site is stabilized by flattening the slopes. The rehabilitation plan of the old dump site is shown in the figure below.



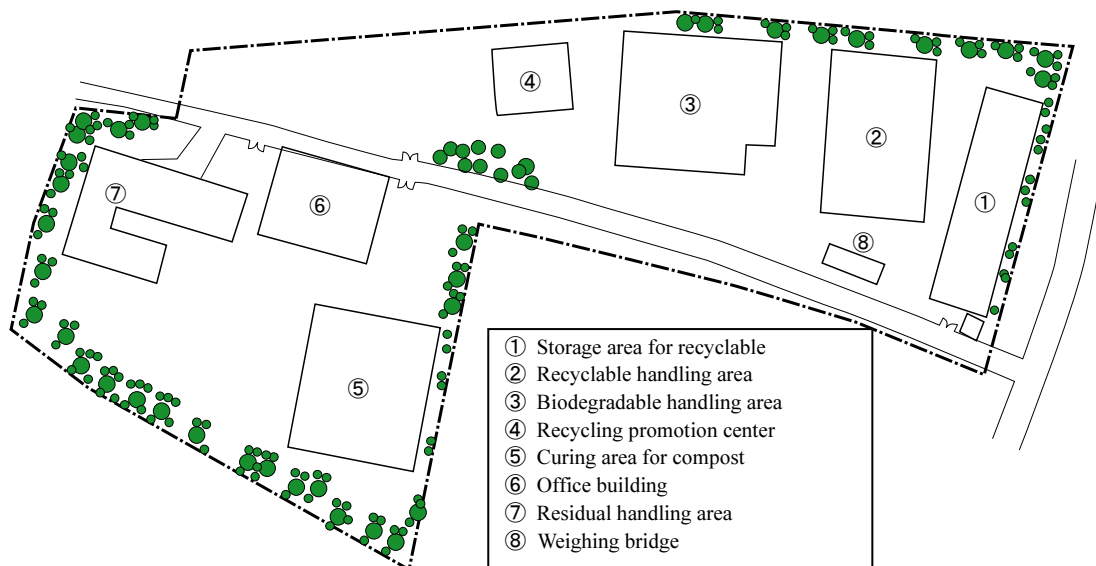
Rehabilitation Plan for the Old Dump Site

Source: JICA Study Team

The Rehabilitation of the Old Dump Site aims to mitigate the environmental degradation which has been brought about by the waste that has been dumped. As a result of series of evaluations from the technical, social, environmental, financial aspects, the Rehabilitation of the Old Dump Site is evaluated as viable as a whole.

4.3 Development of Manoc-Manoc Centralized MRF

The proposed centralized MRF is to be located in Barangay Manoc-Manoc based on the aspect of transport efficiency of residual waste and land availability including the possibility of extension of the existing MRF area. The layout plan of the proposed Manoc-Manoc Centralized MRF is shown in the figure below.



Layout Plan of Manoc-Manoc Centralized MRF

Source: JICA Study Team

The development of the Manoc-Manoc Centralized MRF aims at producing sufficient diversion of the solid waste to be transported to the SLF. As a result of series of evaluations from the technical, social, environmental, financial aspects, the Development of the Centralized MRF is evaluated as viable as a whole.

5. Recommendations

As the result of the Study, the following are recommended.

- (1) Recommendations for the Municipality of Malay
 - 1) Practical Implementation of the 10-year SWM Plan
 - Necessary actions to be taken in 2008 as the first step of the 10-year SWM Plan
 - Revision and updating of the 10-year SWM Plan
 - Introduction of progress assessment system
 - Introduction of Human Resource Management (HRM)
 - Establishment of financial management system
 - Promotion of coordination between the LGU and Barangays
 - Promotion of collaboration among stakeholders

- Encouragement of collaboration with neighboring countries
- Grasping material balance inflow and outflow to/from Boracay Island
- Receiving of waste from the Municipality of Buruanga
- 2) Tourism Management for Environmental Conservation
 - Counting the number of tourists
 - Consideration of the Boracay Integrated Tourism Master Plan
 - Consideration of carrying capacity of Boracay Island
- (2) Recommendations regarding sludge treatment
 - Improvement of sludge drying procedures
 - Improvement of handling methods for dried sludge
- (3) Recommendations for the other LGUs and NSWMC
 - Structure of the 10-year Solid Waste Management Plan
 - Calculation methods of diversion
 - Careful arrangement of land for the development of SLF
 - Requirements for SLF development

PART I GENERAL

1.1 Background of the Study

Environmental problems, especially those pertaining to solid waste, have caused adverse impacts on public sanitary conditions and are one of the most serious social issues in the Philippines. The Government of the Republic of the Philippines (the Philippines) established the Ecological Solid Waste Management Act (Republic Act (RA) 9003) in 2001 in order to tackle solid waste problems which were becoming worse year by year. In accordance with RA9003, the province, city or municipality, shall prepare its respective 10-year solid waste management plan (10-year SWM Plan). However, although many local government units (LGUs) have developed respective 10-year SWM Plans, no plan has been approved by the National Solid Waste Management Commission (NSWMC) so far. It is therefore necessary to enhance the implementation of RA9003 by generating the best practice model.

Boracay Island belongs to the Municipality of Malay (MOM) in Aklan Province and has been developed as the most popular tourist resort in the Philippines. Since the number of tourists has increased year by year, the amount of solid waste generated has rapidly increased. Consequently, the solid waste management (SWM) of the MOM has been in a critical situation. Under these backgrounds, the 10-year Solid Waste Management for the Municipality of Malay (10-year SWM Plan) has been formulated in order to conserve the natural environment and tourism resources and to improve public sanitation for the residents based on RA9003.

1.2 Objectives of the Study

The overall goal of the Study is to enhance the implementation of RA9003 generating the best practice model at the MOM under the collaboration of communities, the LGU, the national level government and the other stakeholders. The proposed plan is expected to be utilized as a reference guide for formulation of the 10-year SWM plan of LGUs with similar local conditions in the Philippines.

Under the above overall goal, the Study was conducted with the following objectives.

- 1) To formulate a 10-year SWM Plan for the MOM
- 2) To conduct a feasibility study (F/S) for priority projects
- 3) Through the course of the Study, to strengthen the capacity for SWM of the staffs of the MOM and the NSWMC

1.3 Study Area

The study area covers the entire jurisdiction of the MOM, Aklan Province as shown in Figure 1.3-1. The MOM has 17 barangays with a total area of 6,731 ha.

1.4 Target Waste

The target wastes of the study are municipal solid waste and infectious waste, as defined in RA9003, which is generated from the jurisdiction of the MOM.



Figure 1.3-1 Study Area

PART II PROPOSED 10-YEAR SOLID WASTE MANAGEMENT PLAN FOR THE MUNICIPALITY OF MALAY

CHAPTER II-1 INTRODUCTION

1.1 Purpose

1.1.1 Background

Boracay Island in Aklan Province belongs to the MOM and has become the most popular tourist resort in the Philippines. The number of visitors has increased year by year. In line with this, the amount of solid waste generated has rapidly increased and become one of the serious problems on the Island. Following RA9003, the MOM closed the dumping site on Boracay Island and started operation of Material Recovery Facilities (MRFs) in 2006. However, because there is no sanitary landfill site in the MOM, a large amount of solid waste that should have been disposed of has instead been stored on the proposed new landfill sites on the Mainland of Malay and the MRFs on Boracay Island without any suitable disposal method since 2006. The SWM of the MOM is in a critical situation. On this basis, the 10-year SWM Plan for the MOM has been proposed in order to conserve the natural environment and tourism resources as well as to improve public sanitation for the residents.

1.1.2 Purpose

As provided in RA 9003, the 10-year SWM Plan was proposed to ensure the following principal goals on SWM:

- Protection of public health and the environment
- Utilization of environmentally friendly methods in SWM
- Promotion of “diversion” of solid waste
- Retention of responsibility of SWM at the barangay level
- Development of a system for special waste management
- Encouragement of participation of private sectors and Non Governmental Organizations (NGOs) in SWM

1.2 Approach

The following approaches have been taken into consideration for formulation of the 10-year SWM Plan.

Approach 1: Consistency with RA9003 and Other Related Laws and Regulations

Approach 2: Consistency with SWM Hierarchy

Approach 3: Consistency with Suitable Technology

Approach 4: Consistency with Actual Solid Waste Management Conditions

Approach 5 : Consistency with the Boracay Development Plan

Approach 6: Stakeholder Involvement

CHAPTER II-2 PROFILE OF MALAY MUNICIPALITY

The profile of Municipality of Malay is summarized in Table 2.1-1.

Table 2.1-1 Profile of Municipality of Malay

Items	Profile
Total Land Area - Whole MOM - Boracay Island	6,731 ha 1,004 ha
Population of the MOM Total Population (2007 National Statistical Office (NSO) census) Population Density	33, 769 502 persons/km ²
Population of Boracay Island Total Population (2007 NSO census) Population Density	49 % of total population of the MOM 16, 534 1, 650 persons/ km ²
Total Tourists census (2006) Foreigners Filipinos	556,084 tourist/year an annual increase of 0.11-0.34 % an annual increase of 0.08-0.36 %
Industry	<ul style="list-style-type: none"> Mainly agriculture on the Mainland of Malay with products such as rice, coconut and root crops Tourism on Boracay Island and Caticlan Total of 2,605 business establishments (2005)
Land Use - Alienable and Disposable (46.5%) Agricultural Built-up Area Parks/Open Spaces/others - Forest and Timberland (38.6%) - Tourism (14.9%)	2,719 ha 184 ha 224 ha 2,600 ha 1,004 ha
Geography and Soil	<ul style="list-style-type: none"> Hilly to mountainous, slope of 8-16 % on Boracay Island and 33-88 % on the Mainland of Malay with highest peak of 600 m Subsurface area is silted clay with slight to moderate permeability (mainland), bedrock is 1.5-2 m deep
Climate	<ul style="list-style-type: none"> Tropical monsoon with wet (June to November) and dry seasons (January to May) Temperature range of 28.9 °C -32.5 °C Total annual rainfall of 2,027 mm

Source: MOM and JICA Study Team

CHAPTER II-3 CURRENT CONDITIONS OF SOLID WASTE MANAGEMENT

3.1 Institutional Arrangements

The Ecological Solid Waste management Act of 2000 (RA9003) and the implementing rules and regulations (IRRs) of RA 9003 are the fundamental law and regulations regarding SWM in the Philippines which provide a direction for the preparation of organizations regarding SWM as well as 10-year SWM Plan to be prepared by LGUs. According to the law and regulations, the MOM establishes Municipal Solid Waste Management Board (MSWMB) and Solid Waste Management Action Team to implement solid waste management in Boracay as well as the Mainland of Malay along with cooperation from private sectors and other stakeholders.

Government agencies such as the Department of Environment and Natural Resources (DENR), the Department of Tourism (DOT) and the Department of Education (DOE), through the public schools and the private sector, initiated and contributed to the Information, Education, Communication (IEC), particularly on Boracay Island. Efforts towards a public awareness campaign by officials of barangays of the Mainland of Malay remain unorganized and ineffective for lack of a unified IEC program.

The main revenue sources for SWM are the Environmental and Admission Fee (EAF) introduced recently, the Garbage Collection Fee (GCF) from business establishments and potential revenue for SWM is Internal Revenue Allotment (IRA) from Barangays as well as General Fund. The amount needed is approximately PhP 30 million which is 15 times as much as the previous year due to the need of transportation of residuals and the development of MRFs. The other sources of revenue for SWM are the grant from governmental organization (ex. DOT), private sectors, and NGOs. The O&M and investment cost of collection and transportation of biodegradable and recyclable wastes at MRF's by barangays are covered by the budget of the MOM from the above revenue sources. On the other hand, the expenditure regarding collection and transportation of residual waste including sea transportation to the proposed Sanitary Landfill (SLF) is covered by the budget of the MOM directly.

3.2 Solid Waste Characterization

Based on the results of the Waste Characterization Survey (WACS), including the attribution survey and interviews at each MRF, the current waste flow of the MOM in 2007 is summarized as shown in Figure 3.2-1.

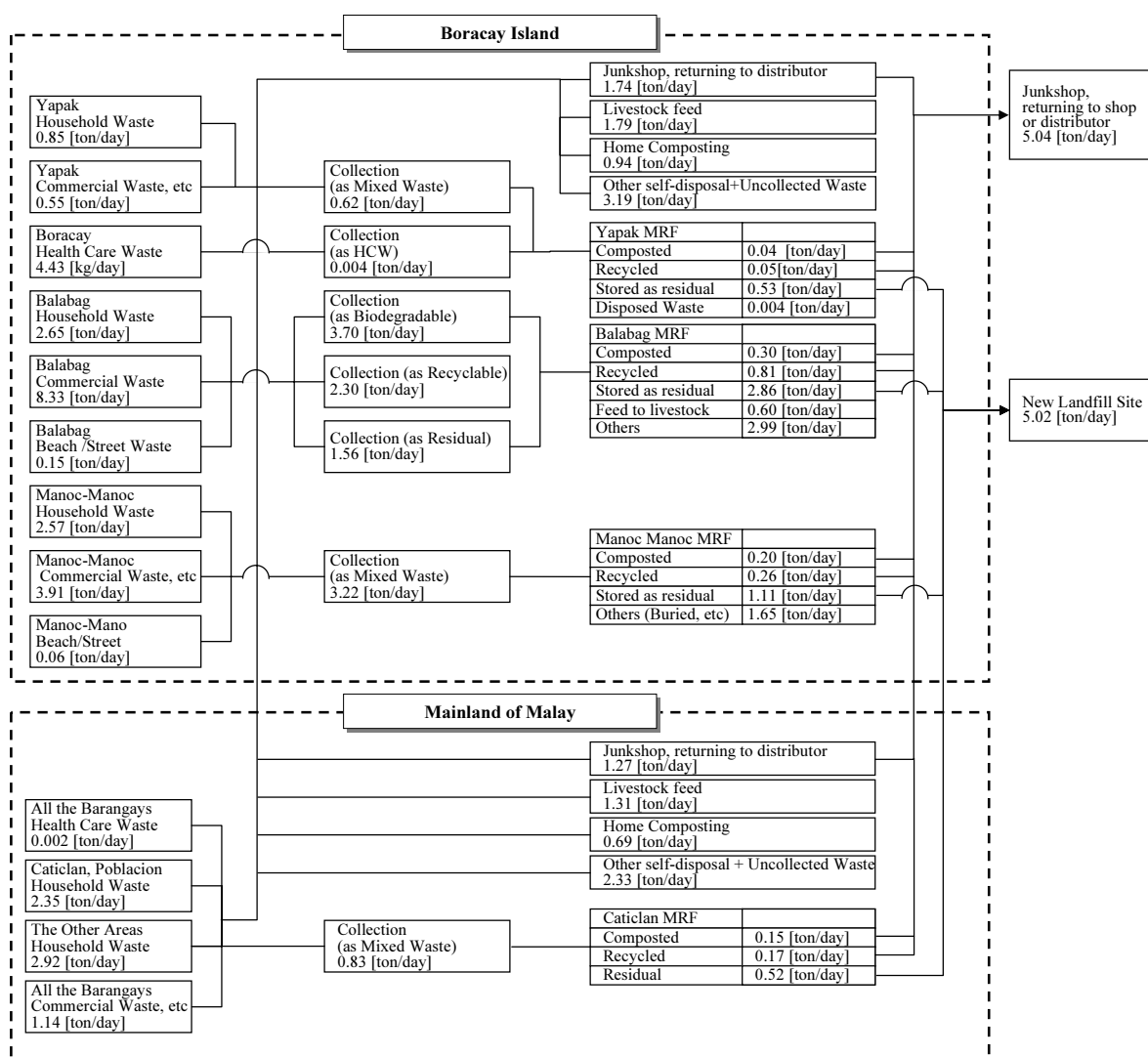


Figure 3.2-1 Solid Waste Flow of the Municipality of Malay in 2007

Source: JICA Study Team

3.3 Technical Aspects

Some of the non-biodegradable reusable and recyclable wastes are brought to recycling companies through junkshops or distribution companies. For biodegradable waste, home composting or utilization of feed to livestock is carried out mainly in rural areas.

The main street and beaches are swept by the sweepers of the MOM on Boracay Island, but there is no sweeping service for any road on the Mainland of Malay.

On Boracay Island, collection service is provided by the segregated collection in Barangay Balabag and mixed collection for partial areas of Barangay Manoc-Manoc and Yapak. The MOM has the responsibility of the collection of residual waste, while each barangay has the responsibility of biodegradable and recyclable wastes. The collected waste is transported into each MRF for sorting recyclables and biodegradable for selling to junkshops or recycling companies as well as small scale recycling activities. Sorted residual waste is transported to the proposed site of the SLF for temporary storage. There is an old dump site

which has been closed without suitable rehabilitation. The household special waste is discharge with segregation but suitable treatment has not been implemented. Health Care Waste (HCW) has been collected and transported into the Yapak MRF to be stored in a prepared concrete enclosure.

3.4 Identified Key Issues on Solid Waste Management

The main issues identified and countermeasures taking into consideration the requirements of RA9003 and suitable SWM are summarized in Table 3.4-1.

Table 3.4-1 Identified Issues and Countermeasures of Solid Waste Management

Issues	Strategies
1. Diversion	
Measures against increasing waste have been taken only for promotion of household level composting, but there have been no measures to reduce other wastes, even household level composting is not fully encouraged.	Promotion of Source Reduction 1) Introduction of new source reduction program 2) Introduction of waste avoidance program
There is no sufficient MRFs though three MRFs on Boracay Island and only one in Caticlan on the Mainland of Malay Unhealthy and inefficient working and operational conditions at the existing MRFs	Promotion of Intermediate Reduction at MRFs 1) Improvement of existing MRFs 2) Development of cluster MRFs
2. Collection and Transportation	
1) There are areas where collection service is not provided 2) There is no collection service on the Mainland of Malay except for Barangay Caticlan and along the main road. 3) Compliance rate of segregation in Barangay Balabag is 70-80%, while other barangays are do not (fully) conducted segregated collection.	1) Improvement or Introduction of Collection Systems 2) Extension and/or introduction of collection service areas 3) Improvement/extension of segregated collection
3. Disposal	
1) There is no SLF. 2) There is an old dump site on Boracay Island that hasn't had any remedial measures implemented.	1) Development of a SLF 2) Safe Closure of Old Dump Site
4. Special Waste Management	
No proper treatment and or disposal of HCW	Introduction of Infectious Waste Management System
5. IEC program	
Some IEC programs have been implemented on an ad hoc basis, but they were neither effective nor sustainable.	Implementation of Public Education and Information
6. Institutional and Organizational Arrangements	
No incentive programs are provided.	Introduction of Incentive System
1) The GCF is not collected from Households. 2) Utilization and revision of the rules regarding EAF are not established.	Introduction of a Cost Recovery System 1) Revision of the GCF System 2) Improvement of the EAF System
1) There is no individual section for SWM 2) No Solid Waste Management Action Team (SWMAT) is established on the Mainland of Malay.	Organizational Setting up for SWM
7. Capacity Development	
1) There is no systematic training program on SWM 2) There are no administrative tools for SWM.	1) Implementation of Training program on SWM 2) Development of administrative Tools for SWM

Source: JICA Study Team

CHAPTER II-4 FUTURE FRAMEWORK

4.1 Socio-Economic Framework

(1) Population

The future population during the 10-year SWM Plan period from 2008 to 2017 has been projected by referring to the annual growth rates of the available data for past years. The NSO census data in 2000 and provisional NSO census data in 2007 are available for the MOM. Based on the annual growth rate and provisional NSO census data¹ in 2007, the population from 2008 to 2017 was projected as shown in Table 4.1-1.

Table 4.1-1 Projected Population of Malay Municipality

Area	Population		Adopted Growth Rate (%)	
	2007	2017 (projected)	2008-2012	2013-2017
Boracay Island	16,534	22,084	3.4	2.2
Mainland of Malay	17,235	24,299	2.3-4.7	2.3-4.7
Total	33,769	46,383	3.6	2.9

Source: JICA Study Team, NSO census

(2) Tourist Arrivals

The Boracay Integrated Tourism Mater Plan is being developed by the Philippines Tourism Authority (PTA) covering Carabao Island toward increasing the number of tourist arrivals on Boracay Island but this tourism master plan has not been prepared yet. The tourist arrivals in the future are projected as shown in Table 4.1-2 based on the past growth rate.

Table 4.1-2 Projection of Yearly Annual Tourist Arrival on Boracay Island

Category	Projected Tourists Arrival	
	2007	2017*
Foreigner	207,519	280,000
Filipino	400,345	630,000

Note: * Projected tourist arrivals are rounded to the nearest thousand.

Source: JICA Study Team

(3) Other Socio Economic Situations

In accordance with population and tourist increases as well as socio-economic growth, the number of commercial sector entities (hotels, restaurants, and shops) is expected to increase. The estimated numbers of each sector are summarized in Table 4.1-3.

Table 4.1-3 Future Commercial Sector Projection

Area	Category	Unit	2007	2017
Boracay	Hotels	guest	12,377	18,536
	Restaurants	guest	14,070	19,902
	Shops	shop	1,114	3,512
Mainland of Malay	Hotels	guest	651	976
	Restaurants	guest	1,563	3,512
	Shops	shop	124	278

Source: JICA Study Team

¹ The NSO census data is approved for the provincial level. In the national level, the data might be reviewed and revised later.

4.2 Projected Solid Waste Generation

Based on the existing data from the various past surveys and the result of the WACS by the JICA Study Team, the waste unit generation rate (UGR) in the future as well as in 2007 has been set with consideration of the economic growth or change of life styles.

Table 4.2-1 Unit Generation Rate (UGR) of Solid Waste

Generation Source		Area	Unit	2007	2017
Resident	Boracay	Yapak	kg/cap./day	0.32	0.43
		Balabag		0.44	0.53
		Manoc Manoc		0.33	0.40
	Mainland of Malay	Urban		0.34	0.41
		Semi-urban		0.30	0.33
		Rural		0.27	0.29
Hotel		kg/guest/day	0.40	0.48	
Restaurant		kg/guest/day	0.21	0.25	
Shop		kg/shop/day	4.40	5.36	
Institution		kg/office/day	3.00	3.00	
Hospital (including MSW)		kg/hospital/day	1.33	1.33	
Hospital (HCW only)		(g/patient/day)	22.6	22.6	
Beaches	Boracay	Yapak	kg/km/day	29.6	29.6
		Balabag, Manoc-Manoc	kg/km/day	35.8	35.8
Streets	Boracay	Yapak	kg/km/day	9.7	9.7
		Balabag, Manoc Manoc	kg/km/day	12.8	12.8

Source: JICA Study Team

Based on the UGRs, solid waste generation per day (t/day) is projected as shown in Table 4.2-2.

Table 4.2-2 Future Solid Waste Generation Projection (t/day)

Area	Barangay	2007	2017
Boracay	Yapac	1.4	4.6
	Balabag	11.1	18.0
	Manoc-Manoc	6.5	10.1
	Sub-total	19.0	32.7
Mainland of Malay	Urban	3.5	7.5
	Semi-urban	2.1	3.0
	Rural	0.8	1.1
	Sub-total	6.4	11.6
Total		25.4	44.3

Source: JICA Study Team

CHAPTER II-5 PLAN STRATEGY

5.1 Vision and Goals

A meeting of the Municipal Solid Waste Management Board (MSWMB) was held on July 29, 2007 in which the vision of this 10-year SWM Plan was decided as follows:

**“A Sustainable and Integrated Solid Waste Management System is Developed.
- Toward Clean Boracay Island and Malay Municipality through Active Stakeholders’
Participation -”**

In order to develop a sustainable SWM system, the following goals have been set in the 10-year SWM Plan.

Table 5.1-1 Goals of the 10-year SWM Plan

Action	Goals
Diversion	<ul style="list-style-type: none"> - Source reduction such as at households and businesses is promoted as much as possible - After the above source reduction, discharged waste is reused and/or recycled as much as possible
Collection	<ul style="list-style-type: none"> - After the above source reduction, discharged waste is collected properly
Disposal	<ul style="list-style-type: none"> - Sanitary landfill is operated properly - Open dump is to be converted to a safe site

Source: JICA Study Team

5.2 Targets

To actualize the vision and goals, targets should be quantitatively stated for achievement toward the target year of 2017. The targets are set for Boracay Island and the Mainland of Malay, respectively because their respective solid waste management conditions are different as shown in Tables 5.2-1 and 5.2-2.

Table 5.2-1 Targets of the 10-year SWM Plan for Boracay Island

Category	Component	Present (2007)	Target Year (2017)
Diversion	Source Reduction Ratio (SRR)	23%	35%
	Intermediate Reduction Ratio (by composting and recycling at MRFs)	20%	53%
	Total	35%	76%
Collection	Service Coverage	86%	100%
Disposal	Sanitary Disposal	0%	100%
	Safe Closure of Old Dump Site	0%	100%

Note: Source Reduction Ratio (SRR) = Waste Reduced at Source / Waste Generated

Intermediate Reduction Ratio = Waste Reduced at MRFs / Waste Collected

Service Coverage = Waste Collected/ Waste Discharged

Sanitary Disposal = Residual Waste Landfilled in a sanitary way/ Total Residual Waste

Table 5.2-2 Targets of the 10-year SWM Plan for Mainland of Malay

Category	Component	Present (2007)	Target Year (2017)
Diversion	Source Reduction Ratio (SRR)	51%	54%
	Intermediate Reduction Ratio (by composting and recycling at MRFs)	38%	40%
	Total	56%	68%
Collection	Service coverage	78%	90%
Disposal	Sanitary disposal	0%	100%

Note: Source Reduction Ratio (SRR) = Waste Reduced at Source / Waste Generated
Intermediate Reduction Ratio = Waste Reduced at MRFs / Waste Collected
Service Coverage = Waste Collected/ Waste Discharged
Sanitary Disposal = Residual Waste Landfilled in a sanitary way/ Total Residual Waste

5.3 Strategies

In order to achieve the targets of the 10-year SWM Plan, the following strategies shall be adopted as shown in Table 5.3-1

Table 5.3-1 Strategies of SWM

Components	Strategies	
Source Reduction	Reduction of all possible residual waste	- Prohibition of using specific packages (Boracay Island) - Various campaigns of waste avoidance (ex. My Bag Campaign)
	Reduction of bio-degradable waste	- Promotion of home compost - Promotion of livestock feeding (Mainland of Malay)
	Promotion of reuse and recycling of reusable or recyclable wastes	- Introduction of deposit system - Introduction of group recycling
Intermediate Reduction	Development of centralized and cluster MRFs for effective and environmentally friendly operation	
	Development and Improvement of MRFs on Mainland of Malay	
Collection and Transportation	Improvement of collection system in accordance with development of centralized MRF with consideration of collection coverage areas	
	Introduction of effective segregated collection	
Final Disposal	Development of the Sanitary Landfill	
	Implement necessary rehabilitation in accordance with relevant orders and a guideline	
Special Waste Management	Special waste shall be collected and transported properly and disposed of in an isolated cell at the SLF	
Information, Education and Communication (IEC)	IEC activities shall be implemented through various communication tools for the various targets which include residents, tourists and business sectors to support and promote the activities for diversion, collection and disposal	
Funding Arrangement Strategy	Local common fund shall be strategically established for effective utilization of various revenue sources to implement the plan	
Capacity Development	Series of training as well as development of SWM administrative tools such as SWM guidelines or manuals shall be developed for the MOM as well as the barangays.	

Source: JICA Study Team

5.4 Future Solid Waste Flow

Based on the strategies, the future waste flow in 2017 is described in Figure 5.4-1 as the final picture of solid waste generation, diversion and disposal in the 10-year SWM Plan.

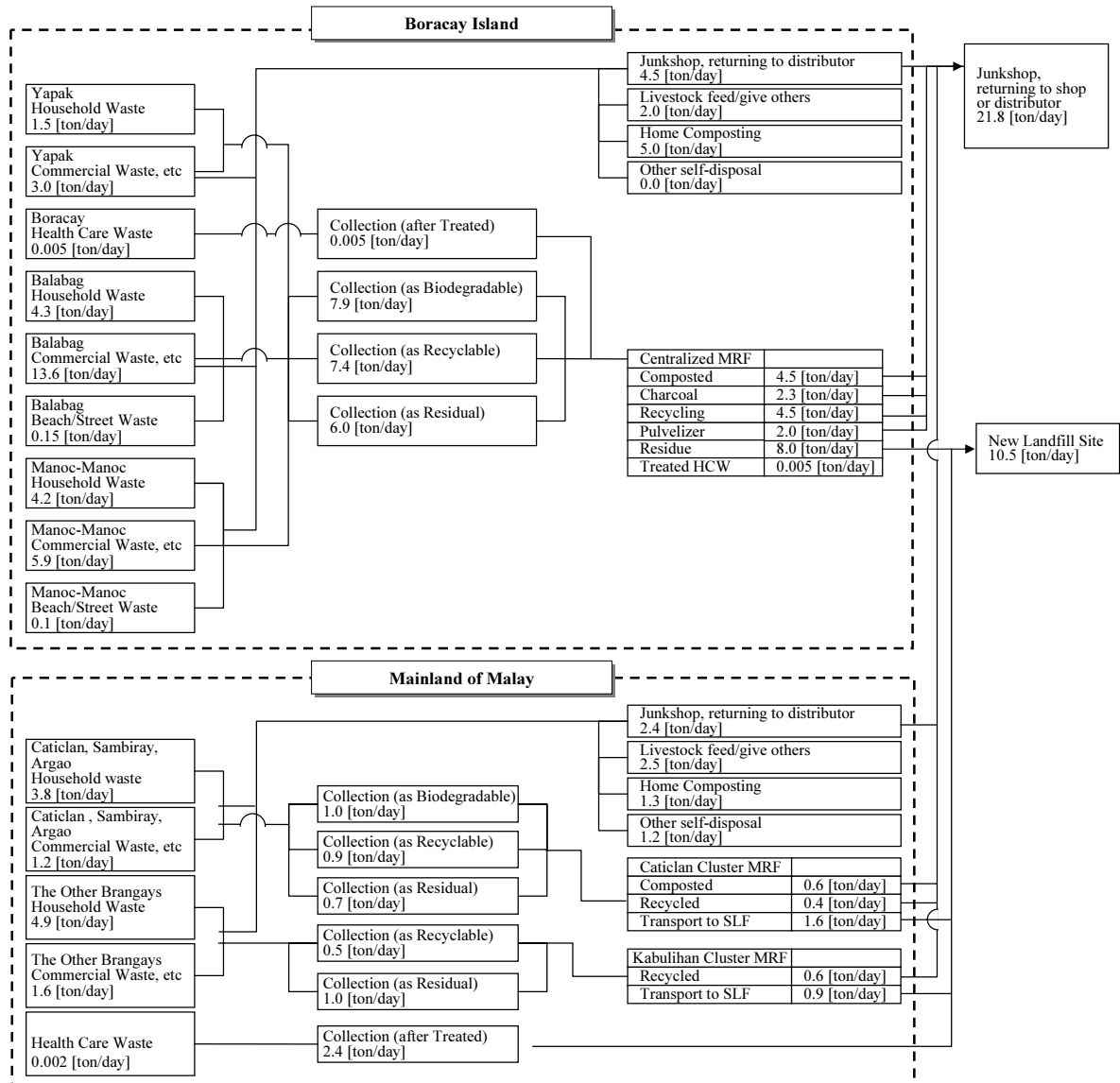


Figure 5.4-1 Future Waste Flow in 2017

Source: JICA Study Team

CHAPTER II-6 TECHNICAL SYSTEM OF FOR SOLID WASTE MANAGEMENT

6.1 Source Reduction

In accordance with the waste hierarchy, a series of source reduction programs was proposed for Boracay Island and the Mainland of Malay. For the reduction at the source, of biodegradable waste, which accounts for about 30-40 % of the generated waste, promotion of home composting was proposed for the 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. On Boracay Island, using of specific packages is proposed to be prohibited, while on the Mainland of Malay, a group recycling program is 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 ² 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 of 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 of 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

² "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.

6.2 Sweeping, Collection and Transportation

6.2.1 Sweeping

The area of street and beach sweeping on Boracay Island is proposed to be expanded and the system will be newly introduced on the Mainland of Malay along the main street.

6.2.2 Collection and Transportation

The improvement of the collection system and the extension of collection area will be carried out on Boracay Island and on the Mainland of Malay. The proposed collection and transportation systems in 2017 are summarized as table 6.2-1.

Table 6.2-1 Collection and Transportation System in 2017

No.	Items	Collection Area of Centralized Manoc-Manoc MRF	Collection Area of Caticlan Cluster MRF	Collection Area of Kabulihan Cluster MRF
1	Collected Waste (2017)	21.3[ton/day]	2.7[ton/day]	1.5[ton/day]
2	Waste Transported to the SLF (2017)	8.0[ton/day]	1.6[ton/day]	0.9[ton/day]
3	Collection Method	Mainly curbside collection (Segregated collection for biodegradable, recyclable and residual wastes) with primary collection for some areas.	Curbside collection (Segregated collection for biodegradable, recyclable and residual wastes).	Storage area
4	Equipment	Secondary collection : 8 vehicles Primary collection: 8 vehicles	Secondary collection : 1 vehicle	Secondary collection : 1 vehicle
5	Number of Worker (2017)	123 people (including staff for sweepers, collection and transportation and environmental monitors)	10 people (including staff for sweepers, collection and transportation and environmental monitors)	12 (including landfill operators)

Source: JICA Study Team

6.3 Intermediate Reduction at MRF

A centralized MRF is proposed to be set up at Barangay Manoc-Manoc on Boracay Island (Manoc-Manoc Centralized MRF), while two cluster MRFs are proposed like the Caticlan Cluster MRF and Kabulihan Cluster MRF on the Mainland of Malay. The summary of the development plan is described in Table 6.3-1.

Table 6.3-1 Development of MRFs

No.	Items	Manoc-Manoc Centralized MRF	Caticlan Cluster MRF	Kabulihan Cluster MRF
1	Location	Current Manoc-Manoc MRF	Current Caticlan MRF (Barangay Caticlan)	In the Proposed SLF (Barangay Kabulihan)
2	Collection Coverage Area	Barangay Yapak, Balabag, Manoc-Manoc	Barangays Caticlan, Argao, Sambiray	Urban and Semi-urban Barangays except for the collection areas of Caticlan Cluster MRF
3	Collected Waste (2017)	21.3[ton/day]	2.7[ton/day]	1.5[ton/day]
4	Main facilities	Bioreactors, shredders, curing areas, sorting area with a belt conveyor, glass crusher, storage areas, other small scale recycling technologies, office, weigh bridges, etc.	Composting pit, shredder, sorting area, storage area	Storage area
5	Number of workers (2017)	123 people (including staff for sweepers, collection and transportation and environmental monitors)	10 people (including staff for sweepers, collection and transportation and environmental monitors)	12 (including landfill operators)

Source: JICA Study Team

6.4 Disposal

6.4.1 Development of New Sanitary Landfill

The proposed SLF is to be located in Barangay Kabulihan approximately four km from Barangay Poblacion. The site which was identified by the DENR in February 2006 straddles the municipal boundary between the MOM and the Municipality of Buruanga (MOB).

Phase 1 would 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. The development plan of the SLF is summarized in Table 6.4-1.

Table 6.4-1 Development of New Sanitary Landfill Site

No.	Summary of Development Plan	
1	Cumulative waste (until 2017)	54,384 [tons]
2	Bulk Density	0.75 [ton/m ³]
3	Capacity of landfill area	88,000 [m ³]
4	Main facilities	Embankment dam, groundwater drainage system, leachate collection and treatment system, surface water collection system and landfill gas collection system, administrative operation compound, site road and utilities, special waste cell and operation equipment.
4	Number of workers	12 people
5	Commencement of operation	Middle of 2009

Source: JICA Study Team

6.4.2 Rehabilitation of Old Dump Site

(1) Condition of Old Dump Site

The site occupies a small valley between two low hills. Approximately 100-200 m to the east of the site is the coastline. The 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 and there is a vertical cliff approximately 20 m high. 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.

(2) Development Plan

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. Some portion of the waste is proposed to be excavated and deposited to the western half of the site for slope protection. Main facilities include earth embankment, drainage facility, fencing, gate, sign board and water quality monitoring well.

6.5 Special Waste

According to RA 9003, special waste is defined as HCW 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 on the environment and human health. This 10-year SWM Plan exclusively focuses on the HCW management. The HCW management system is composed of five steps: 1) segregation; 2) treatment; 3) temporary storage; 4) collection/ and transportation and 5) final disposal.

Taking into account the volume and composition of the HCW, it is proposed to segregate the HCW into at least the categories such as infectious waste, sharps and pathological waste and they will be packed and stored appropriately. Regarding treatment method, an autoclave shall be set up in Boracay Health Center on Boracay Island and the Public Health Center on the Mainland of Malay before transportation to the centralized Manoc-Manoc MRFs or SLF. After temporary storage at the centralized MRF, the treated HCW is brought to the proposed SLF on Boracay Island. On the Mainland of Malay, the treated HCW shall be directly transported into the SLF.

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

7.1 Information, Education and Communication (IEC)

Successful SWM requires behavior change of the target audiences. The step-by-step processes required to change behaviors are considered. Various IEC activities are proposed to be adopted, taking advantage of the different methods available as follows:

- I Mass Communication and Education (MCE: It would be applied to large audiences quickly and effectively.)
 - Mass Media: Electronic Media (Radio (short messages), Radio (talk programs), Websites), Print Media (Local newspapers, Local magazines, Posters, leaflets, stickers), Traditional Media (Banners)
 - Special Events (Public and educational events)
- II Interpersonal Communication and Education (ICE: It would be applied in order to encourage interactive dialogues between individuals or among group members.)
 - School environmental education, Creation or encouragement of community groups, other local public awareness activities)

7.2 Introduction of Incentive Program

A series of incentive programs is proposed as shown in Table 7.2-1.

Table 7.2-1 Proposed Incentive Programs

Diversion	Waste Generator		Recyclers and End Users		Management Sector	
	Residents	Business Establishments	Recyclers	Consumer (Residents and Business establishments)	Barangay	LGU
Source Reduction (3Rs)	3R-Master Training Service	-	Low interest loan for Recyclers	-	Rewards & Penalties	-
Recycle/ Composting	-	Reward System for Source Separation	Optimization System for Selling Price	-		
Green Purchasing	-	-	Green & Blue Label System		Green Procurement	

Source: JICA Study Team

7.3 Implementation of Market Development

In order to practice diversion optimally, it should be addressed to develop the markets as shown Table 7.3-1.

Table 7.3-1 Market Development

Materials	Target	Method for Developing Markets
Collected Recyclables	Recyclers	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Product development (to make products from recyclables fascinating to consumers) - To involve individual purchasers - To introduce a concept of "Green Procurement"
Compost	Farmers, General public, Hotels and Golf links	<ul style="list-style-type: none"> - 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 (eco-parks) 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 and Restaurants	<ul style="list-style-type: none"> - To expand targets from Boracay to Karibo - To give a brand name to the compost, flowers and agricultural products

Source: JICA Study Team

7.4 Legal System Arrangement

Corresponding to the proposed 10-year SWM Plan, necessary legal arrangements such as amendments of the existing municipal ordinances (MOs) or publication of new MOs should be conducted. The necessity of amendments of the existing MOs is proposed as follows;

- Ordinance No.230: Changed based on basic rules to be decided (such as raising fees)
- Ordinance No.233: Changed based on basic rules to be decided (such as raising fees)
- Ordinance No.56: In accordance with development of the SLF and minor changes
- Ordinance No.185: In accordance with introduction of new source reduction programs

7.5 Organizational Set up for Solid Waste Management

The proposed organizational set up for SWM is shown in Figure 7.5-1. It is proposed to set up the re-organized BSWMAT as shown in Figure 7.5-2 in order to implement these projects smoothly in accordance with the establishment of the proposed Manoc-Manoc Centralized MRF. The establishment of MSWMAT is also proposed for the Mainland of Malay.

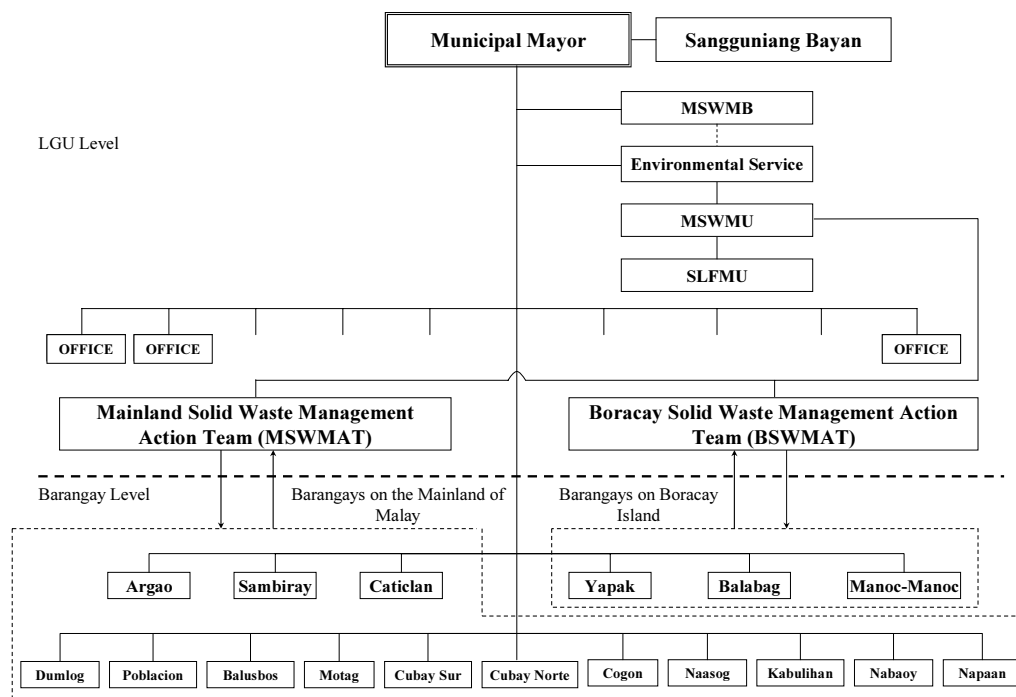


Figure 7.5-1 Proposed Organizational Set-up for Solid Waste Management

Source: JICA Study Team

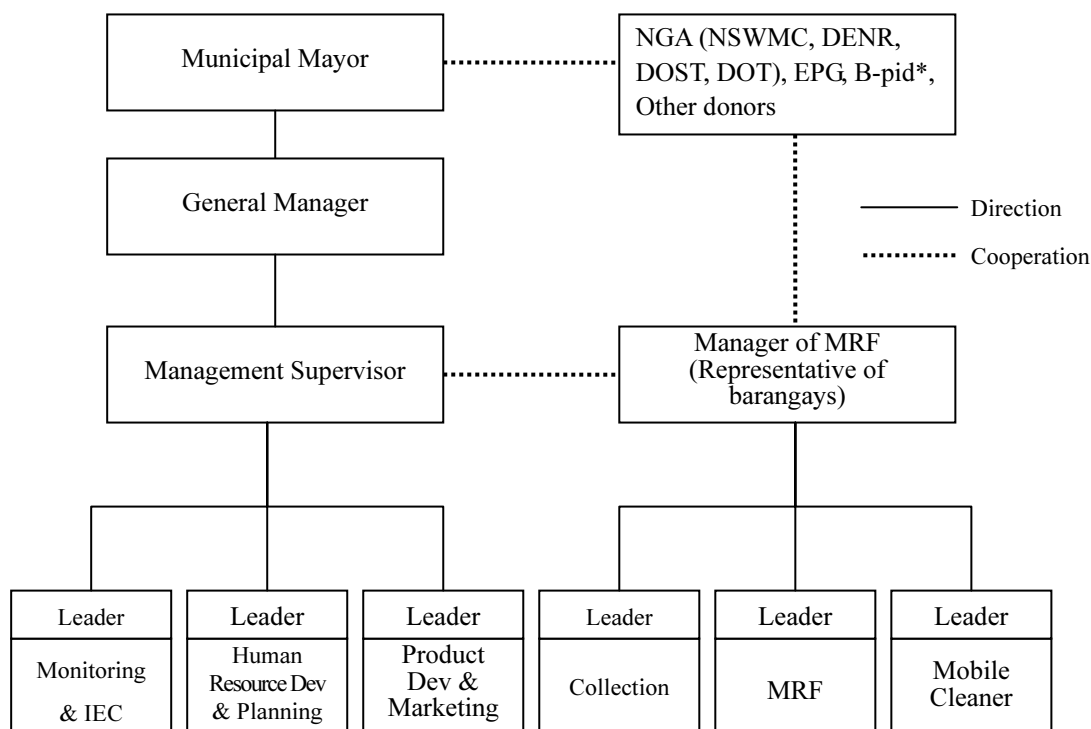


Figure 7.5-2 Proposed Organization of Boracay Solid Waste Management Action Team

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

7.6 Capacity Development

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	<ul style="list-style-type: none"> - 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 (Off-the-job-training)
SLFMU	<ul style="list-style-type: none"> - Supervision of design, construction, operation, and management of the SLF - SW data management - Payments to contractors, workers, and other expenses - Environmental management of the SLF and rehabilitated the old dump site including environmental monitoring 	OJT (On-the-job-training) and Off-JT
BSWMAT and MSWMAT	<ul style="list-style-type: none"> - Operational technologies (recycling and composting) - SW data management - Payments to contractors, workers, and other expenses - Environmental management of MRFs including environmental monitoring 	OJT and Off-JT

Note: 1) MSWMU: Municipal Solid Waste Management Unit
 2) SLFMU: Sanitary Landfill Management Unit
 3) BSWMAT: Boracay Solid Waste Management Action Team
 4) MSWMAT: Mainland Solid Waste Management Action Tea,
 Source: JICA Study Team

The following administrative tools should be prepared and revised or updated periodically such as every two or three years.

- Solid waste management operational manual of the MOM
- Solid waste management guidelines of the barangays
- Operation and management manuals of the MRFs and the SLF
- Solid waste data base of the MOM and at each MRF and SLF

CHAPTER II-8 IMPLEMENTATION PLAN

8.1 Implementation Plan

8.1.1 Implementation Schedule of the 10-year SWM Plan

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.

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)

The implementation schedule of the proposed 10-year SWM Plan is shown in Table 8.1-1

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																																																								
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12																																																									
4. Special Waste Management	4.1	Introduction of Infectious Waste Management System on Boracay Island																																																																																																																																																																					
4.2	Introduction of Infectious Waste Management System on the Mainland of Malay																																																																																																																																																																						
5. IEC Program	5.1	Implementation of Public Education and Information																																																																																																																																																																					
6. Institutional and Organizational Arrangement	6.1	Introduction of Incentive Program																																																																																																																																																																					
6.2	Implementation of Market Development																																																																																																																																																																						
6.3	Arrangement of Legal System																																																																																																																																																																						
6.4	Organizational Setting Up																																																																																																																																																																						
6.5	Introduction of Cost Recovery System																																																																																																																																																																						
7. Capacity Development	7.1	Implementation of Training Program on Solid Waste Management																																																																																																																																																																					
7.2	Development of Administration Tools for Solid Waste Management																																																																																																																																																																						

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

Source: JICA Study Team

8.1.2 Responsible Organizations of the 10-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 their cooperation and contribution to implement the 10-year SWM Plan are proposed.

8.1.3 Monitoring Program

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. It should be based on objective information and data collected and recorded regularly to measure against predetermined indicators to assess progress.

1) Monitoring

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.

First Level Monitoring

For the first level monitoring, it is recommended to conduct the monitoring based on the following formula to calculate diversion rates:

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

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 MRFs (recycled, composted and provided to the farmers for livestock feeding)

QWG : Quantity of Waste Generated

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

QWRS : Interview survey with questionnaires and direct measurements

QWRM : Measurement by a weighbridge at the Manoc-Manoc Centralized MRF

QWG : Survey at generation sources

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. 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 Ratio (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

On the other hand, there will be no weighbridge available at the MRFs before the fill-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 beforehand.
- During the monitoring, each sack of the residual waste is counted.
- Multiply the number of the sacks by the amount of a sack which is measured beforehand.

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 the perspectives such as relevance, effectiveness, efficiency, impact and sustainability of municipal activities. In 2017, the final evaluation should be conducted to examine whether the targets are achieved, and to draw best practices and lessons learned for the future SWM plans.

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 priority 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, their feasibility studies (F/Ss) were conducted. The following are the selected priority projects.

- Development of Kabulihan SLF
- Rehabilitation of Old Dump Site
- Development of Manoc-Manoc Centralized MRF

CHAPTER II-9 COST ESTIMATE AND FINANCIAL ASPECT

9.1 Cost Estimate of the 10-year SWM Plan

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 9.1-1.

Table 9.1-1 Investment Cost for the 10-year SWM Plan (2008-2017)

(Unit: x10³ 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
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
Total of 2. Sweeping, Collection and Transport	2,528
3. Disposal	
3.1 Development of Kabulihan Sanitary Landfill	56,087
3.2 Rehabilitation of Old Dump Site	8,136
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
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 and is summarized in Table 9.2-1.

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

(Unit: x10³ PhP)

Project	Total	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
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

Source: JICA Study Team

9.3 Funding Options

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. Main sources are as follows:

- General taxes and incomes of the MOM and barangays
- Internal Revenue Allotment (IRA) of the MOM and barangays
- Garbage Collection Fee (GCF)
- Profit from sales of recyclables and the compost products
- Environmental and Admission Fees (EAF)

Since it would be difficult to recover the total investment cost with only the main sources as shown in the Figure 9.3-1, loans for investments are necessary to secure the cash to recover the costs. The costs for SWM with loans are estimated as shown in Figure 9.3-2.

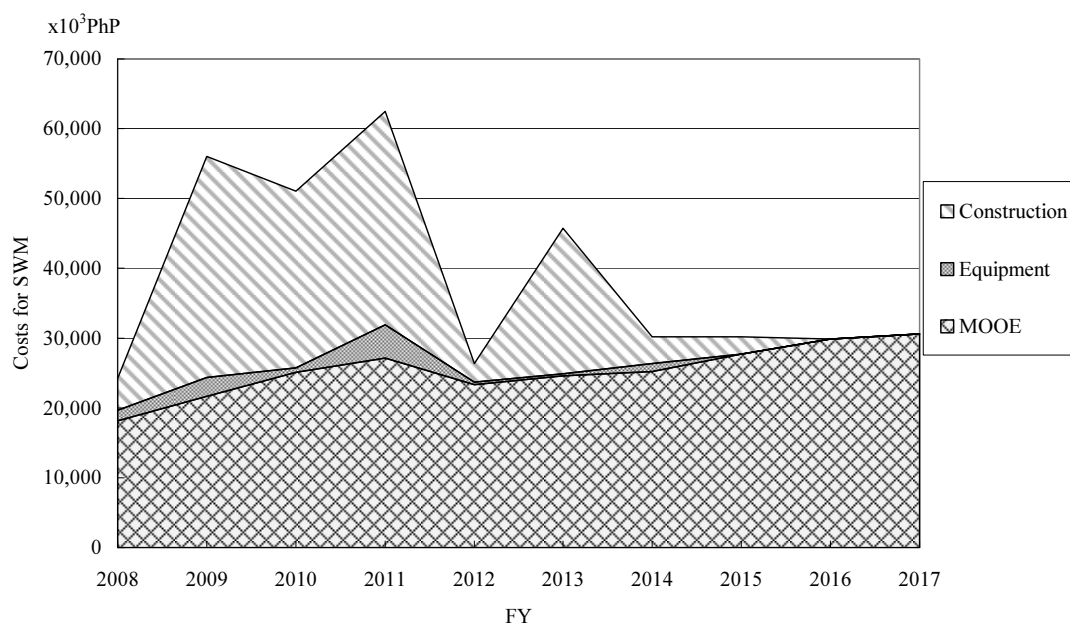


Figure 9.3-1 Total Cost for SWM for the 10-year SWM Plan

Note: MOOE stands for Maintenance, Operation and Other Expenses

Source: JICA Study Team

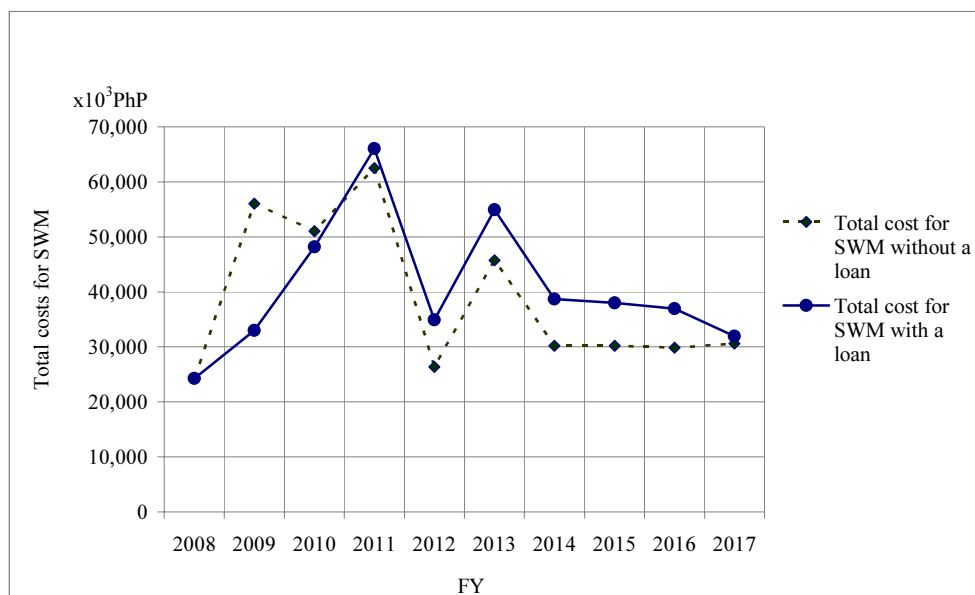


Figure 9.3-2 Comparison of Total Costs for SWM with and without a Loan

Note: Repayment Conditions: Repayment term is four years, Grace period is three years, Payment method is Amortization method (Equal principal equal repayments), Interest is 11%, Equity participation is 10% of the loanable amount, DBP (Development Bank of the Philippines) is a candidate to make a loan.

Source: JICA Study Team

9.4 Cost Sharing

Cost sharing among related bodies would be done along the following concepts. The amount of costs to be shared is shown in the Figure 9.4-1.

- The MOM and barangays should cover the costs for SWM with 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 considering the ratio of SWM expenditures to the total amount of the General Fund in 2006 (14%).
- 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 in case that the MOM and barangays can not recover the all costs for SWM. The GCF from households would be PhP 50 per household per month, while the GCF from business establishments would be raised to 1.6 times of the current fee by the end of the term of the 10-year SWM Plan.
- The EAF from tourists would be appropriated to the costs for SWM in case that the other sources could not cover the all costs. The EAF should be a final resource to recover the costs. In this case, it is necessary to raise the EAF to PhP 60 per tourist.

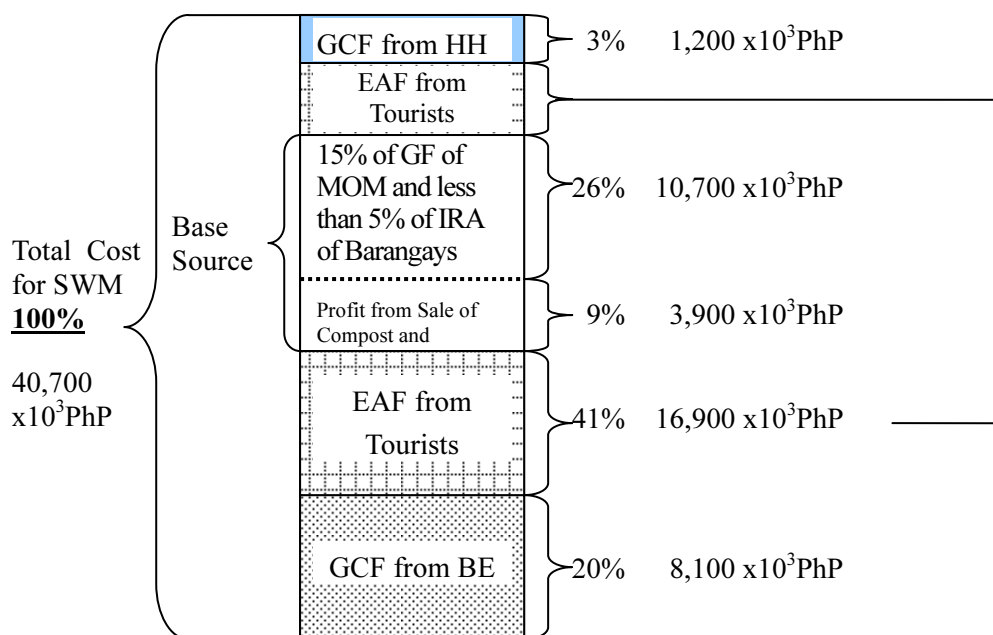


Figure 9.4-1 Cost Sharing

Source: JICA Study Team

9.5 Setting up Local Common Funds

It is a key issue how the MOM, barangays, and other concerned bodies, such as donors, will manage funds for SWM based on the above cost sharing. Main resources, the GCF and EAF appropriated to SWM expenses are separately treated by the General Fund and the Trust Fund of the MOM. Profits of 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 biodegradable waste 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 whether 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. Donations 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 provide the incomes and expenditures of SWM with clear transparency.

A Local Common Fund (LCF) could be thought of as a method of for the integration of the accounting system. The LCF is proposed as the fund locally and commonly managed by concerned bodies and the related financial resources are expected to be put into the fund. 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.

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

The proposed LCF should be managed mainly for the following points. Especially, the IRA is required to be appropriated to payment of the loan according to a collateral requirement of the DBP.

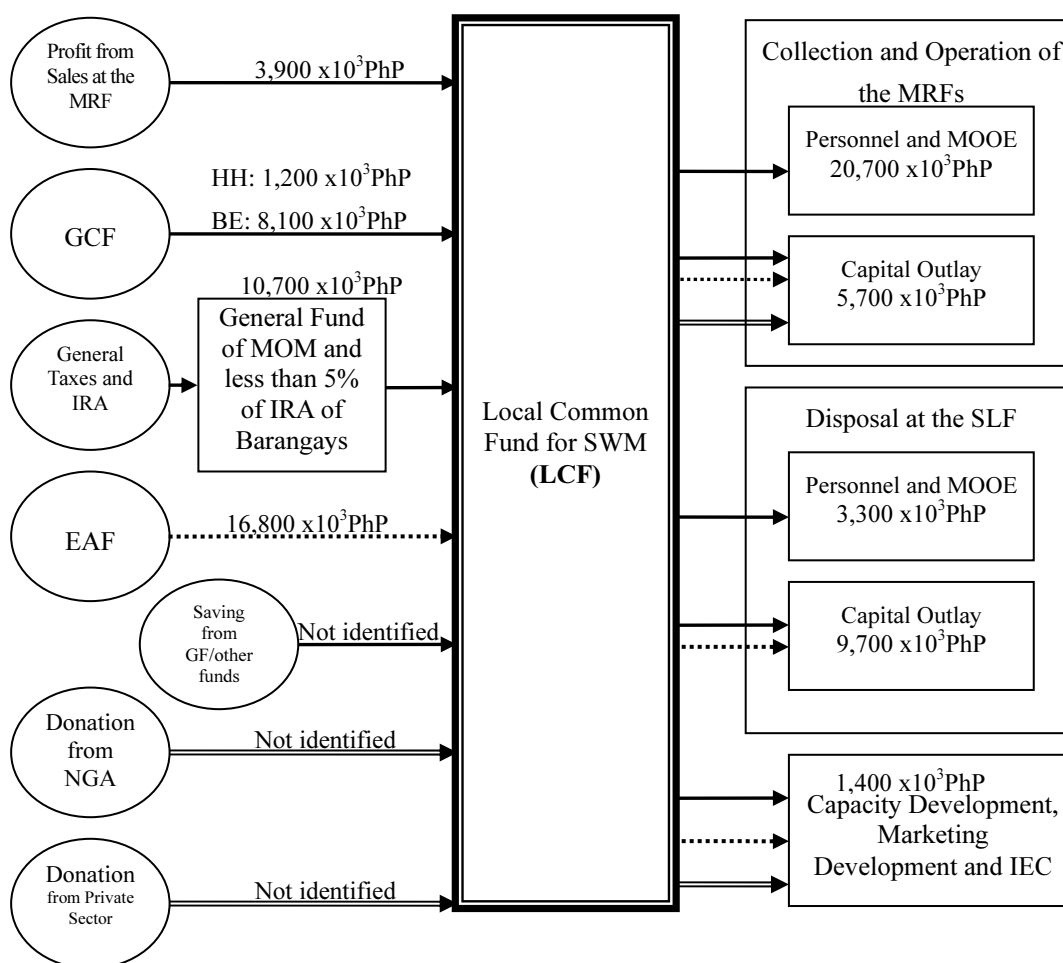


Figure 9.5-1 Management of LCF

Source: JICA Study Team

9.6 Cost Recovery

Total costs for SWM could be recovered as discussed above if the EAF is increased up to PhP 60 per tourist from the current PhP 50. However, since investments for the MRF and SLF are proposed during the first four years of the 10-year SMW Plan, considering the recovery of the costs in 2009 and 2010, the EAF should be raised up to PhP70 or 80 per tourist considering the recovery of the costs in 2009 and 2010. Figure 9.6-1 shows the annual cost recovery with 15% of the General Fund of the MOM/Barangays, the GCF from households and business establishments and the EAF from tourists.

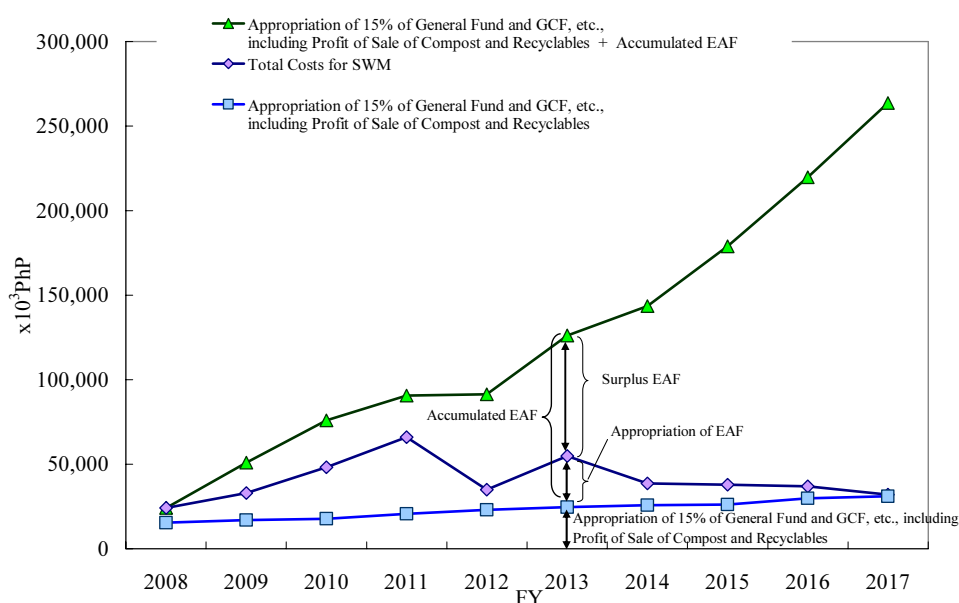


Figure 9.6-1 Cost Recovery during the 10-year SWM Plan (in case of EAF at PhP100 of EAF)

Source: JICA Study Team

9.7 Cost Evaluation and Comparison

The O&M cost, which is 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 capita is PhP 418.

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 a special cell for health care waste. It does not include running cost of rehabilitation of Old Dump Site.

Source: JICA Study Team

CHAPTER II 10 SOCIAL AND ENVIRONMENTAL ASPECTS

10.1 Environmental Policy Framework in the Philippines

Environmental Policy Framework in the Philippines to be considered for the implementation of the 10-year SWM Plan is as follows:

- National Policy Objectives: Philippine Agenda (PA) 21, Medium Term Philippine Development Plan (MTPDP)
- Legal and Regulatory Framework: The Philippine Constitution, Presidential Decree No. 1151, Presidential Decree No. 1152, Presidential Decree 984, Presidential Decree No. 1586, Presidential Proclamation 2146, DENR Administrative Order r (DAO) No. 21, DAO No. 37, DAO No. 05

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: (Environmentally Critical Projects) 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 (Environmentally Critical Areas);
- 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.

10.2 Social and Environmental Aspects

(1) Summary of Social Aspects

- Enhancing 3Rs Activities: The notion of segregation, recycling and composting is common and, as a rule, they are being practiced on both Boracay Island and the Mainland of Malay. It would have a positive effect to improve and promote these activities.
- Considerations on Junkshops and Waste Pickers: Once the new collection system is established on the Mainland of Malay, junkshops and waste pickers may lose their opportunities to pick up the recyclable materials at the sources. However, the cluster MRF at Caticlan could be a new place where the junkshops can access the recyclable materials more efficiently and may provide employment opportunities for the waste pickers.
- Job Opportunities at the Kablihan SLF: Based on the interview during a social survey, most of the residents around the proposed SLF are in favor of the project. However, they expressed their expectation for employment opportunities which may be created by the SLF. A strategic employment plan for local residents could contribute to the local economy.

- Job Opportunities at Manoc-Manoc Centralized MRF: 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.

(2) Summary of Environmental Aspects

- Environmental Improvement by Expansion of Waste Collection: The waste collection service proposed to cover some barangays on the Mainland of Malay is expected to improve the sanitary and environmental conditions.
- Environmental Impacts by Development of the Kablihan SLF: The development of the new SLF would be an effective measure to prevent the environmental deterioration by residual waste without proper measures at present. 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.
- Environmental Impacts by Rehabilitation of the Old Dump Site: Since the suspension of the operation in 2006, the lack of practical measures for rehabilitating the old dump site has caused groundwater contamination around the site, though it is not serious. 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.
- Environmental Impacts by Development of the Centralized MRF: Offensive odors which may be caused by the waste collected or by the composting activities there is one of the biggest concerns of the local residents. It is necessary to consider the proper location of composting machinery as well as proper handling of biodegradable waste to minimize the odor impacts on the surrounding area.

10.3 Initial Environmental Examination (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.

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	Some environmental and social impacts are expected such as odors and water pollution	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 or social impact is expected.	Not necessary
Development of Caticlan Cluster MRF	Mainland of Malay	No serious environmental or social impact is expected.	Not necessary

Source: JICA Study Team

IEEs for the respective 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.

CHAPTER II-11 EVALUATION

11.1 Technical Aspect

The proposed methods and technologies relating to diversion, composting, recycling and collection and transport have been used in this region or other areas in the Philippines. The SLF to be developed at Barangay Kabulihan is designed based on the DAO 10, Series of 2006. 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. 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

The proposed MRFs and SLF should contribute to mitigate the impacts and accomplish proper handling of the collected waste. 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. 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. For this, the arrangements of loans and an 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. The environmental conservation of Boracay Island could keep attracting the tourists continuously and also leads to promote further tourism development. The 10-year SWM Plan is evaluated as economically feasible.

11.6 Overall Evaluation

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.

PART III FEASIBILITY STUDY FOR THE PRIORITY PROJECTS

CHAPTER III-1 FEASIBILITY STUDY FOR THE KABULIHAN SANITARY LANDFILL

1.1 Site Conditions

The proposed SLF is located in Barangay Kabulihan and lies approximately four (4) km from Barangay Poblacion. The site, which extends to a total area of 6.25 ha., straddles the municipal boundary between the MOM and the Municipality of Buruanga (MOB). The site was identified by the DENR in February 2006 as a potential landfill site for MOM. Following an assessment by the Mines and Geosciences Bureau (MGB), also in February 2006, it was 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 Buruanga Poblacion of the MOB.

It is envisaged that the landfill site be developed progressively in two individual and separate Phases, with Phase 1 being developed in the eastern half of the site that is already partially cleared. Phase 1 would be developed partially under the 10-year SWM Plan, while Phase 2 would be developed in the final one to two years of filling of Phase 1.

1.2 Planning Concept

1.2.1 Design Condition

(1) Estimated Amount of Waste Disposal at the SLF

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 of tourists and the collection service area are expected to increase over time. Allowing for a 20% contingency, it is estimated that the SLF needs to accommodate approximately 55,000 tons of residual waste, including the residual waste currently stored on-site and the residual waste to be generated and requiring disposal until the site is operational. Based upon this, the required capacity of the SLF until the end of 2017 is calculated to be approximately 88,000 m³.

(2) Design Requirements of DAO 10

Since the amount of residual waste 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 are as shown in Table 1.2-1.

Table 1.2-1 Design Requirements for Category 1 Landfill

Features	Minimum Requirement
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 must be at least 60 cm thick and have a permeability of 1×10^{-5} cm/sec

Source: DAO 10, Series 2006

1.3 Conceptual Design of the SLF

1.3.1 Overall Landfill Footprint

The total landfill footprint of Phase 1 is approximately 15,635 m². The eastern, southern and western margins of Phase 1 abut higher ground. Along the northern margin, however, the stream valley provides a natural break in the continuity of the higher ground surrounding the landfill footprint. Accordingly, it is proposed to construct an embankment dam that serves to close off the lowest part of the landfill footprint. The landfill footprint for Phase 1 has been subdivided into three principal stages. It is envisaged that the landfill is developed first in the lowest part of the valley along the northern margins of Phase 1 and then progress southwards up gradient.

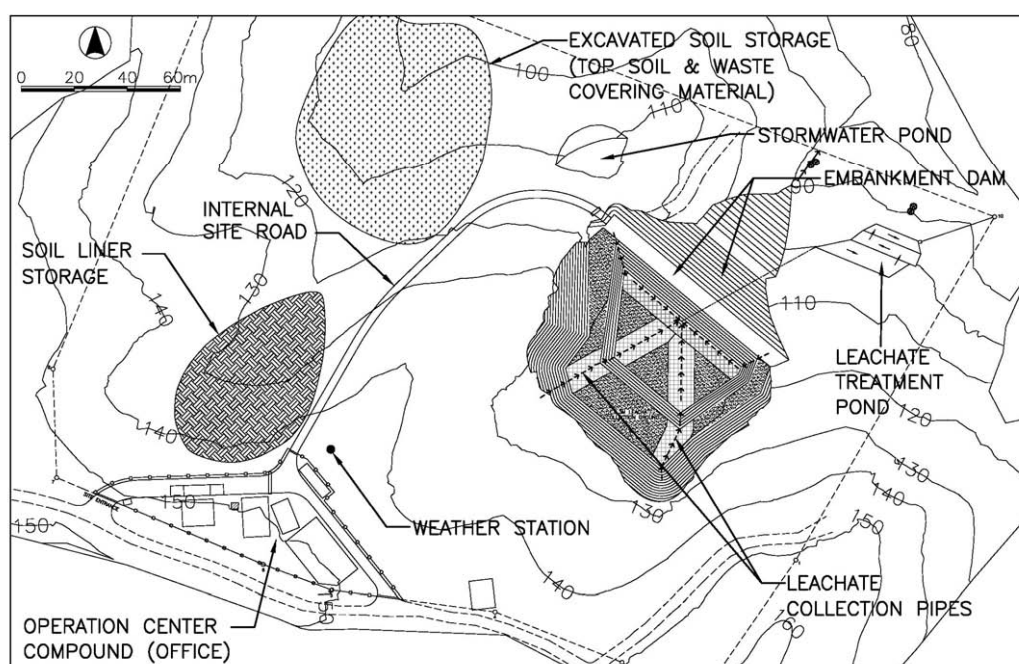


Figure 1.3-1 Development Plan of Sub-Phase 1A of Landfill Area

Source: JICA Study Team

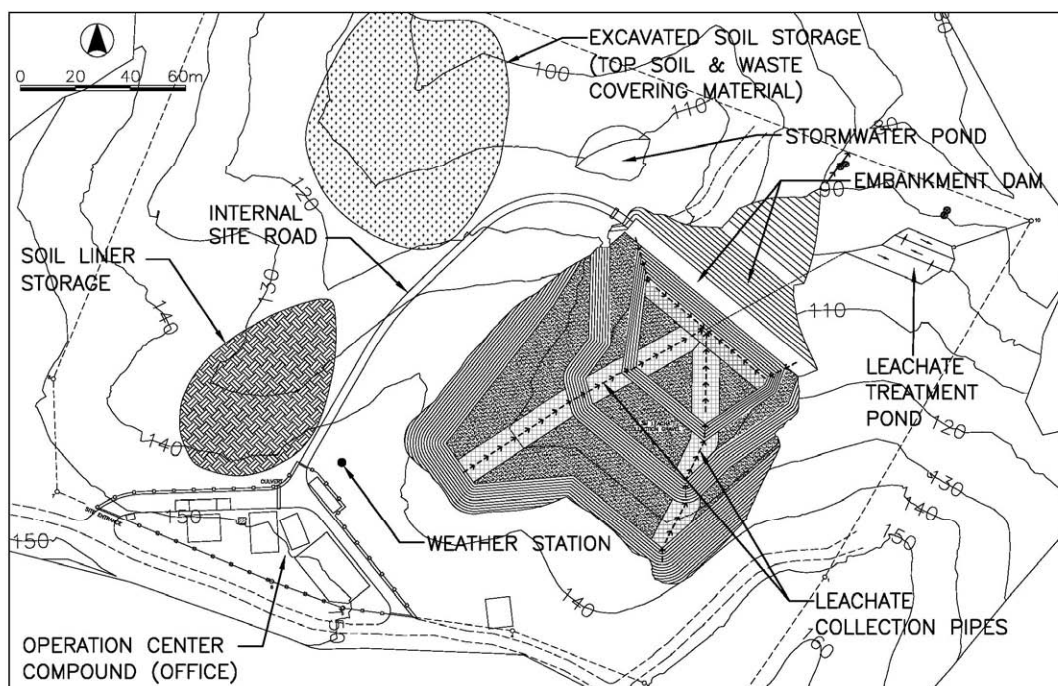


Figure 1.3-2 Development Plan of Sub-Phase 1B of Landfill Area

Source: JICA Study Team

1.3.2 Facility Plan

The conceptual design for the SLF considers the following principal elements of site works and site infrastructure:

- overall landfill footprint, including buffer zones,
- site phasing and sub-phase development to permit controlled disposal of residual waste,
- site preparation works, including site clearance,
- embankment dams and peripheral bunds,
- containment landfill liner systems,
- leachate control and management system,
- landfill gas control and management system,
- surface water control and management system,
- restoration and aftercare of completed areas of the waste disposal area,
- site roads, including site access road and internal on-site roads,
- waste reception and management area, including the site office and ancillary buildings,
- site security works, including fencing,
- utilities,
- special waste cell, and
- environmental monitoring system.

1.3.3 Equipment Plan

The anticipated mobile equipment requirements for waste loading from the temporary store, landfill disposal operations in the cell and covering of disposed waste by cover soils are a backhoe loader, bulldozer, dump truck and service vehicle. In addition to the above, it is necessary to procure at least one submersible pump and associated accessories to facilitate the management and recirculation, as required, of leachate at the site and to provide the capability to water and irrigate capped and restored parts of the site during periods of dry weather.

1.4 Operation and Management Plan

It is proposed that residual waste delivered to the site should be stored initially on a temporary basis at a storage area located within the administration and operations compound. Here, after recording and measuring the waste delivery, waste shall be unloaded, either manually if delivered in sacks, or by discharging directly from the dump truck. Once sufficient residual waste has been accumulated at the temporary store to warrant final disposal, the stored waste shall be loaded onto the site-based dump truck for delivery to the active waste disposal area. Waste shall be deposited in its final place of burial, adopting the area method of landfilling, in accordance with the Contractor's specified operating practices.

Consistent with the proposed *modus operandi* for site operations, it is recommended that the requirements for site staff are kept to a minimum level in order to minimize operational costs. Table 1.4-1 sets out the proposed site operational staff.

Table 1.4-1 Estimated Minimum Staff Requirements for Site Operations

Staff	Full-time	Part-time	Workload per person (hrs./week)
Landfill Manager (Engineer)	-	1	8
Supervisor	1	-	40
Clerk	2	1	40/20
Operators	2	-	40
Labour	3	2	40/20 (as required)

Source: JICA Study Team

1.5 Implementation Plan

The anticipated schedule for the development of the SLF, for the whole 10 year period covered by the plan, is formulated considering a Design-Build-Operate (DBO) contractual arrangement, which comprises the following principal milestones:

- identification of project management consultants by mid-2008
- completion of DBO tender process and Award of Contract in the last quarter of 2008
- mobilization of DBO Contractor in the last quarter of 2008
- commencement of detailed design in the last quarter of 2008

- commencement of construction activities no later than the beginning of 2009
- completion of construction of Sub-Phase 1A-1 in the second quarter of 2009
- procurement of necessary operational equipment in the first quarter of 2009
- commencement of Operations (disposal of residual waste) – middle of 2009

1.6 Cost Estimate

The disbursement schedule during the 10 years from 2008 to 2017 was prepared on the basis of the implementation schedule for the development of the Kabuliha New Sanitary Landfill Site. The annual cost is estimated as shown in Table 1.6-1.

Table 1.6-1 Annual Investment and O&M Costs of Kabuliha Sanitary Landfill Site
(Unit: x10³ PhP)

No.	Work Items	Total	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
A	Engineering Service(1)[(2)*0.05]	2,250	169	1,074	254	45	0	639	0	68	0	0
B	Construction (2)	44,992	3,388	21,477	5,075	896	0	12,788	0	1,368	0	0
1	Preparatory work (including Detailed Design)	5,922	2,523	1,505	104	0	0	1,790	0	0	0	0
2	Excavation, hauling and storage	7,431	803	2,430	162	0	0	4,037	0	0	0	0
3	Formation of embankment dam	4,427	0	4,427	0	0	0	0	0	0	0	0
4	Installation of basal engineered barrier	8,283	0	3,558	1,547	0	0	3,178	0	0	0	0
5	Installation of leachate collection pipes	6,298	0	1,929	1,468	0	0	2,901	0	0	0	0
6	Leachate extraction and transfer system	404	0	404	0	0	0	0	0	0	0	0
7	Leachate treatment facility	2,518	0	2,518	0	0	0	0	0	0	0	0
8	Landfill gas facilities	112	0	0	0	56	0	0	0	56	0	0
9	Upper engineered barrier	2,152	0	0	0	840	0	0	0	1,312	0	0
10	Stormwater drainages	1,099	0	880	0	0	0	219	0	0	0	0
11	Stormwater outfall structure	124	0	124	0	0	0	0	0	0	0	0
12	Stormwater retention pond	788	0	0	788	0	0	0	0	0	0	0
13	Building work	1,890	0	945	945	0	0	0	0	0	0	0
14	Internal roads	1,389	62	1,202	62	0	0	62	0	0	0	0
15	Gates and fencing	656	0	656	0	0	0	0	0	0	0	0
16	Power supply	600	0	600	0	0	0	0	0	0	0	0
17	Water supply	300	0	300	0	0	0	0	0	0	0	0
18	Construction of special waste cell	600	0	0	0	0	0	600	0	0	0	0
C	Administration Cost (3)[(1)+(2)*0.05]	2,362	178	1,128	266	47	0	671	0	72	0	0
D	Equipment Procurement (4)	1,450	1,400	50	0	0	0	0	0	0	0	0
1	Submersible pump and accessories	50	0	50	0	0	0	0	0	0	0	0
2	Multi-cab	200	200	0	0	0	0	0	0	0	0	0
3	Backhoe Loader	1,200	1,200	0	0	0	0	0	0	0	0	0
E	Physical Contingency(5)[((1)+(2)+(3))*0.1+(4)*0.05]	5,033	444	2,370	560	99	0	1,410	0	151	0	0
	Subtotal of Investment (6) [(1)+(2)+(3)+(4)+(5)]	56,086	5,579	26,099	6,155	1,086	0	15,508	0	1,659	0	0
F	Operation and Maintenance Cost (7)											
1	Transport of Residual Waste	38,609	4,925	5,199	5,647	5,531	3,337	3,077	2,808	2,740	2,673	2,673
2	O&M of SLF	22,768	2,145	2,275	2,478	2,601	2,406	2,341	2,224	2,097	2,100	2,102
	Subtotal of O&M (7)	61,377	7,070	7,473	8,125	8,132	5,743	5,418	5,032	4,837	4,773	4,776
	Price Escalation (8)		632	3,441	2,251	1,986	1,587	7,117	2,048	3,102	2,631	3,003
	Total Cost (9)[(6)+(7)+(8)]	145,262	13,282	37,013	16,530	11,204	7,329	28,042	7,080	9,598	7,404	7,779

Source: JICA Study Team

1.7 Financial Analysis

Since the amount of investments would be relatively high in 2009 (stage 1), it is necessary to cover the cost by arrangement of a loan at stage 1. The loan would contribute to the reduction in the amount of cash that the MOM should pay at one time. Main income sources are the General Fund/IRA of the MOM and the GCF and a part of the income of the EAF also could be appropriated. The cash flow was calculated as shown in Table 1.7-1.

Table 1.7-1 Cash Flow of Development of Kabulihan Sanitary Landfill

Year		(x10 ⁹ PhP)									
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cash Inflows	A	2,838	34,130	13,547	6,847	11,609	33,122	11,621	13,331	10,327	4,800
GCF from HH		-	88	92	104	172	188	202	220	237	248
General Taxes/IRA from MOM and Barangays and EAF		2,838	7,397	6,262	5,752	10,400	31,862	10,326	11,988	8,640	3,070
GCF from BE		-	749	780	992	1,036	1,072	1,093	1,122	1,451	1,482
Income from Loan Payable		0	25,897	6,412	0	0	0	0	0	0	0
Cash Outflows	B	2,838	34,130	13,547	6,847	11,609	33,122	11,621	13,331	10,327	4,800
Investment for Development of Kabulihan Sanitary Landfill Sourced from Self-Sustaining Fund		586	2,877	712	132	0	20,782	0	2,451	0	0
OM related to Landfill		2,252	2,508	2,868	3,161	3,070	3,137	3,129	3,099	3,257	3,425
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 for Development of Kabulihan Sanitary Landfill sourced from a Loan		0	25,897	6,412	0	0	0	0	0	0	0
Net Increase in Cash	C=A-B	0	0	0	0	0	0	0	0	0	0

Note: The cash outflows include inflation rate and physical contingency.

Source: JICA Study Team

1.8 Social and Environmental Considerations

The MOM has prepared an IEE study for the previously designed SLF and submitted an IEE report to the DENR-EMB Regional Office on 10th of February, 2007. The Office has approved it and issued an ECC for the new SLF on 5th of June, 2007. However, the MOM needs to amend the existing IEE to obtain an amended ECC.

The proposed development of the SLF is expected to contribute to mitigate the negative environmental impacts which may be caused by the waste being dumped at sites other than the SLF. In order to mitigate the negative environmental impacts which could be caused by the development of SLF itself, careful environmental considerations have been given to the development plan such as a leachate collection and treatment system and liner system at the bottom of the landfill area. Although no serious environmental or social impacts are expected, environmental monitoring, especially on both surface and ground water, is planned to be conducted.

1.9 Evaluation and Conclusion

The proposed SLF is planned following the DAO 10 Series 2006 which should be adapted to the SLF development in the Philippines. Careful social and environmental considerations have also been given to the development plan based on DAO 10. The SLF aims to dispose of the residual waste in a sanitary way so that the environmental degradation which has been brought about by the waste dumped at sites other than the SLF can be minimized. It is also expected that the development of the SLF would contribute to make the whole area of the MOM clean and attractive. As for the financial aspects, investment and O&M costs for the development of the SLF can be recovered by the MOM. Considering the above series of evaluations from the technical, social & environmental, financial & economical aspects, the Development of the SLF is evaluated as viable as a whole.

CHAPTER III-2 FEASIBILITY STUDY FOR THE REHABILITATION OF THE OLD DUMP SITE

2.1 Site Condition

The topographic map and the areas to which solid waste has been dumped are reproduced as shown in Figure 2.1-1. The site occupies a small valley between two low hills, one to the north which reaches an elevation of approximately 63 m above sea level (ASL). Approximately 100-200 m to the east of the site is the coastline, which comprises a vertical cliff approximately 20 m high in this location. The steep slope of the dump site is unstable and is prone to slope failures, particularly in the central and northern sections where failure of the slopes is continuing and has accelerated with the onset of the rainy season.

According to the topographic and boring survey, solid waste was dumped along the northern edge of a steep northeast-southwest ridge and the dumping area is approximately 0.7 ha and the depth of deposited waste is 0.5 to 7.0 m. According to the information, dumped solid waste is estimated at about 15,000m³.

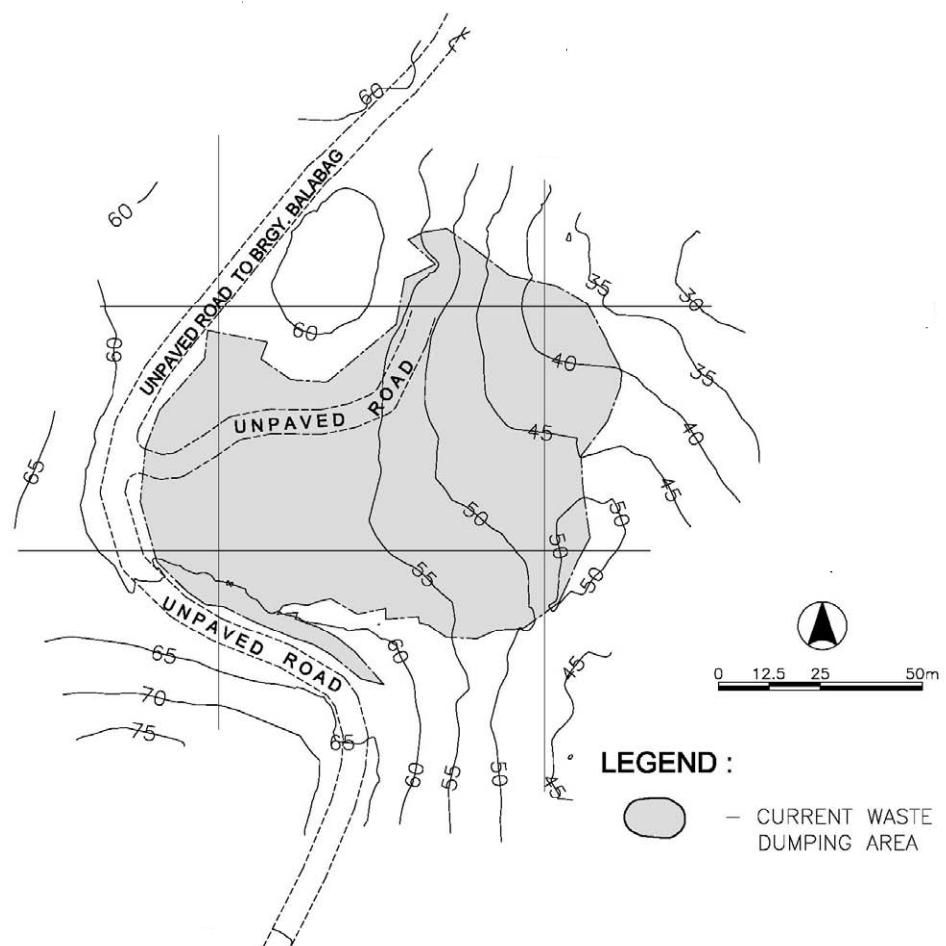


Figure 2.1-1 Area Where Solid Waste was Dumped at the Old Dump Site

Note: Shaded area shows the area where solid waste was dumped.

Source: JICA Study Team

Surface water runs on to the old dump site only after torrential rain. There was no significant pollution identified except for a few parameters such as iron, lead and total coliform. Groundwater quality was analyzed during the rainy season. The results indicated several contaminants, though their extent was not significant. The same as in the surface water survey, the groundwater contained high concentrations of iron, and the concentration of lead was also higher than the Philippine standards. The gas survey did not detect any serious landfill gas around the old dump site. Four parameters, Methane (CH₄), Carbon Dioxide (CO₂), Hydrogen Sulfide (H₂S) and Ammonia (NH₃) were below detection limits of a portable gas detector.

2.2 Planning Concept

2.2.1 Development of Technical Options

The planning concept for the rehabilitation of the old dump site was considered based on the results of the site condition surveys as well as DAO 09 Series 2006 and the Guidebook for Safe Closure Systems Applied for Disposal Sites by the NSWMC. One of the most critical environmental issues which should be taken into consideration is contamination of groundwater in and around the old dump site. Since there is a coastline east of the site, the contaminated groundwater could possibly flow out to the ocean especially when it is low tide. DAO 09 requests to apply and maintain soil cover at least 60 cm thick for the final soil cover which includes a 15 cm topsoil and 45 cm compacted soil together with a drainage control system. If the area to be covered by the soil is reduced it will minimize the necessary soil materials and therefore also the rehabilitation cost. Taking into account the above discussions, the following four technical options were proposed mainly focusing on the mitigation of groundwater contamination as summarized in Table 2.2-1.

Table 2.2-1 Comparison of Options for Rehabilitation of the Old Dump Site

Items	Option 1	Option 2	Option 3	Option 4
Surface Areas to be Covered by Soil	The areas to be covered are computed using the re-contoured topographic map as follows:			
	5,149 m ²	3,472 m ²	5,417 m ²	2,537 m ²
Length of T-Retaining Wall	Concrete volume computation was computed based on the design section of the T-Retaining Wall. The estimated total lengths of the T-retaining wall are as follows:			
	None	None	64 m	62 m
Length of Drainage Facility	Drainage facilities are to be provided in accordance with DAO 09 and the Guidebook for Safe Closure Systems Applied for Disposal Sites. The estimated total lengths of the drainage are as follows:			
	205 m	150 m	200 m	92 m

Source: JICA Study Team

Base on the above quantities of the facilities, the tentative rehabilitation costs were estimated. Option 4 showed the lowest cost for the rehabilitation works since the area to be covered by soil is less than the other options which produces the minimum cost for soil capping. However, because the inverted-T retaining wall could be seen from the sea side it would not

be good for the landscape of Boracay Island. In addition, there is a possibility to produce negative impacts on the environment by moving a relatively large amount of the waste dumped. Therefore, Option 2 is selected as the rehabilitation method for the old dump site.

2.3 Concept Design

DAO 09 stipulates rehabilitating works for open dump sites: However, it is not being considered nor would it be cost effective to install a system for leachate collection or treatment because the application and maintenance of soil cover and provision of the drainage control system would significantly mitigate the potential for leachate generation. In addition, the waste which is currently dumped is mainly garden waste or beach debris which have limited potential for landfill gas generation and the waste which has been dumped has already decomposed or been burned previously. Therefore, considering the type, volume, and thickness of the waste after regrading, gas management is not considered necessary. Under the selected Option 2, it is envisaged that the following will be considered for designing as shown in Figure 2.3-1.

- Excavation of existing waste in order to stabilize any unstable slopes by reducing slope gradients to a maximum of 1:3 or 1:4
- Excavation of existing waste to reduce the area to reduce the amount of capping as well as leachate which may infiltrate
- Provision of an embankment to protect against the collapse of the waste layer as well as preventing intrusion of surface water into the waste dumping area
- Compaction of all existing waste in order to reduce the volume of the waste mound
- Application of a suitable soil cover over the waste and also over the areas that were cleared of waste during the regrading in order to promote vegetative growth
- Revegetation of the dumping and cleared areas
- Provision of storm water drainage systems around the areas that received soil cover to collect surface run-off and thus to prevent surface erosion of the covered areas,
- Fencing of the site to prevent unauthorized access

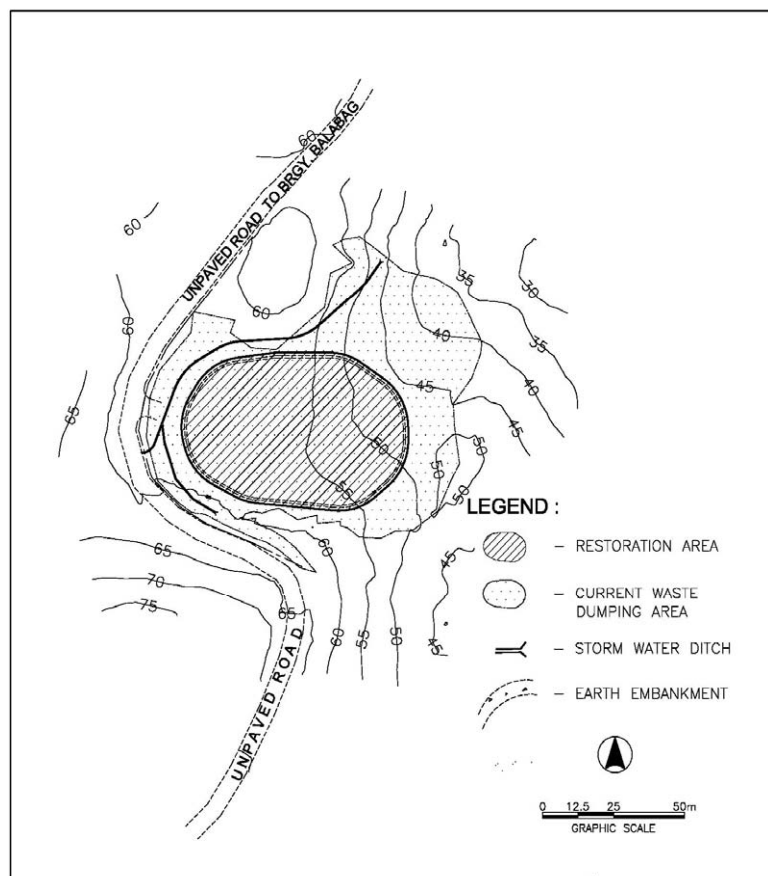


Figure 2.3-1 Rehabilitation Plan for the Old Dump Site
Source: JICA Study Team

2.4 Facility and Equipment Plan

The equipment and facilities to be installed at the site for the rehabilitation are described in Table 2.4-1.

Table 2.4-1 Facility and Equipment Plan

Facility	Explanation	Specification
Earth Embankment	Will be prepared to protect against the collapse of the waste layer as well as protect against the intrusion of surface water into the dumping area.	Length of the earth embankment: 216m
Drainage Facility	To be constructed along the periphery of the closed disposal site to divert surface run-off away from the area.	Length of the drainage facility: 150m
Fencing, Gate, and Sign Board	The site is to be fenced to control access and to prevent stray animals from getting into the site. Sign boards which inform the public that the site is a former disposal area and a gate are to be installed.	Length of the fence: 160m
Water quality monitoring wells	During the study, ground water monitoring wells have been installed upstream and downstream of the site.	Two wells upstream and down stream

Source: JICA Study Team

2.5 Operation and Management Plan

Since the site will be returned to the landowner after the rehabilitation works, it will not be necessary to continue operation of the waste disposal site after the rehabilitation. However, periodic inspection and maintenance of the capped areas to ensure their integrity as post closure management (PCM) including environmental monitoring is required. In addition, currently some people are still dumping their waste there even after the termination of the operation. Therefore, guards should inspect the site randomly checking for illegal dumping and the functionality of the drainage systems.

Other than development or utilization of the land by the owner, it is reasonable to consider that the MOM should have the responsibility to conduct the PCM for a while even after returning the site to the landowner. Once effects of the rehabilitation are confirmed and stabilized, all responsibilities could be transferred to the landowner. The proposed groundwater and sea water quality monitoring plan is as shown in Table 2.5-1.

Table 2.5-1 Monitoring and Frequency Parameters for the Old Dump Site

Items	Parameters	Frequency	Location	Responsibility	Reference Standards
Groundwater	Temperature, pH, Turbidity, DO, EC, BOD, Coliform, etc.	Twice/year (10 years)	Two installed monitoring wells	MOM/DENR	Philippine Standard for Drinking Water
Sea water	Obtain results of regular monitoring by DENR	Twice/year (10 years)	2 points (Stations 13 and 14)	DENR	DAO No. 34 (Class SB)

Source: JICA Study Team

2.6 Implementation Plan

Basically, the rehabilitation works should be commenced as soon as possible in order to avoid further environmental degradation in and around the site. It is proposed that the process for Authority to Close (ATC) and tender for contractor selection should be conducted from 2008 to 2009, while the rehabilitation work itself should be conducted from 2010-2011.

2.7 Cost Estimate

The disbursement schedule during the 10 years from 2008 to 2017 was prepared on the basis of the implementation schedule for the rehabilitation of the old dump site. The O&M costs are required for the post-closure works, i.e. the environmental monitoring. The annual cost is estimated as shown in Table 2.7-1.

Table 2.7-1 Annual Investment and O&M Costs of the Rehabilitation of the Old Dump Site
(Unit: x10³ PhP)

No	Work Items	Total	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
A	Engineering Service(1)[(2)*0.05]	335	9	21	218	87	0	0	0	0	0	0
B	Physical Closure (2)	6,709	183	427	4,361	1,738	0	0	0	0	0	0
1	Preparatory work	610	183	427	0	0	0	0	0	0	0	0
2	Excavation of dumped garbage	1,065	0	0	1,065	0	0	0	0	0	0	0
3	Placement of excavated garbage	985	0	0	985	0	0	0	0	0	0	0
4	Compaction of placed garbage	82	0	0	82	0	0	0	0	0	0	0
5	Construction of earth embankment	1,538	0	0	1,538	0	0	0	0	0	0	0
6	Placement of top soil	468	0	0	0	468	0	0	0	0	0	0
7	Leveling and grading	406	0	0	0	406	0	0	0	0	0	0
8	Vegetative cover and hydro-seeding	514	0	0	0	514	0	0	0	0	0	0
9	Construction of drainage	691	0	0	691	0	0	0	0	0	0	0
10	Gate and fencing	350	0	0	0	350	0	0	0	0	0	0
C	Administration Cost (3)[((1)+(2))*0.05]	352	10	22	229	91	0	0	0	0	0	0
D	Post Closure Management Cost (4)	900	0	100	100	100	100	100	100	100	100	100
E	Physical Contingency(5)[((1)+(2)+(3))*0.1]	740	20	47	481	192	0	0	0	0	0	0
	Subtotal of Investment (6) [(1)+(2)+(3)+(4)+(5)]	9,036	222	617	5,389	2,208	100	100	100	100	100	100
	Price Escalation (7)[(5%/year) of (6)]	1,668	11	63	849	476	28	34	41	48	55	63
	Total Cost (8)[(6)+(7)]	10,704	233	680	6,238	2,684	128	134	141	148	155	163

Source: JICA Study Team

2.8 Financial Analysis

A loan would be applied to the Investment of the rehabilitation of the old dump site. The repayment would be sourced from the General Fund/IRA and the EAF, and the cost for O&M would be also sourced from general fund of the MOM. The cash flow of rehabilitation of the old dump site was calculated as shown in Table 2.8-1.

Table 2.8-1 Cash Flow of the Rehabilitation of the Old Dump Site

Year		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cash Inflows	A	233	681	6,237	2,684	128	134	141	148	155	163
	General Taxes/IRA from MOM and Barangays and EAF	233	681	6,237	2,684	128	134	141	148	155	163
Cash Outflows	B	233	681	6,237	2,684	128	134	141	148	155	163
	Investment for Rehabilitation of Old Dump Site	233	571	6,121	2,562	0	0	0	0	0	0
	OM related to Rehabilitation of Old Dump Site	0	110	116	122	128	134	141	148	155	163
Net Increase in Cash	C=A-B	0	0	0	0	0	0	0	0	0	0

Note: The case outflows include inflation rate and physical contingency.

Source: JICA Study Team

2.9 Environmental and Social Considerations

The proposed rehabilitation plan would contribute to mitigate the negative environmental impacts which may be caused by the dumped waste at the site. In order to mitigate the negative environmental impacts which could be caused by the rehabilitation itself, careful environmental considerations have been given to the rehabilitation plan. No serious environmental or social impacts are expected, and monitoring of water quality will be conducted. As a result, the Rehabilitation of the Old Dump Site is evaluated as environmentally sound.

2.10 Evaluation and Conclusion

The Rehabilitation of the Old Dump Site aims to mitigate the environmental degradation which has been brought about by the waste that has been dumped. Based on the 10-year SWM Plan, it is expected that the implementation of the rehabilitation would contribute to make the whole area of the MOM clean and attractive especially on Boracay Island. Considering the above series of evaluations from the technical, social & environmental, financial and economical aspects, the Rehabilitation of the Old Dump Site is evaluated as viable as a whole.

CHAPTER III-3 FEASIBILITY STUDY FOR CENTRALIZED MATERIAL RECOVERY FACILITY

3.1 Site Condition

The Centralized MRF is proposed in the area including the current Manoc-Manoc MRF which is adjacent to a fighting cock arena and near the fire station of Barangay Manoc-Manoc. The site gently slopes south to north and there is a small hill at the east side. There are no water bodies such as creeks or ponds in or around the proposed site. The land has a gradual gradient from south to north, i.e. the elevation of northern part of the site is lower than the southern part. The northern area is prone to be inundated and muddy during the rainy season. The geology and soil is the typical sandy clay found on Boracay Island. The area includes the previous dumping area (a part of the current Manoc-Manoc MRF) and no structural building will be planned in that area. There are several facilities such as a fire station, spa, and fighting cock arena adjacent to the site. Inside of the boundary of the proposed centralized MRF, there are only a few households. However, several houses are located along the northern boundary. Single phase electricity and tap water service are provided in the area. On the other hand, since there is no sewage system in the site, septic tanks are used.

3.2 Planning Concept

3.2.1 Basic Concept

- Diversion of waste to be transported to the proposed SLF
- Phase by Phase Development
- Effective Utilization of Existing Facility and Equipment
- Promotion of Source Segregation of Biodegradable, Recyclable and
- Residual Waste for Quality Control of Hauled Waste
- Sufficient Environmental and Social Consideration
- Suitable Operation and Maintenance System
- Secure adequate storage space for the Material Flow

3.2.2 Optimum Waste Handling System in the MRF

Considering the introduction of new technology or the development schedule of the centralized MRF, the overall development of the system by Phase is summarized in Table 3.2-1.

Table 3.2-1 Selected Waste Handling Procedures

Type of Waste	Handling Technique	Phase I	Phase II	Phase III
Biodegradable waste	Bioreactor	○	○	○
Recyclable waste	Sorting on a belt conveyor system		○	○
	Preparation of products from poly styrene foam utilizing a melting oven	○	○	○
	Glass crushing after sorting	○	○	○
Residual waste	Bailing system	△*	○	○
	Hollow block making system from residual waste	△*	○	○

Note: △* means that the bailing system and hollow block making system from residual waste will be introduced in only Balabag MRF before Phase I and the equipment and facilities of the systems will be moved to the Centralized MRF in phase II.

Source: JICA Study Team

3.3 Conceptual Design

According to the design concept, each facility is developed phase by phase. In Phase I, the area of the current Manoc-Manoc MRF is utilized for all types of waste handling. In Phase II, the area will be expanded into the current garden areas on the opposite sides of the current Manoc-Manoc MRF and will be utilized for biodegradable and recyclable handling areas except for curing compost. In Phase III, the recycling promotion center will be developed in addition to the facilities and equipment developed in Phase II. The layout of facilities in Phase III is described in Figure 3.3-1.

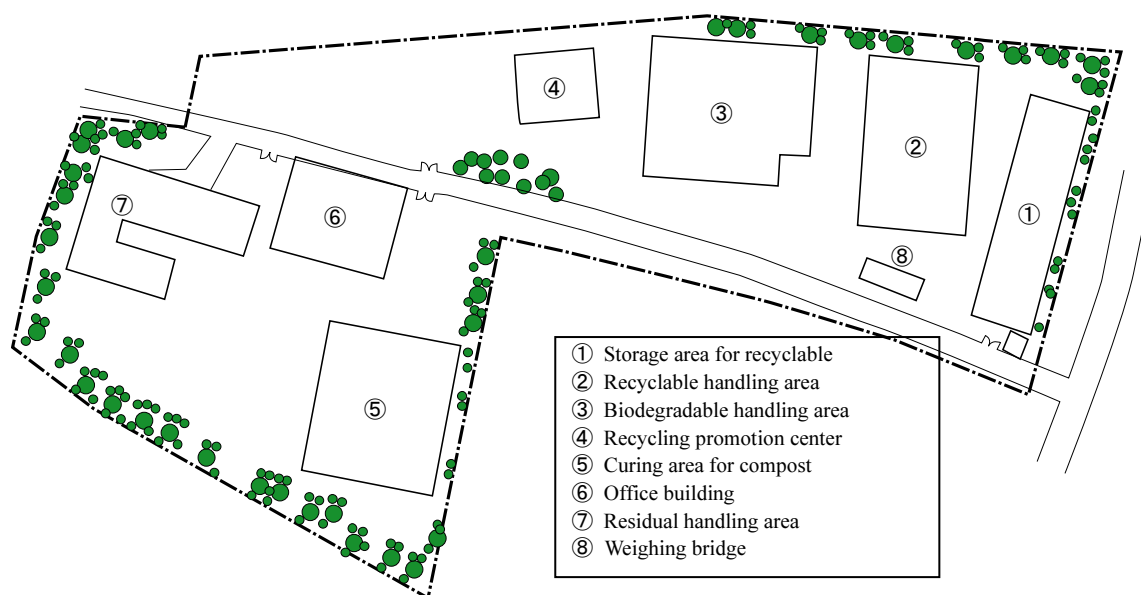


Figure 3.3-1 Layout Plan of Manoc-Manoc Centralized MRF Phase III

Source: JICA Study Team

3.4 Facilities and Equipment Plan

3.4.1 Summarization of Facilities and Equipment

The proposed facilities and equipment of the Manoc-Manoc Centralized MRF are described in Table 3.4-1

Table 3.4-1 Facilities and Equipment Proposed for the Manoc-Manoc Centralized MRF

No.	Facility/ Equipment	Function	Total Number and Specification of Equipment and Facilities	Utilize existing equipment	Newly purchased equipment or constructed facility
Facility					
1	Office building	An office for the site staff, including space for visitors.	Reinforced Concrete (RC) structure with an area of approx. 200m ²	-	1 unit in Phase I
2	Biodegradable and Recyclable Handling Area (Phase I)	Including sorting area, bioreactor area, , sieving and packing area,	RC structure with an area of approx.280m ²	-	1 unit in Phase I
3	Biodegradable Handling Area (Phase II)	Including sorting area, bioreactor area, sieving and packing area, and charcoal briquette making area	RC structure with an area of approx.500m ²	-	1 unit in Phase II
4	Recyclable Handling Area (Phase II)	Including sorting area, packing area, area for making block from polystyrene foam	RC structure with an area of approx.300m ²	-	1 unit in Phase II
5	Storage Area for Recyclables	The purpose of these areas is storage of sorted recyclable waste and treated hazardous health care waste.	RC structure with an area of approx. 310m ²	-	1 unit in Phase II
6	Curing Area for Compost	A curing area is needed for curing after removal of compost from the bioreactor. The curing time is assumed to be around 30 days.	RC structure with an area of approx. 450m ²	-	1 unit in Phase II
7	Rainwater drainage facility	To drain the rainwater running off the slope of the landfill site and prevent the rainwater from getting into the waste areas.	Open canal of bottom width 400mm x depth 600mm in a trench along with concrete pipes of 150mm diameter and 200mm diameter	-	Phase I and Phase II
8	Weighbridge	The gross weight of trucks which load solid waste or recyclables is to be measured by this weighbridge to identify the waste and material flow.	Mobile weighbridge (1set) with a maximum capacity of 20ton	-	Phase I
9	Gate/gate house/ fence	The entire MRF area is to be encompassed by a fence and all the people and vehicles which enter into this Centralized MRF are to be checked in at the gate and gate house.	Approximately 200m of fence and the gate house is 6m ²	-	Phase I and Phase II
10	Vehicle Washing Area (Collector pond)	A vehicle washing area is to be prepared for washing waste from the tires of the collection vehicles before they exit the site.	Approximately 10m ² with a wash pool and water supply system	-	1 unit (Phase I and Phase II)

No.	Facility/ Equipment	Function	Total Number and Specification of Equipment and Facilities	Utilize existing equipment	Newly purchased equipment or constructed facility
11	Recycling Promotion Center	The recycling promotion center is for small scale and new technology development for preparing recycled products and for exhibition of recycled products as well as environmental education through MRF activities.	86m ² including the area for the technology development and exhibition area for recycled products	-	1 unit (Phase III)
Equipment					
1	Bioreactor ^{***}	Bioreactors quickly decompose biodegradable waste through primary fermentation process.	0.5 [ton/day]	3 unit	-
			1 [ton/day]	-	2 units (Phase I :1 unit Phase II :1 unit)
			2[ton/day]	-	1 unit in Phase II
2	Charcoal Briquette Making System ^{**}	The charcoal briquette making facility aims to prepare charcoal from cellulose material. After shredding and drying the wood or grass, carbonization is accomplished through a heating, binding, and pressing process.	The handling area is to be approximately 15m ² . The charcoal briquette system includes a carbonizer, shredder, mixer and briquette maker. The capacity is approximately 0.5 ton/day	1 unit	-
3	Belt Conveyor	Transport the waste collected as recyclable for sorting activity in recyclable handling area	The total length of belt conveyor is 20m	-	1 unit (Phase II)
4	Glass Crusher [*]	The glass crusher crushes the broken glass or unsold glass bottles to prepare cullet	Two glass crushers with capacity of 500kg/hr	1 unit	1 unit (Phase II)
5	Shredder ^{**}	The shredder shreds the garden waste for putting into bioreactor or charcoal briquette making system	Two shredders	2 units	1 unit (Phase I)
6	Plastic Densification System ^{***}	The plastic densification system aims to melt polystyrene foam with used oil and prepare tiles or blocks from molds.	The capacity is to be approximately 5kg/hr	1 unit	-
7	Hollow block preparation system ^{**}	After it is pulverized, the residual waste will be mixed with aggregates and binding agents. After mixing, it is molded and cured for a certain period.	The pulverizer with capacity of 2 ton/day	1 unit	-
8	Bailing Machine [*]	Pressing waste to reduce the volume of waste for effective transportation and extension of the lifetime of the SLF	The capacity of bailing machine is approximately 500kg/hr	-	1 unit (Phase I)

Note: * Bailing machine is planned to be purchased by LGU for Balabag MRF in 2008. In the F/S, the cost is tentatively included in Phase 1

** Charcoal Briquette Making System and Hollow block preparation system is assumedly donated by DOT.

*** Three bioreactors (0.5ton/day) and Plastic Densification System are to be transported from each MRF in Boracay Island to Manoc-Manoc centralized MRF at the stage of Phase II

Source: JICA Study Team

3.5 Operation and Management Plan

3.5.1 Operation and Maintenance System

(1) Operation

For O&M of the Manoc-Manoc Centralized MRF, the following activities are necessary:

- Collection vehicle operation: Control waste collection vehicles coming to and leaving from the MRF, weighing waste collection vehicles in a weigh bridge and daily maintenance of the vehicles, etc.
- Biodegradable Handling Area Operation (Phases II and III)¹: Unloading and treatment of biodegradable waste, and O&M of facilities such as bioreactors and shredders.
- Recyclable Handling Area Operation (Phases II and III): Unloading of recyclable waste, sorting of both recyclable and residual wastes to be transported to the SLF, and handling of the polystyrenes or broken glass for recycling and storage of other recycled waste.
- Residual Handling Area Operation (Phases I, II and III): Daily operation activities include unloading of residual waste, sorting of other types of waste, bailing and sacking of the residual waste to be transported to the SLF.
- Daily operating hours: 5::30 to 18:00, in principle, to be applied to all seasons

(2) Maintenance

Each facility and piece of equipment is to be checked periodically as stipulated in the fabricator's manual or their recommendation. A set of maintenance manuals including daily, weekly and monthly maintenance items and necessary countermeasures for emergencies shall be prepared.

3.5.2 Organization

The operational organization of the Manoc-Manoc Centralized MRF is proposed to be set up as part of the re-organized Boracay Solid Waste Management Action (BSWMAT). The organization for the operation of the MRF is as shown in Figure 3.5-1. The overall management of the MRF together with sweeping and collection on the whole of Boracay Island shall be conducted by the management supervisor while technical issues are to be managed by the technical supervisor. In addition, a set of operation manuals shall be prepared for the human resource development of staff of the MRF.

¹ In phase I, biodegradable and recyclable handling area is to be located in a similar facility in the area of the current Manoc Manoc MRF.

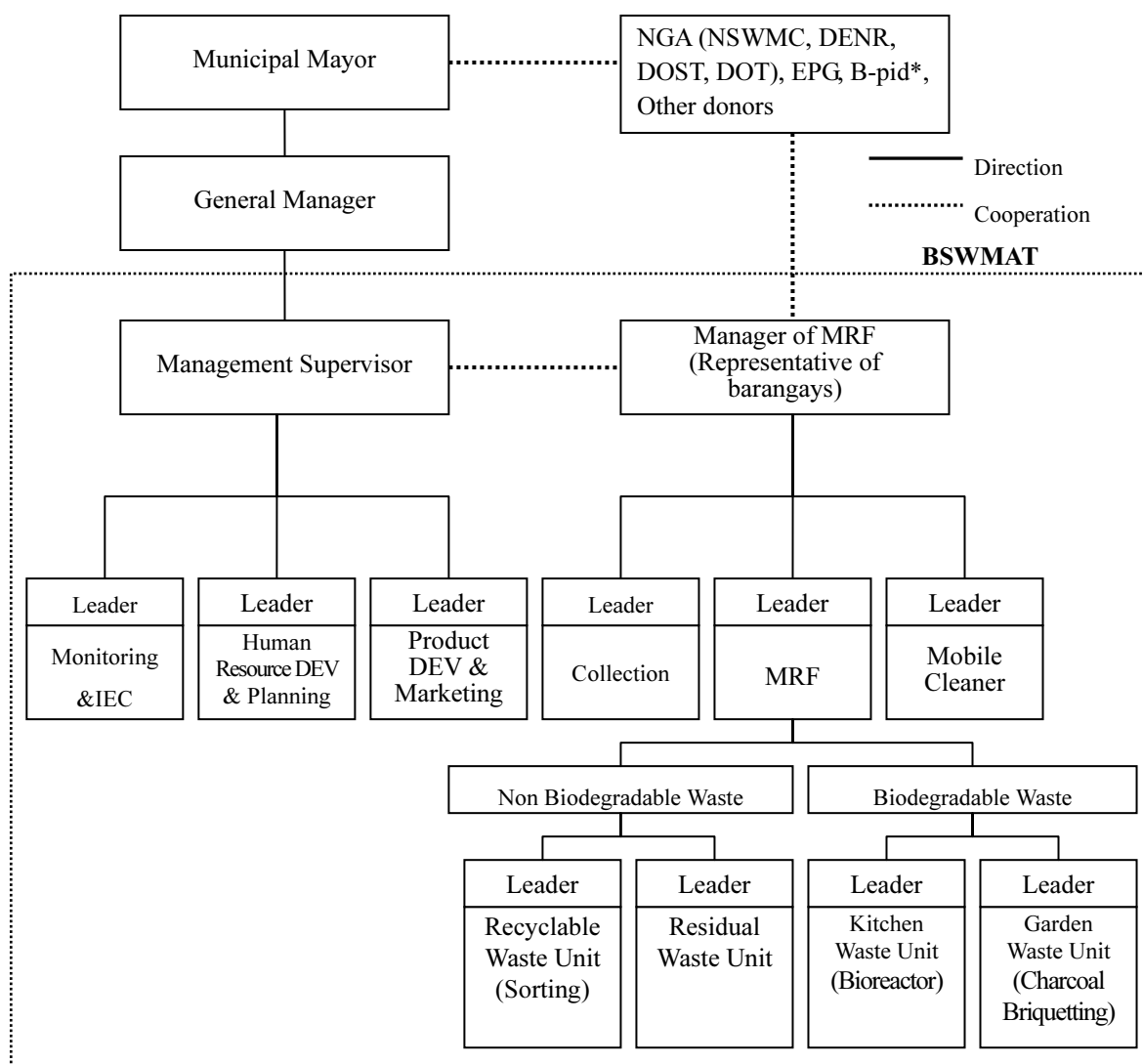


Figure 3.5-1 Operational Organization of the Manoc-Manoc Centralized MRF
Source: JICA Study Team

3.6 Implementation Plan

The implementation schedule of the MRF is generally divided into Phases I to III as follows;

- Identification of project management consultants by the end of 2008
- Implementation of detailed design and construction activities from the beginning of 2009 to the end of 2009 for Phase I
- Commencement of the operation of Phase I from the beginning of 2010
- Implementation of detailed design and construction activities from the beginning of 2010 to the end of 2011 for Phase II
- Commencement of the operation of Phase II from the beginning of 2012
- Implementation of detailed design and construction activities from the middle of 2014 to the beginning of 2015 for Phase III
- Commencement of the operation of Phase III from the beginning of 2015

3.7 Cost Estimate

3.7.1 Investment Cost

The disbursement schedule during the 10 years from 2008 to 2017 was prepared on the basis of the implementation schedule for the development of the Manoc-Manoc Centralized MRF. The annual cost is estimated as shown in Table 3.7-1.

Table 3.7-1 Annual Investment and O&M Costs of the Manoc-Manoc Centralized MRF
(Unit: x10³ Php)

No.	Work Items	Total	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
A	Engineering Service (1)[(2)*0.05]	1,474	0	87	427	851	0	0	108	0	0	0
B	Construction (2)	29,476	0	1,740	8,547	17,025	0	0	2,164	0	0	0
1	Preparatory work	956	0	519	437	0	0	0	0	0	0	0
2	Civil work (Phase I)											
1)	Excavation and leveling	910	0	910	0	0	0	0	0	0	0	0
2)	Installation of drainage	97	0	97	0	0	0	0	0	0	0	0
3	Building work (Phase I)											
1)	Office	4,050	0	0	4,050	0	0	0	0	0	0	0
2)	Biodegradable & recyclable handling area	2,750	0	0	2,750	0	0	0	0	0	0	0
4	Civil work (Phase II)											
1)	Excavation and leveling	1,144	0	0	572	572	0	0	0	0	0	0
2)	Installation of drainage	965	0	0	0	965	0	0	0	0	0	0
5	Building work (Phase II)											
1)	Storage area for recyclable	2,800	0	0	0	2,800	0	0	0	0	0	0
2)	Recyclable handling area	2,500	0	0	0	2,500	0	0	0	0	0	0
3)	Biodegradable handling area	4,000	0	0	0	4,000	0	0	0	0	0	0
4)	Curing area for compost	4,500	0	0	0	4,500	0	0	0	0	0	0
6	Civil work (Phase III)	599	0	0	0	0	0	0	599	0	0	0
7	Building work (Phase III)	1,200	0	0	0	0	0	0	1,200	0	0	0
8	Fencing and gate (cyclone wire, steel post & barbed wire)	1,574	0	0	262	1,049	0	0	262	0	0	0
9	Moving of existing facilities	29	0	0	0	29	0	0	0	0	0	0
10	Miscellaneous works (water supply, power supply)	1,404	0	215	476	610	0	0	103	0	0	0
C	Administration Cost (3)[((1)+(2))*0.05]	1,548	0	91	449	894	0	0	114	0	0	0
D	Equipment Procurement (4)	6,480	0	2,290	500	2,950	0	240	500	0	0	0
1	Phase 1 equipment procurement for MRF	2,050	0	2,050	0	0	0	0	0	0	0	0
2	Phase 2 equipment procurement for MRF	2,750	0	0	0	2,750	0	0	0	0	0	0
3	Collection equipment procurement	1,680	0	240	500	200	0	240	500	0	0	0
E	Physical Contingency (5)[((1)+(2)+(3))*0.1+(4)*0.05]	3,574	0	306	967	2,024	0	12	264	0	0	0
	Subtotal of Investment (6) [(1)+(2)+(3)+(4)+(5)]	42,551	0	4,515	10,890	23,744	0	252	3,150	0	0	0
F	Operation and Maintenance Cost (7)											
1	O &M of MRF	48,839	4,167	4,707	5,521	5,588	4,516	4,577	4,612	4,980	5,046	5,123
2	O &M of Collection on Boracay Island	59,698	4,861	4,982	5,835	5,906	5,848	5,890	5,933	6,785	6,825	6,832
	Subtotal of O&M (7)		9,028	9,689	11,357	11,494	10,365	10,467	10,546	11,765	11,872	11,955
	Price Escalation (8)	44,774	451	1,456	3,507	7,594	2,864	3,646	5,575	5,617	6,545	7,519
	Total Cost (9)[(6)+(7)+(8)]	195,862	9,479	15,659	25,754	42,832	13,228	14,365	19,271	17,383	18,417	19,474

Source: JICA Study Team

3.8 Financial Analysis

The financial analysis covers the following components:

- Investment cost for development of the Centralized MRF
- Investment cost for closure of existing MRFs
- O&M costs regarding the collection and transport of biodegradable, recyclable and residual wastes from collection areas of the Centralized MRF including monitoring and sweeping activities
- Cost regarding the transport of residual waste from the Centralized MRF to the SLF

The revenue and expenditure were calculated as shown in Table 3.8-1. The expected amount of revenues to the LCF could cover the total costs required to manage collection and transport and O&M of the MRF(s) as the SWM system on Boracay Island including the Development of Centralized MRF.

Table 3.8-1 Cash Flow of SWM including Development of the Centralized MRF and Collection and Transport on Boracay Island

Year		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cash Inflows	A	14,650	21,783	33,002	50,354	20,070	18,523	23,300	21,431	22,564	23,828
GCF from HH		-	589	616	695	727	815	854	953	998	1,045
General Taxes/IRA from MOM and Barangays and EAF		14,650	14,655	25,422	40,581	9,181	6,581	10,496	8,603	6,914	7,239
Profit from Compost/ Recyclables at MRFs, etc.		-	1,526	1,742	2,443	3,345	4,079	4,774	4,508	5,138	5,827
GCF from BE		-	5,014	5,222	6,636	6,816	7,048	7,176	7,367	9,514	9,718
Cash Outflows	B	14,650	21,783	33,002	50,354	20,070	18,523	23,300	21,431	22,564	23,828
Investment for Development of the Centralized MRF		0	4,700	11,999	28,606	0	0	3,694	0	0	0
Investment for Closure of Existing MRF		0	0	0	0	2,583	0	0	0	0	0
MOOE related to MRF		4,375	5,553	7,040	7,565	5,764	6,134	6,490	7,358	7,829	8,345
Investment for Collection and Transport		0	307	671	282	0	373	816	0	0	0
MOOE related to Collection and Transport		10,275	11,224	13,292	13,902	11,723	12,016	12,300	14,073	14,735	15,484
Net Increase in Cash	C=A-B	0	0	0	0	0	0	0	0	0	0

Note: The case outflows include inflation rate and physical contingency.

Source: JICA Study Team

3.9 Social and Environmental Considerations

Based on the Philippine EIS system, the capacity of proposed Centralized MRF does not require an EIS or IEE report to secure an ECC, but it does need to obtain a CNC (Certificate of Non-Coverage). The proposed development of the Centralized MRF is expected to contribute to mitigate the negative environmental impacts which may be caused by the waste, especially biodegradable waste. Environmental impacts which could be caused by the development of centralized MRF itself will include social environmental impacts including resettlement of squatters, land utilization and natural environmental impacts including water quality, offensive odors or vermin. It is important to accommodate suitable mitigation measures for negative environmental impacts through periodic environmental monitoring by MOM and Barangay Manoc-Manoc.

3.10 Evaluation and Conclusion

The development of the Manoc-Manoc Centralized MRF aims at producing sufficient diversion of the solid waste to be transported to the new SLF based on the vision of the 10-year SWM Plan. The proposed plan covers seven major fields to achieve the vision. Corresponding projects have been proposed to attain the specific targets of diversion, collection and disposal. It is expected that the implementation of the proposed projects will contribute to make the whole area of the MOM clean and attractive especially on Boracay Island. Considering the above series of evaluations from the technical, social & environmental, financial & economic aspects, the development plan of the Centralized MRF is evaluated as viable as a whole.

PART IV RECOMMENDATIONS

CHAPTER IV-1 RECOMMENDATIONS FOR THE MUNICIPALITY OF MALAY

1.1 Practical Implementation of the 10-year Solid Waste Management Plan

1.1.1 Necessary Actions to be Taken in 2008 as the First Step of the 10-year SWM Plan

(1) Official Approval of the proposed 10-year Solid Waste Management Plan

In accordance with Section 16 of RA9003, the province, city or municipality, through its local solid waste management boards, shall prepare its respective 10-year SWM Plan consistent with the National Solid Waste Management Framework. It is therefore recommended to obtain an official approval of the 10-year SWM Plan by NSWMC to increase the plan's effectiveness. For this, the MOM should obtain the official approval of the plan from the Municipal Solid Waste Management Board (MSWMB) and the Sangguniang Bayan (SB) at first. Besides, although many LGUs have developed respective 10-year SWM Plans, no plan has been approved by the NSWMC. In order to enhance the implementation of RA9003, the best practice model, the officially approved 10-year SWM Plan, should be generated as soon as possible.

(2) Proceeding of the Priority Projects

Necessary actions to be conducted in 2008 as part of the proposed 10-year SWM Plan have been clarified. It is suggested that the following actions are necessary to proceed the priority projects at first.

- Development of the Kabulihan SLF: Amendment of the IEE to obtain the amended Environmental Compliance Certificate (ECC)
- Rehabilitation of the Old Dump Site: Submission of a rehabilitation plan to obtain Authority to Close (ATC)
- Development of the Manoc-Manoc Centralized MRF: Application for Certificate of Non-coverage (CNC)

As for the fund arrangement, the MOM should arrange the loan to implement the above priority projects. Especially for the SLF development, the MOM is advised to take urgent actions in order to secure the commencement of official operation of the landfill site from the middle of 2009.

(3) Other Activities to be Commenced in 2008

As has been proposed in the 10-year SWM Plan, it is recommended to implement the following major activities in 2008 in addition to the above discussed priority projects.

- 1) Introduction of Source Reduction Program
 - BALIK BAYONG Program
 - BALIK BOTE Program
- 2) Improvement of Collection System on Boracay Island
 - Revision of collection area
 - Improvement of collection method
 - Equipment procurement
 - Human resource development
- 3) Implementation of Public Education and Information:
 - Training of trainers
 - General advocacy of the 10-year Solid Waste Management
- 4) Arrangement of Legal System
 - Amendment of MO
- 5) Organization Set Up
- 6) Introduction of Cost Recovery System
 - Setting up a LCF
 - Revision of GCF system (setting up basic rules)
 - Revision of EAF system (setting up basic rules)
- 7) Capacity Development
 - Training program
 - Development of solid waste administrative tools (manuals, guidelines)

1.1.2 Revision and Updating of the 10-year SWM Plan

The 10-year SWM Plan should be viewed as a dynamic document which requires periodic updates due to changes in laws, ordinances and regulations, technologies associated with SWM practices and the social and economic conditions. This is also stipulated in RA 9003 as one function of the MSWMB to review the plan every two years. Considering that many of the regulations and subsequent guidelines that will bring this 10-year SWM Plan into full operational mode are still to be finalized, updating every two years should be highly recommended.

1.1.3 Introduction of Progress Assessment System

In order to secure progress of the 10-year SWM Plan, it is recommended to introduce a progress assessment system. Under the system, the MOM should have annual meetings for progress assessment of the 10-year SWM Plan. The MOM also should accept appraisals by outsiders such as NGOs who evaluate the progress and activities based on the documents that report activities implemented, indicators to be monitored and expenditures related to SWM.

1.1.4 Implementation of Human Resource Management Program

In order to manage human resources for SWM (but not limited to this) of the MOM and barangays, a human resource management (HRM) program should be initiated. The HRM program consists of a database of human resources and a series of trainings.

- Development of database of human resources for SWM of the MOM and barangays
- Development of a HRM program regarding SWM
- Introduction of management by objective with annual appraisal of performance of each staff member against the agreed tasks
- Improvement of morale and motivation through encouragement and motivation of the staff, and rewarding good performance for improving their works for SWM, for example, bonuses and/or linking promotions

1.1.5 Establishment of Financial Management System

Even though the LCF is established, no systems have been prepared. It is difficult to adequately manage the fund without transparent sharing of related information among the persons and bodies concerned. In particular, daily information on the amount of income and expenses should be regularly checked by several practitioners from each related section. After that, these data should be reported to the private sectors and general public. It is recommended to develop a process to share the information on the following items. Development processes should be also described in the operational guideline of the LCF.

- Which information should be checked?
- When should the information be checked?
- Who should check the information?
- How should the related persons/bodies check the information?

Cost sharing can be realized among barangays when the LCF is established, however, it is an issue how they share the costs in practice. A criterion is necessary to share the costs with their consensus. To establish the consensus, the way of securing equity among barangays should be taken into consideration. Recycling rate, quality of separated waste, reduction rate and amount of residual waste could be indexes to decide amount of costs shared among barangays with equity. Consequently, to decide the amount of costs based on such kind of indexes is an incentive for barangays to address reduction of waste actively. It is recommended for MOM and barangays to establish the rule on this.

1.1.6 Promotion of Coordination between LGU and Barangays

The MOM has organized the MSWMB with various sectoral representatives designated as members including the Association of Barangay Chairpersons. The board meetings are held every month in principle to discuss various issues on SWM and they are also expected to play a coordination role among stakeholders. For the coordination between the LGU and barangays, the existing BSWMAT and proposed Malay Solid Waste Management Action

Team (MSWMAT) are expected to play important roles for promotion of the meetings.

1.1.7 Promotion of Collaboration among Stakeholders

In order to minimize the necessary costs for the implementation of the 10-year Solid Waste Management Plan by the MOM and barangays, as well as to make its implementation practical and effective, support from national governmental agencies (NGAs) such as NSWMC, DENR Region VI, DOST and DOT, business sectors and NGOs instead of utilization of consultants is essential. Especially DENR Region VI together with NSWMC has committed to provide the MOM and barangays with full technical support such as waste reduction at the sources and the IEC program. Support from DOT and DOST are also expected to the MRF development and O&M. It is recommended to promote further collaboration between them.

1.1.8 Encouragement of Collaboration with Neighboring Countries

Three individuals from Palau who are working in SWM at the National Government of Palau and Koror State Government visited the Philippines to exchange experiences in SWM. They are also working as counterparts of a technical cooperation project between Japan and Palau on SWM. They visited MRFs on Boracay Island and the proposed SLF, and also saw the source segregation collection activities. The experience exchange meetings were held between the persons concerned with SWM of the MOM, those from Palau, and the NSWMC. As a result of this study tour, an atmosphere to promote further collaboration among the participants has been created and information exchange has started through e-mails. Since Palau is an island country which is famous as a tourist destination, the problems which Palau are facing are similar to those in Boracay. Therefore, it is recommended to collaborate with them closely and continuously to promote better SWM.

1.1.9 Grasping Material Balance inflow and outflow to/from Boracay Island

In order to promote diversion especially on Boracay Island, reduction of waste generation at the sources is to be tackled first. The reduction of the waste at the sources also contributes to reduce burdens on SWM to each barangay as well as to the environment. For effective source reduction including avoidance of use of materials which may become waste, especially residual waste, grasping of material balance inflow and outflow to/from Boracay Island is important to establish and implement measures and its monitoring. However, such material balance has not been recorded even at the ports. Therefore, the material balance including recyclable materials should be recorded.

1.1.10 Receiving of Waste from the Municipality of Buruanga

In the 10-year SWM Plan, the new Kabulihan SLF will receive only residual waste. If the Municipality of Buruanga (MOB) tries to haul the waste there, the MOB is requested to develop a suitable MRF for handling biodegradable and recyclable wastes to segregate them

from residual waste to be transported the new SLF. It is desirable that the hauled residual waste from the MOB as well as from Boracay Island would be packed in sacks so as not to spill out as well as to count the number of sacks to identify the amount of waste hauled to estimate the remaining landfill capacity.

1.2 Tourism Management for Environmental Conservation

1.2.1 Counting the Number of Tourists

The number of tourist arrivals at Boracay Island has been counted and recorded by the Tourism Office of the MOM. Although the tourists are being checked at the Caticlan Airport and jetty port, there are some uncounted tourists. This figure is essential data for not only SWM but also other environmental management efforts as well as for development. This also closely relates to the proposed cost recovery system for the 10-year SWM Plan implementation. Therefore, the tourist counting and recording system should be improved through measures such as introduction of tourist counting at hotels and resorts.

1.2.2 Consideration of the Boracay Integrated Tourism Master Plan

The Boracay Integrated Tourism Master Plan is being developed by the PTA. The development plan covers not only Boracay Island but also Carabao Island where the new international airport is planned to be developed. This Tourism Master Plan is aiming at inviting more tourists to the region including Boracay Island. Since this master plan has not been prepared yet, it is necessary to integrate its ideas and future framework once the plan is available.

1.2.3 Consideration of Carrying Capacity of Boracay Island

Carrying capacity is an important concept for balancing development and environmental conservation and it is used for various parks and tourist spots where the natural environment is essential for the attraction. From the pollution control viewpoint it could be said that the current number of tourists is almost reaching the carrying capacity. If the development works continue without additional measures, the environment of Boracay Island may become worse and it may cause negative impressions to the tourists, and finally it may lead to decreasing of the number of tourists. Therefore, in addition to SWM, a comprehensive carrying capacity study should be conducted so that the appropriate roadmap for the development works can be produced with balance between environmental conservation and tourism development.

CHAPTER IV-2 RECOMMENDATIONS FOR OTHER LGUS AND NSWMC

2.1 Structure of the 10-year Solid Waste Management Plan

The proposed 10-year SWM Plan has been prepared based on the annotated outline of the plan which was prepared by NSMWC. During the preparation of the plan in this study, the JICA Study Team prepared the 10-year SWM Plan strictly applying the structure of the annotated outline at first. However, the current structure of the plan discussed in the annotated outline is a relatively redundant one which guides the LGUs to repeat the same issues and the structure itself is not complicated. This may be come from the fact that the annotated outline has tried to include “every thing” relating to SWM.

In this connection, the JICA Study Team has discussed the structure of the 10-year SWM Plan with the related people and settled upon the structure of the 10-year SWM Plan as shown below:

- Introduction
- Profile of Municipality of Malay
- Current Conditions of Solid Waste Management
- Future Framework
- Plan Strategy
- Technical System of SWM
- Institutional, Organizational System of SWM
- Implementation Plan
- Cost Estimates and Financial Aspects
- Social and Environmental Aspects
- Evaluation

Therefore, it is recommended that those LGUs which will prepare their own respective 10-year SWM Plans should refer to the contents of the proposed 10-year SWM Plan under this study.

2.2 Recommended Calculation Method for Diversion

Theoretically, diversion should include the affect of all proper waste reduction from the waste flow to the SLF as defined in RA9003. The following calculation method (formula) of diversion rate is applied in the Study and it is recommended that this formula should be used commonly in the Philippines so that diversion can be measured appropriately and compared among the LGUs.

$$[\text{WDR}] = \{[\text{QWRS}] + [\text{QWRM}]\} / [\text{QWG}]$$

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 MRF (recycled, composted and other waste reduction activities)
- QWG : Quantity of Waste Generated

2.3 Development of Sanitary Landfills in the Philippines

2.3.1 Careful Arrangement of Land

At the commencement of the Study, the JICA Study Team was advised that the whole of the site offered by DENR for the SLF was available. However, it soon became apparent that a portion of the identified site was classified as Alienable and Disposable (A & D) land that was the subject of a claim by the heirs of Mr. Conrado Acosta. The issues had remained during the Study period in spite of the effort of MOM or other relevant stakeholders with the support of the JICA Study Team.

From the above lesson, it is strongly recommended that the lands should be arranged carefully for facilities' development. If it is difficult to obtain the lands especially for landfill development, re-using the existing landfill site through its rehabilitation should be considered as an option.

2.3.2 Requirements for Sanitary Landfill Development

According to DAO 10, there are four categories for SLF development which depend on the amount of residual waste to be received at the site. In the proposed 10-year SWM Plan as well as associated F/S on the SLF, Category 1, namely the lowest level of the SLF development, has been adopted because the proposed SLF plans to receive less than 15 ton/day of the residual waste. In addition, minimal facilities and equipment are also proposed for the SLF. However, the estimated investment cost for the development of the SLF, was beyond the annual budget of the MOM which can be allocated to SWM. Consequently, the MOM should be planning to arrange a budget by arranging a loan. Even a Category 1 SLF should have a clay liner at least 60cm thick with a permeability no greater than 10^{-5} cm/sec, leachate collection and treatment facilities, etc. Although the MOM could cover the development cost by using various financial sources including the EAF, it may be difficult to develop the SLF, even though it is Category 1, considering their ability to cover the development cost in the cases for smaller scale LGUs. It is therefore recommended to create additional categories with less stringent requirements for smaller scale SLF development so that the LGUs can afford the development of their own SLFs, subject of course to obtaining proper environmental permits.