

# **APPENDICIES**

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MANAGEMENT    PLAN    FOR    THE  
MUNICIPALITY OF MALAY**

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**APPENDIX II:**  
**PROPOSED 10-YEAR SOLID WASTE**  
**MANAGEMENT PLAN FOR THE**  
**MUNICIPALITY OF MALAY**

## Appendix II-2.4.1 Condition of Marine Transportation

### 1. General Cargo Transportation

Boracay Island is located about 1 km off the northwest coast of the Mainland of Malay. Sea transportation is the sole transportation mode available to connect between Boracay Island and the Mainland of Malay. Caticlan functions as a gateway port accommodating not only small boats carrying passengers and cargoes to/from Boracay Island but also for RORO ships on the route along the Strong Republic National Highway coming from Metro Manila.

Almost all general cargo flow between Boracay and The Mainland of Malay Islands is one-way from the Mainland of Malay to Boracay Island. Construction materials (cement, gravel, sand, steel bar, steel pipe, concrete and block), food, beverages, consumer goods, furniture, electrical appliances, etc. are transported from the Mainland of Malay. On the other hand, there is almost no product for outward cargo from Boracay Island except for reusable/recyclable materials such as empty bottles and empty plastic bottles. Residual wastes crammed into white sacks at MRFs are also transported as a kind of general cargo by a general transportation company.

On Boracay Island, there are seven cargo loading/unloading sites. On the northwest coast of The Mainland of Malay, there are four cargo loading/unloading sites connecting to Boracay Island. At Manoc-Manoc, Tambissan, Tulubhan, Bulabog, Caticlan and Tabon beaches, wooden motorized outrigger bancas, so-called pump boats, land along natural beaches for loading/unloading operations.

#### Outline of Cargo Loading/Unloading Sites on Boracay Island and the Mainland of Malay

Name of Site	Loading/Unloading Facility	Usage
<b>【Boracay island】</b>		
Manoc-Manoc beach	Two collapsed short jetties (out of use)	General cargo
Cagban jetty	Jetty: 97m(Length), 5m (Width) It is mainly used for passengers	Passenger and General cargo
Tambissan beach	None	Passengers and General cargo
Tulubhan beach	None	General cargo
Bulabog beach	None	General cargo
Yapak beach (Private)	Crawler crane for unloading on beach	Construction materials for Shangri-La
Lapuz-Lapuz berth (Private)	Berth: 36m (Length), 21m (Width)	Construction materials for hotel etc.
<b>【Mainland of Malay】</b>		
Caticlan terminal	Jetty: 76m (Length), 5m (Width) It is mainly used for passenger Jetty:132m (Length), 10m (Width) It accommodates RORO ship	Passengers and General cargo
Caticlan beach	None	General cargo
Tabon jetty/beach	Jetty: 28m (Length), 3m (Width) Jetty is mainly used for passengers	Passengers and General cargo
Sambiray jetty	Collapsed jetty: 70m (Length), 8m (Width)	Out of use

Source: JICA Study Team

## 2. Natural Condition

In Visayas, Habaqat monsoons (SW wind) blow from July to October. Shipping operators decide the shipping route mainly depending on the wind direction. Complementary routes, i.e. Tambissan/Tulubhan/Bulabog beaches to/from Tabon jetty/beach, are utilized during Habaqat monsoon season. According to the Coast Guard Department, the duration of SW winds is 2-3 months a year.

The Caticlan Airport Station records weather data including temperature, wind direction/speed, atmospheric pressure and visibility every hour during the daytime. The table below picks up the days which recorded more than 10 kt/hour wind speed in the weather record in 2006. It could be supposed that the complementary route was frequently taken in July, August and September.

### Days with SW Wind by Speed

Wind Speed (kt/hour)	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
10< <sup>(1)</sup>						2	5	2	8	2			
15< <sup>(2)</sup>						1	7	12	10	2	1	1	
20< <sup>(2)</sup>					1		8	7		2			
25< <sup>(2)</sup>					1		2	1		1			
Total					2	3	22	22	18	7	1	1	76

Note: <sup>(1)</sup> Wind duration is more than 3 hours, <sup>(2)</sup> Wind duration is more than 1 hour.

Source: Weather Record at Caticlan Airport, 2006

Sea depth in front of the beaches in Barangay Macnoc-Manoc on Boracay Island and Barangay Caticlan of the Mainland of Malay are relatively shallow and the seabed slope is quite gentle. Sea depth in front of the cargo loading/unloading sites is shown in the table below. Tidal range is from Chart Datum Line (CDL) -0.5m to +1.9m.

### Sea Depth of Cargo Loading/Unloading Sites

(Unit: CDL +m)

Name of Loading/Unloading Sites	Distance from Coastline (m)			
	10	30	50	100
Manoc-Manoc Beach	0.7	2.9	8.0	12.6
Caticlan Beach	0.9	0.9	1.2	2.4
Tambissan Beach	0.0	0.7	1.0	0.8

Note: Distance is approximate as it was measured ocularly by JICA Study Team

Source: JICA Study Team

## 3 Cargo Vessel Route

Most cargos are transported by pump boats between Boracay Island and the Mainland of Malay, and a pump boat is generally used for cargo and passengers and residual waste. Typical size of the pump boat used for cargo transportation is shown in the table below:

### Typical Size of Pump Boat

Size	Overall Length (m)	Beam (m)	GT (Gross Tonnage)
Large	20-25	1.8-2.3	10-12
Medium	13-18	1.2-1.5	5-8

Source: JICA Study Team

An Landing Ship Medium (LSM) type cargo vessel equipped with bow ramp is sometimes in operation. In February 2007 a cargo vessel of 4,000 Dead Weight Tonnage (DWT) collided with a submerged power cable off Manoc-Manoc beach. Since then, it is regulated that Manoc-Manoc beach could accommodate the cargo vessels only up to 100 DWT. Figure below illustrates the cargo shipping routes between Boracay and the Mainland of Malay and they are summarized below:

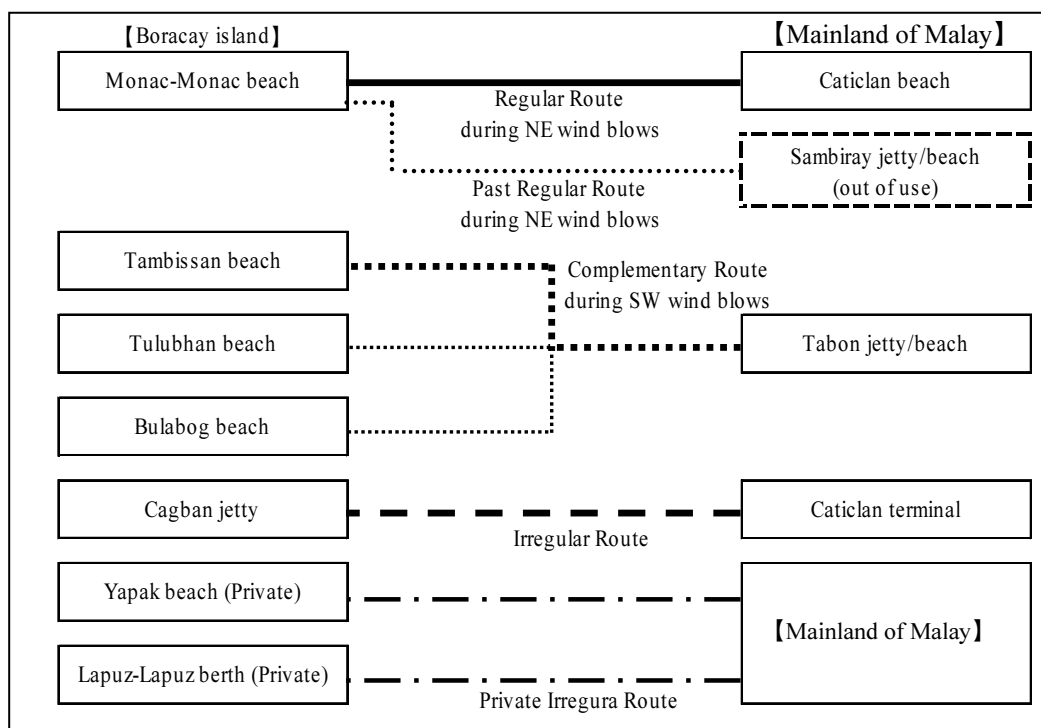
Manoc-Manoc beach-Caticlan beach: This route is the main regular route at present. Most of general cargos including residual are handled at these beaches.

Manoc-Manoc beach-Sambiray jetty: Sambiray Jetty was used regularly before it collapsed. The stone mounted jetty is about 70m length and 8m width. Rubble stone and armour stone at the top of the jetty were blown out by a typhoon, since then it has not accommodated ships.

Tambissan/Tulubhan/Bulabog beach-Tabon jetty/beach: These routes are utilized during Habaqat monsoon with SW winds. Tambissan beach has the most advantage in terms of natural conditions among the three beaches, nevertheless water in front of the beach is not appropriate depth for beach landing during low tide.

Cagban jetty-Caticlan jetty: Cagban Jetty is the gateway of Boracay Island. This route is mainly utilized for passenger traffic. Accordingly, general cargo is occasionally handled during the evening when passenger boat traffic is not heavy.

Yapak beach- Boracay Island/other islands, Lapuz-Lapuz berth- the Mainland of Malay/other islands: Operated by private entities and used for unloading construction materials for hotel building, etc. Construction materials are transported by a cargo vessel and pump boat from the Mainland of Malay and other islands.



**Cargo Shipping Routes between Boracay Island and the Mainland of Malay**

Source: JICA Study Team

### **Appendix II-3.1.1 Laws and Regulations Related to Solid Waste Management**

There are a number of laws and regulations which contain major relevant provisions that should be taken into consideration for the formulation of the 10-year SWM Plan.

#### **P.D. 1152-Philippine Environment Code**

Comprehensive program on environment protection and management establishing special environmental management policies and prescribing environmental quality standards in the Philippine Environment Code.

#### **P.D. 984 – Pollution Control Law**

Provides the specific guidelines and implementing rules and regulations on liquid waste disposal at physical or chemical treatment plants in accordance with existing rules and regulations.

#### **Commonwealth Act No. 383**

An Act to punish the dumping into any river of refuse matter or substances of any kind whatsoever that may bring about the rise or filling in of river beds or cause artificial alluvial formation.

#### **P.D. 825 – Penalty for Improper Garbage Disposal**

Provides penalty for the improper disposal of garbage and other forms of uncleanness and for other purposes.

#### **P.D. 856 – Code of Sanitation**

Provides the rules on disposal of refuse in food establishments, and for construction of markets at abattoirs. Prescribes the sanitary facilities for potable water, sewage treatment works, septic tanks, and disposal of septic tank effluent drainage.

Provides for special precautions regarding human waste from hospitalized patients given high doses of radioactive isotopes. However, the provision merely provides for separate facilities and flushing at least 3 times after its use. No special treatment or methods of disposal are provided for hospital wastes and it remains a special problem.

#### **DE Administrative Order 98-49**

Technical Guidelines for the disposal of municipal solid waste which operates on the premise of eventual phase-out of all open dumps in the country.

**DE Administrative Order 98-50**

Procedure for the Identification of Sanitary Landfill Sites in view of the imminent phase-out of open dumping.

The above laws belong to the earliest legislations of which provisions particularly address solid waste management practices, environment impacts, technologies, pollution control and prevention, and penalties for violations. While some policies in these laws have been superseded with the enactment of the Ecological Solid Waste Management Act and other laws, they still contain relevant provisions that contribute to planning and implementation.

**RA 6957 amended by RA 7718 (Build-Operate-Transfer Law)**

Providing that infrastructure and development projects normally financed and operated by the public sector, that solid waste management may be wholly or partially implemented by the private sector.

**Republic Act 7160**

Local Government Code of the Philippines, devolving certain powers to the local government units, including those on enforcement of laws on cleanliness and sanitation, preparation of their respective solid waste management programs, and other environmental matters.

**Presidential Decree 1586** – Philippine Environmental Impact Statement or EIS System

The EIS System carries out the policy of the state to “attain and maintain a rational and orderly balance between socio-economic growth and environmental protection.”

**DENR Administrative Order 2000-28**

Implementing Guidelines on Engineering geological and Geohazard Assessment as additional Requirements for ECC Applications covering Subdivision, Housing and other Land Development and Infrastructure Projects”.

**Republic Act 8749** – An Act Providing for a Comprehensive Air Pollution Control Policy and for other purposes (Philippine Clean Air Act)

In order to promote the framework of sustainable development, this law aims to formulate a holistic national program on air pollution management, encourage cooperation and awareness among citizens and industry, focus on pollution prevention rather than control and enforce a system of accountability to all projects that threaten adverse impacts to the environment.

#### Section 20 Ban on Incineration

Prohibits the use of incinerators for municipal, bio-medical and hazardous wastes, if the process emits toxic and poisonous flames. However, hospital incinerators are given 3 years to look for alternative technologies. Such units shall be limited to the burning of pathological and infectious wastes, and subject to close monitoring by the Department.

**DENR Administrative Order No. 34** – Revised Water Usage and Classification

**DENR Administrative Order No. 35** – Revised Effluent Regulation of 1990

**Republic Act No. 9275** – Philippine Clean Water Act 2004

An Act providing for comprehensive Water Quality Management and for other purposes.

**Republic Act 9003** – Ecological Solid Waste Management Act of 2000, and DENR Administrative Order No. 01-34 – Implementing Rules and Regulations of RA 2003

With the enactment of RA 9003, all laws, decrees, issuance, rules and regulations, or parts thereof that are inconsistent with the provisions of the Act are hereby repealed or modified accordingly. RA 9003 is a primary legislation on solid waste management providing a comprehensive, systematic and ecologically viable program that would:

- ensure public health and protect the environment,
- employ environmentally-sound methods to encourage resource conservation and recovery, and promote national research and development programs,
- encourage greater private sector participation while retaining the primary enforcement and responsibility of SWM with LGU's, and
- integrate the Ecological SWM, research conservation and recovery topics into the academic curricula of formal and non-formal education.

To promote environmental means of disposing of waste, the DENR is enforcing specific technical guidelines in the Implementing Rules and Regulations (DENR Administrative Order 01-34) in order to direct the LGU's towards an environmentally sound, technically feasible and economically sustainable SGM program.

**National Solid Waste Management Commission Resolution No.1** – Series of 2002

Delegation of Certain Functions of the NSWMC Chairman to the DENR Regional Executive Directors and Prescribing Appropriate Permits and Clearances for Solid Waste Management Facilities.



### Appendix II-3.1.2 Municipal Solid Waste Management Board (MSWMB)

RA 9003, Chapter 2, Section 12 requires the creation of a local solid waste management board as follows:

*Each municipality shall form a Municipal Waste Management Board that shall prepare, submit, and implement a plan for the safe and sanitary management of solid waste generated in areas under its geographic and political coverage.*

Malay Executive Order No. 124 Series of 2005 reorganized the Municipal Solid Waste Management Board, viz:

#### **Executive Order No. 124**

WHEREAS, Section 12 of Republic Act No. 9003, otherwise known as the Ecological Solid Waste Management Act of 2001, provides for the creation of Municipal Solid Waste Management Board ;

WHEREAS, DOILG Memorandum Circular No. 2001-19 dated March 2, 2001 directs the creation of the Provincial, City and Municipal Solid Waste Management Boards pursuant to Sections 11 and 12 of the same Act;

WHEREAS, the concluded local elections necessitate the reorganization of the Board

NOW, THEREFORE, I, CECIRON S. CAWALING, by virtue of the powers vested in me by law, do hereby order that:

SECTION 1. REORGANIZATION – There is hereby reorganized a Municipal Solid Waste Management Board in the Municipality of Malay.

SECTION 2. COMPOSITION. The Municipal Solid Waste Management Board shall be composed of the following:

Chairman	CECIRON S. CAWALING
Members	FROLIBAR S. BAUTISTA Municipal Vice Mayor
	DANTE C. PAGESUGUIRON SB Member Chairman, SB Committee on Environmental Protection

NOLASCO V. CLAUD

President, Liga ng mga Barangay

LADD E. CAHILIG

President, Sangguniang Kabataan Federation

GLENN Y. SACAPAÑO

Punning Barangay ng Balabag

DANILO G. DE LOS SANTOS

Punning Barangay ng Manoc-Manoc

HECTOR A. CASIDSID

Punong Barangay ng Yapak

BOBBY M. CAHILIG

Punong Barangay ng Caticlan

President, Malay Federated Chamber of Commerce & Industry

President, Boracay Foundation, Inc.

President, Kiwanis Club of Boracay

President, Rotary Club of Boracay

Head, PCGA-Boracay

Representative, Recycling Industry

Representative, DOT-Boracay

Representative, DENR

District Supervisor, DepEd

School Heads, Secondary Schools

Chief of Police, Malay PNP

Chief of Police, Boracay Special Protection Unit

Station Manager, YES-FM-Boracay

#### WORKING COMMITTEES

##### EDUCATION:

Chairman: Station Manager, YES FM-Boracay

Members: District Supervisor, DepEd  
School Heads, Secondary Schools  
Municipal Information Officer  
Editor-in-Chief, Boracay Bulletin  
Field Reporter, Radio Bomb

	Station Manager, Kalibo CTV Station Manager, Paradise Cable President, Boracay Foundation, Inc. Chairman, BLTMPC
ENGINEERING:	
Chairman:	Municipal Engineer
Members:	Representative, PICE Aklan Chapter Representative, PTA Representative, PEO
ENFORCEMENT:	
Chairman:	Chief of Police, Boracay-PNP
Members:	Chief of Barangay Tanods Balabag, Manoc-Manoc, Yapak, Caticlan Team Leader, Municipal Auxiliary Police Detachment Commander, MARICOM Station Commander, PCG Head, PCGA-Boracay Chairman, CBTMPC Chairman, BLTMPC Representative, DENR Aklan
ENTREPRENEURSHIP:	
Chairman:	President, Malay Federated Chamber of Commerce and Industry
Members:	President, Boracay Foundation, Inc. President, Kiwanis Club of Boracay President, Jaycees –Boracay President, Rotary Club of Boracay President, Vendors Association Municipal Agricultural Officer
SECRETARIAT:	
Chairman:	Engr. Arnold Solano Municipal SWM Action Officer
Members:	Alma S. Belejerdo Municipal Planning & Development Coordinator Dr. Adrian D. Salaver Municipal Health Officer Engr. Elizer B. Casidsid Municipal Engineer Representative, Sangguniang Bayan

SECTION 3. FUNCTIONS- The Board shall perform the following functions :

- a. Convene regular meetings for purposes of planning and coordinating the implementation of solid waste management plans of component barangays,
- b. Oversee the implementation of the Municipal Solid Waste Management Plan
- c. Review every two (2) years, or as the need arises, the Municipal Solid Waste Management Plan for purposes of ensuring its sustainability, viability, effectiveness and relevance. In relation to local and international developments in the field of solid waste management,
- d. Develop specific mechanics and guidelines to implement the Municipal Solid Waste Management Plan,
- e. Recommend to appropriate local government authorities specific measures or proposals for franchise or built-operate –transfer agreements with duly recognized institutions to provide either exclusive or non-exclusive authority for the collection, transfer, storage, processing, recycling or disposal of municipal solid waste,
- f. Provide the necessary logistical and operational support to component barangays,
- g. Recommend measures and safeguards against pollution and the preservation of the natural ecosystem,
- h. Coordinate the efforts of component barangays in the implementation of the Municipal Solid Waste Management Plan,
- i. Call on any concerned agency or sector, as it may deem necessary, for support or other appropriate action,
- j. Develop the Municipal Solid Waste Management Plan to ensure long-term solid waste management, as well as integrate, the various solid waste management plans and strategies of component barangays,
- k. Adopt measures to promote and ensure the viability and effective implementation of solid waste management programs in all component barangays,
- l. Monitor the implementation of the Municipal SWM Plan through the component barangays and in cooperation with concerned Non-Government Organizations, and
- m. Adopt specific revenue-generating measures to promote viability of the SWM Plan.

SECTION 4. EFFECTIVITY: This order shall take effect immediately.

DONE: this 11<sup>th</sup> day of January, 2005 at Malay, Aklan, Philippines.

CECIRON S. CAWALING  
Municipal Mayor

The MSWM Board passed the following five (5) resolutions in 2007:

**Resolution 2007- 1:**

Request the Sangguniang Bayan to appropriate budget for the collection and disposal of residual waste from the three (3) MRFs on Boracay Island to the proposal Sanitary Landfill site at Kabulihan, covering the Fiscal Year 2006. The Environmental and Admission Fee shall be tapped for this purpose.

**Resolution 2007-2:**

Request the Sangguniang Bayan to appropriate out of the Environmental Admission Fee a budget for the collection and disposal of residual waste from the three (3) MRFs to the proposed proposal Sanitary Landfill Site for Fiscal Year 2007.

**Resolution 2007-3:**

Requesting the Sangguniang Bayan to pass a resolution endorsing the proposed Sanitary Landfill site located at Barangay Kabulihan, Malay, and Aklan to be official and permanent Municipal Sanitary Landfill of Malay, Aklan.

**Resolution 2007-4:**

Resolution requesting the Sangguniang Bayan to request the provincial government of Aklan through Governor Carlito Marquez to release funds for the construction of the municipal engineered sanitary landfill.

**Resolution 2007-5:**

Resolution requesting the Sangguniang Bayan to adopt the total budget of the Municipal Ecological Solid Waste Management Board for Calendar Year 2007 in the total amount of Thirty five million five hundred eighty thousand two hundred forty three pesos.

Source: MOM

### **Appendix II-3.1.3 Barangay Solid Waste Management Committee**

The following is a sample of a Barangay Ordinance creating a Barangay Solid Waste Management Committee.

Republic of the Philippines  
Province of Aklan  
Municipality of Malay  
Barangay Balabag

#### **ORDINANCE NO. 2003-001**

#### **AN ORDINANCE CREATING THE BARANGAY SOLID WASTE MANAGEMENT COMMITTEE, PROVIDING FUNDS FOR THE OPERATION THEREOF AND FOR OTHER PURPOSES**

Be it ordained by the Sangguniang Barangay in session assembled:

SECTION 1. CREATION. There is hereby created in the Barangay, a Barangay Solid Waste Management Committee (BSWMC).

SECTION 2. MEMBERSHIP. The BSWMC shall be composed of the following:

Chairman : Hon. Glenn Y. Sacapaño  
Punong Barangay  
Members: Hon . Liobe G. Sacapaño  
Chairman, Committee on Environmental Mngt. & Sanitation  
Hon. Mark Ronald Wendell S. Salazar  
SK Chairman  
Lilibeth C. Sacapaño  
Chairwoman, Barangay Selda Leader  
Nenet C. Sacapaño  
Head Teacher, Balabag Elementary School  
Avelino Bendolo  
PTCA President, BES  
Lowell Talamisan  
President, PPC  
Victor Supetran  
BLTMPC

SECTION 3. POLICIES, RULES & REGULATIONS. The following policies, rules and regulations shall be strictly adhered to in the implementation of the BSWMC which are consistent with the requirements, standard and capability of each community within the

barangay,

- a. Development and dissemination of information campaign materials on SWM to every household, business establishment and other institution shall be intensified and faithfully complied with.
- b. Community training and seminars on Ecological SWM particularly on household waste segregation, composting, and recycling shall be conducted with technical assistance to be requested from Municipal Health Officer.
- c. The barangay Council shall allocate funds for the Barangay Solid Waste Management Program.
- d. Core of area or area coordinators shall be organized to conduct training for the residents on segregation, composting, and recycling and to initiate livelihood opportunities from use of recycled wastes as well as to monitor the implementation of the program.
- e. The committee shall look for other sources of funds other than the barangay budget and to integrate the Ecological Solid Waste Management Program in the Barangay Development Plan or annual Investment Program.
- f. Monthly reports on the progress of the program shall be submitted by the committee to the Municipal ESWMC, and a copy furnished to the local DOILG office.
- g. The BSWMC shall form the secretariat to assist the Committee in the performance of its functions. It shall provide technical and administrative support to the committee in calling from time to time other concerned sectors within its territorial jurisdiction, as it may deem necessary.
- h. Only segregated waste will be collected. Open burning of garbage is not allowed. No garbage either in plastic bags or other containers shall be displayed along the roads, access roads, fences, posts or other conspicuous places which will create an eyesore before the public.

SECTION 4. PENALTY CLAUSE. Violation of this provision of this ordinance under Section 3 shall be punished by a fine of not less than five hundred pesos (PhP 500) but not more than One thousand pesos (PhP 1,000) or other punishment as the court may direct.

SECTION 5. REPEALING CLAUSE. All ordinances, rules and regulations or parts thereof which provisions are in conflict with, or contrary to, provisions of the ordinance are hereby repealed or modified accordingly. SECTION 6. EFFECTIVITY. This ordinance shall take effect upon approval.

Approved this 6<sup>th</sup> day of May, 2003 at Barangay Balabag, Malay, Aklan

### Appendix II-3.1.4 Current IEC Initiatives by School and Private Sector

#### 1. Public Schools

School	IEC Activities	Core Message	Target
Boracay National High School , Balabag  Manoc-Manoc Yapak	Integration of ESWM in Science and Values Education subjects	Cleanliness, anti-littering & segregation	829 students 21 teachers
	Waste segregation in school		300 students 4 teachers
	Cleaning and segregation activities as community service every Saturday		200 students 5 teachers
	Eco-tour of MRF by graduating biology class	Where garbage ends and how the government manages it	
Balabag Elementary School	Integration of concept of segregation in science and values education subjects	Cleanliness, anti-littering & segregation	500 Grade 4-5 students
	Daily pick-up and segregation of litters after school		
Manoc-Manoc Elementary School	Integration of concept of segregation in science and values education subjects		1,149 students
	Orientation of Parents and Teachers	Proper waste management	
	Morning and afternoon pick-up of and segregation of litter	Cleanliness, anti-littering & segregation	
Yapak Elementary School	Integration of concept of segregation in Science and English subjects	Cleanliness, anti-littering & segregation	469 students 9 teachers
	Set-up school MRF, composting , nursery and eco-store for fine crafts like vases, bags and mats	Recycling as a practice	
	Set-up sack hangers for segregation in every classroom	Proper segregation	
	Pick-up & segregation of litter after classes	Cleanliness	



2. Private Sector

Proponents	IEC Activities	Core Message	Target Audience
Manila Broadcasting Company	Radio plugs 30 seconds every hour for a minimum of 16 spots	Waste Segregation	Public
OIKOS / Kalibo Cable TV	Scrolling ads on TV stations for 6 months	Waste Segregation	Public
	Production of TV aired in Roro and Caticlan Jetty Port		Visitors
Boracay Foundation, Inc.	BFI Newsletters	Promotion of MRF projects	BFI members Public/Business establishments
Boracay Chamber of Commerce, Inc./ Pearl 2 Project	BCCI Newsletters	News updates on the MRF Projects	Public
	6 seminars	Recycling Waste Segregation	Business establishments
	2 seminars	RA 9003	Barangays
	60 IEC briefings		Selda, small groups & establishments
	Poster-Making	Waste recycling	Public
	“War on Waste” contest	Setting up a segregation policy & system in the establishments	Business establishments
	Trophy design contest	Use recyclable materials	High School students
	7 School orientations	Recycling & segregation	Students

Source: JICA Study Team

### Appendix II-3.2.1 Solid Waste Characterization Data

#### 1. Physical Composition of waste on Boracay Island

The following table shows the physical compositions of waste on Boracay Island at each source. At waste generation sources except institutions, the food waste excluding bone, shells and egg shells account for the largest portion in the total waste generation. Wood/grass or recyclable and non recyclable paper has a large portion of total waste generation as well. No recyclable plastic including plastic shopping bags and recyclable paper has a large portion of the waste generation which will be one of possible target waste on Boracay Island.

**Physical Composition of Solid Waste on Boracay Island**

No	Items	Household	Hotel	Restaurant	Shop	Institution	Total Ratio
1	Food Waste excluding bone, shells, and egg shells	13%	21%	44%	36%	8%	24%
2	Food Waste (bone, shells, and egg shells)	4%	4%	5%	6%	2%	5%
3	Wood/Grass	13%	7%	6%	2%	14%	8%
4	Animal waste	0%	0%	0%	0%	0%	0%
5	Recyclable paper (paper cartons, news paper, magazines, etc.)	8%	14%	7%	18%	18%	11%
6	Non recyclable paper (tissue paper, cotton, wipes, tetra-packs, cigarettes, etc.)	4%	10%	7%	8%	12%	6%
7	Paper diapers/ napkins	7%	2%	1%	0%	1%	4%
8	Styrene Foam	1%	1%	0%	0%	5%	1%
9	PET bottles	2%	4%	3%	2%	4%	3%
10	Other recyclable plastics (other bottles, straws, CDs)	5%	6%	2%	6%	6%	5%
11	Non recyclable plastics (film bags, wrap or film for food or snacks, sachets)	14%	13%	12%	10%	13%	12%
12	Transparent glass bottles	12%	6%	5%	3%	6%	8%
13	Colored glass bottles	3%	1%	2%	2%	2%	2%
14	Other glasses (flat glasses and drinking glasses)	3%	1%	0%	1%	0%	2%
15	Steel cans, etc.	4%	5%	3%	2%	3%	4%
16	Aluminum cans, etc.	1%	1%	1%	1%	1%	1%
17	Other metals	0%	0%	0%	0%	0%	0%
18	Textile and other Fibers	1%	2%	0%	1%	1%	1%
19	Leather and Rubber including Tires	1%	0%	0%	2%	0%	1%
20	Bulky wastes (old appliances equipment, etc.)	0%	0%	0%	0%	0%	0%
21	Ceramics/Stone, Cement, Soil	2%	1%	1%	0%	1%	1%
22	Batteries and lamp bulbs	0%	0%	0%	0%	0%	0%
Total		100%	100%	100%	100%	100%	100%

Source: JICA Study Team

2. Physical Composition of waste on the Mainland of Malay

The following table shows the physical compositions of waste on the Mainland of Malay at each source. Similar to Boracay Island, the food waste excluding bone, shells and egg shells accounts for a large portion in households, restaurants and shops. In addition, wood or grass has a large portion on the Mainland of Malay (15%) in comparison to Boracay Island (8%).

**Physical Composition of Solid Waste on the Mainland of Malay**

No	Items	Household	Hotel	Restaurant	Shop	Institution	Total Rate
1	Food Waste excluding bone, shells, and egg shells	18%	15%	42%	58%	14%	23%
2	Food Waste (bone, shells, and egg shell)	3%	1%	3%	0%	0%	3%
3	Wood/Grass	17%	10%	11%	3%	9%	15%
4	Animal waste	1%	2%	1%	0%	1%	1%
5	Recyclable paper (paper cartons, news paper, magazines, etc.)	11%	10%	10%	13%	18%	11%
6	Non recyclable paper (tissue paper, cotton, wipes, tetra-packs, cigarettes, etc.)	1%	6%	5%	1%	8%	1%
7	Paper diapers/ napkins	11%	3%	0%	0%	3%	10%
8	Styrene Foam	1%	1%	0%	0%	13%	1%
9	PET bottles	2%	6%	1%	2%	2%	2%
10	Other recyclable plastics (other bottles, straws, CD)	3%	5%	3%	4%	6%	4%
11	Non recyclable plastics (film bags, wrap or film for food or snacks, sachets)	9%	11%	12%	7%	8%	9%
12	Transparent glass bottles	8%	5%	3%	2%	10%	7%
13	Colored glass bottles	1%	0%	1%	1%	0%	1%
14	Other glasses (flat glasses and drinking glasses)	1%	1%	0%	0%	0%	1%
15	Steel cans, etc.	4%	5%	2%	1%	4%	4%
16	Aluminum cans, etc.	0%	0%	0%	0%	0%	0%
17	Other metals	0%	0%	0%	0%	0%	0%
18	Textile and other Fibers	2%	0%	1%	2%	1%	2%
19	Leather and Rubber including Tires	2%	1%	1%	4%	0%	2%
20	Bulky wastes (old appliances equipment, etc.)	0%	0%	0%	0%	0%	0%
21	Ceramics/Stone, Cement, Soil	3%	0%	2%	0%	0%	3%
22	Batteries and lamps bulbs	0%	16%	1%	0%	0%	1%
Total		100%	100%	100%	100%	100%	100%

Source: JICA Study Team

**Appendix II-3.3.1(1) List of Health Care Waste Generators on Boracay Island**

Name of Medical Facility	Category of Facility	Public/Private	Diagnosis and Treatment Departments	Number of Worker	Number of Bed	Number of Out-patients (2002-2006)	Number of In-patients (2002-2006)	Accreditation from DOH	ECC from DENR	Register as Hazardous Waste Generator
1. Don Ciriaco Senares Tirol Sr. Memorial Hospital (Boracay Island Municipal Hospital)	Infirmiry	Public	<ul style="list-style-type: none"> <li>▪ General Medicine</li> <li>▪ Internal Medicine</li> <li>▪ Minor Surgery</li> <li>▪ Diagnostic laboratory: blood test, bacteriological exam, serology, clinical microscopy</li> <li>▪ Child-birth</li> </ul>	16	10	2002: 6,539 2003: 7,565 2004: 10,456 2005: 9,049 2006: 8,658	2002: 529 2003: 548 2004: 582 2005: 899 2006: 693	Yes	No	No
2. Boracay Health Center (Annex)	Clinic	Public	<ul style="list-style-type: none"> <li>▪ Primary health care (consultation only)</li> <li>▪ Family planning</li> <li>▪ Maternal &amp; Child health care</li> <li>▪ Immunization</li> </ul>	7	0	2002: - 2003: - 2004: - 2005: - 2006: 613	2002: - 2003: - 2004: - 2005: - 2006: -	Yes	No	No
3. Phil Home Medical Clinic and diagnostic Laboratory	Clinic	Private	<ul style="list-style-type: none"> <li>▪ General Medicine</li> <li>▪ Minor Surgery</li> <li>▪ Diagnostic laboratory: blood test, bacteriological exam, serology, clinical microscopy</li> </ul>	3	3	2002: - 2003: - 2004: - 2005: - 2006: 1,430	2002: - 2003: - 2004: - 2005: - 2006: -	No	No	No
4. Bysse Medical Clinic (Phase II, D'Mall, Balabag)	Clinic	Private	<ul style="list-style-type: none"> <li>▪ General Medicine (consultation only)</li> <li>▪ Minor Surgery</li> </ul>	2	1	2002: - 2003: - 2004: - 2005: - 2006: 180	2002: - 2003: - 2004: - 2005: - 2006: -	No	No	No
5. Metropolitan Doctors Medical Clinic / Tooth Fairy Dental Clinic (Balabag)	Clinic	Private	<ul style="list-style-type: none"> <li>▪ General Medicine (consultation only)</li> <li>▪ Minor Surgery</li> <li>▪ General Dentistry</li> </ul>	6	0	2002: - 2003: - 2004: - 2005: 500 2006: 600	2002: - 2003: - 2004: - 2005: - 2006: -	No	No	No

Name of Medical Facility	Category of Facility	Public/Private	Diagnosis and Treatment Departments	Number of Worker	Number of Bed	Number of Out-patients (2002-2006)	Number of In-patients (2002-2006)	Accreditation from DOH	ECC from DENR	Register as Hazardous Waste Generator
6. Dentcare & Therabreath Center	Clinic	Private	<ul style="list-style-type: none"> <li>▪ General Dentistry</li> <li>▪ Orthodontics</li> </ul>	1	0	2002: - 2003: - 2004: - 2005: 225 2006: 846	2002: - 2003: - 2004: - 2005: - 2006: -	No	No	No
7. The Island Clinic Boracay	Clinic	Private	<ul style="list-style-type: none"> <li>▪ Primary Health Care (Consultation only)</li> <li>▪ Minor Surgery</li> <li>▪ Diagnostic laboratory: blood test, bacteriological exam, serology, clinical microscopy</li> </ul>	8	1	2002: - 2003: - 2004: - 2005: - 2006: 82	2002: - 2003: - 2004: - 2005: - 2006: -	No	No	No
8. Byshe Medical Clinic & Diagnostic Laboratory (Phase IV, beside Budget Mart)	Clinic	Private	<ul style="list-style-type: none"> <li>▪ General Medicine (consultation only)</li> <li>▪ Minor Surgery</li> <li>▪ Diagnostic laboratory: blood test, bacteriological exam, serology, clinical microscopy</li> </ul>	2	0	2002: - 2003: - 2004: - 2005: 250 2006: 300	2002: - 2003: - 2004: - 2005: - 2006: -	No	No	No
9. Metropolitan Doctors Medical Clinic (Manoc-manoc)	Clinic	Private	<ul style="list-style-type: none"> <li>▪ General Medicine (consultation only)</li> <li>▪ Minor Surgery</li> </ul>	4	0	2002: - 2003: - 2004: - 2005: - 2006: 600	2002: - 2003: - 2004: - 2005: - 2006: -	No	No	No

Name of Medical Facility	Category of Facility	Public/Private	Diagnosis and Treatment Departments	Number of Worker	Number of Bed	Number of Out-patients (2002-2006)	Number of In-patients (2002-2006)	Accreditation from DOH	ECC from DENR	Register as Hazardous Waste Generator
10. Boracay Lying-in and Diagnostic Center	Infirmary (Primary health care facility)	Private	<ul style="list-style-type: none"> <li>▪ General Medicine (out-patient consultation only but will eventually admit patients when expansion is completed)</li> <li>▪ Family planning, maternal and child health care</li> <li>▪ Diagnostic laboratory: blood test, bacteriological exam, serology, clinical microscopy</li> <li>▪ Minor surgery</li> <li>▪ X-ray/radiology</li> </ul>	9	- (Beds available but not being utilized for in-patient admissions yet)	2002: - 2003: - 2004: - 2005: - 2006: - 2007: 126	2002: - 2003: - 2004: - 2005: - 2006: -	No (DOH accreditation is under process at the survey date)	Yes	No
11. Barangay Manoc-manoc Health Center	Clinic	Public	<ul style="list-style-type: none"> <li>▪ Primary health care (consultation only)</li> <li>▪ Family planning</li> <li>▪ Maternal &amp; Child health care</li> <li>▪ Immunization</li> </ul>	4	1	2002: 287 2003: 291 2004: 295 2005: 312 2006: 359	2002: - 2003: - 2004: - 2005: - 2006: -	Yes	No	No
12. Ribadulla Veterinary Clinic	Veterinary	Private	<ul style="list-style-type: none"> <li>▪ General veterinary services (consultation only)</li> <li>▪ Minor animal Surgery</li> </ul>	1	0	2002: - 2003: - 2004: - 2005: - 2006: 212	2002: - 2003: - 2004: - 2005: - 2006: -	No	No	No

Source: JICA Study Team

**Appendix II-3.3.1(2) List of Health Care Waste Generators on the Mainland of Malay**

Name of Medical Facility	Category of Facility	Public/Private	Diagnosis and Treatment Departments	Number of Worker	Number of Bed	Number of Out-patients (2002-2006)	Number of In-patients (2002-2006)	Accreditation from DOH	ECC from DENR	Register as Hazardous Waste Generator
1. Aklan Baptist Hospital, Inc.	Infirmary	Private	<ul style="list-style-type: none"> <li>▪ General Medicine</li> <li>▪ Internal Medicine</li> <li>▪ Minor Surgery</li> <li>▪ Diagnostic laboratory: blood test, bacteriological exam, serology, clinical microscopy</li> <li>▪ Child-birth</li> <li>▪ X-ray/radiology</li> </ul>	12	20	2002: 4,653 2003: 5,304 2004: 6,935 2005: 5,412 2006: 6,229	2002: 1,415 2003: 1,286 2004: 1,321 2005: 1,476 2006: 1,587	Yes	No	No
2. Malay Municipal Hospital	Clinic	Public	<ul style="list-style-type: none"> <li>▪ General Medicine</li> <li>▪ Internal Medicine</li> <li>▪ Minor Surgery</li> <li>▪ Diagnostic laboratory: blood test, bacteriological exam, serology, clinical microscopy</li> <li>▪ Child-birth</li> <li>▪ X-ray/radiology</li> </ul>	12	10	2002: 4,332 2003: 3,407 2004: 2,546 2005: 4,895 2006: 6,711	2002: 183 2003: 177 2004: 98 2005: 539 2006: 612	Yes	No	No
3. Alcobendas Garcia (Tolosa) Dental Clinic	Clinic	Private	<ul style="list-style-type: none"> <li>▪ General Dentistry</li> <li>▪ Orthodontics</li> </ul>	2	0	2002: - 2003: 40 2004: 70 2005: 40 2006: 120	2002: - 2003: - 2004: - 2005: - 2006: -	No	No	No
4. Malay Municipal Health Center (Boracay Health Center Annex)	Clinic	Public	<ul style="list-style-type: none"> <li>▪ Primary health care (consultation only)</li> <li>▪ Family planning</li> <li>▪ Maternal and child health care and immunization</li> <li>▪ Nutrition</li> <li>▪ First aid</li> </ul>	5	1	2002: 523 2003: 444 2004: 1,441 2005: 1,752 2006: 2,273	2002: - 2003: - 2004: - 2005: - 2006: -	Yes	No	No

Name of Medical Facility	Category of Facility	Public/Private	Diagnosis and Treatment Departments	Number of Worker	Number of Bed	Number of Out-patients (2002-2006)	Number of In-patients (2002-2006)	Accreditation from DOH	ECC from DENR	Register as Hazardous Waste Generator
5. Prado's Funeral Homes	Special facilities (Mortuary)	Private	<ul style="list-style-type: none"> <li>▪ Embalming</li> <li>▪ Funeral wakes</li> <li>▪ Interment services (off-site)</li> </ul>	5	0 (One metal surgical table for embalming)	2002: 5-10 2003: 5-10 2004: 5-10 2005: 5-10 2006: 5-10 (ave. per month)	2002: - 2003: - 2004: - 2005: - 2006: -	No	Yes	No
6. Socion Funeral Homes	Special facilities (Mortuary)	Private	<ul style="list-style-type: none"> <li>▪ Embalming</li> <li>▪ Funeral wakes</li> <li>▪ Interment services (off-site)</li> </ul>	4	0 (One metal surgical table for embalming)	2002: 30 2003: 34 2004: 20 2005: 25 2006: 40	2002: - 2003: - 2004: - 2005: - 2006: -	No	Yes	No

Source: JICA Study Team



#### **Appendix II-4.2.1 Solid Waste Generation Data**

##### **1. Waste Unit Generation Rate**

The unit generation rate (UGR) in 2007 has been estimated based on the WACS. Since there is no time series data about UGR in the Philippines, the annual growth ratio of resident UGR is assumed as 1 to 3% according to the previous experiences of Asian countries. On Boracay Island, the land use condition and potential for development is different by each barangay. The area in Barangay Yapak is currently being highly developed and it will continue in near future. On the other hand, many areas of Barangays Balabag or Manoc-Manoc have already been developed, especially along the main road or the white beach and the potential of their development may be lower than Barangay Yapak. In this context, the growth ratio of UGR was set as 3% for Barangay Yapak, while 2% for Barangays Barabag and Manoc-Manoc. On the Mainland of Malay, the life style of urban barangays such as Barangays Caticlan or Poblacion are different from rural or semi-urban barangays and the style of all the barangays on the Mainland of Malay may gradually change but not drastically in the future. In this context, the growth ratio for the UGR on the Mainland of Malay was set as 2% for urban barangays and 1% for semi-urban and rural barangays. Regarding hotels or restaurants, the annual growth ratio was set as 2% for Boracay Island because life style of tourists may slightly change in the future and 1% for the Mainland of Malay due to less development potential in context of the tourism.

Most of the generation source at hotels was assumed to be from the guests (tourists) and annual growth ratio was set as 2%. In restaurants, annual growth ratio of the UGR was set as 2% for Boracay Island while 1% for the Mainland of Malay because the current size and quality is different. Though the UGR of shops is different dependant on the sizes and types, the targeted shops could be representative of MOM because the targeted shops were randomly selected. As for the institutions, beaches and streets, the UGRs are assumed to hold the same value in the future.

### Waste Unit Generation Rate

Generation Source	Area	Unit	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Households	Boracay	Yapak	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.41	0.42	0.43	
		Balabag	0.44	0.44	0.45	0.46	0.47	0.48	0.49	0.50	0.51	0.52	0.53	
		Manoc Manoc	0.33	0.34	0.34	0.35	0.36	0.36	0.37	0.38	0.39	0.39	0.40	
	Mainland of Malay	Urban	kg/cap/day	0.34	0.34	0.35	0.36	0.36	0.37	0.38	0.38	0.39	0.40	0.41
		Semi-urban		0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.32	0.32	0.32	0.33
		Rural		0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.29	0.29	0.29
Hotels	Boracay	Yapak	0.40	0.40	0.41	0.42	0.43	0.44	0.44	0.45	0.46	0.47	0.48	
		Balabag	0.40	0.40	0.41	0.42	0.43	0.44	0.44	0.45	0.46	0.47	0.48	
		Manoc Manoc	0.40	0.40	0.41	0.42	0.43	0.44	0.44	0.45	0.46	0.47	0.48	
	Mainland of Malay	Urban	kg/tourist/day	0.41	0.41	0.42	0.43	0.44	0.45	0.46	0.47	0.47	0.48	0.49
		Semi-urban												
		Rural												
Restaurants	Boracay	Yapak	0.21	0.21	0.21	0.22	0.22	0.23	0.23	0.24	0.24	0.24	0.25	
		Balabag	0.21	0.21	0.21	0.22	0.22	0.23	0.23	0.24	0.24	0.24	0.25	
		Manoc Manoc	0.21	0.21	0.21	0.22	0.22	0.23	0.23	0.24	0.24	0.24	0.25	
	Mainland of Malay	Urban	kg/rest./day	0.21	0.21	0.21	0.22	0.22	0.23	0.23	0.24	0.24	0.24	0.25
		Semi-urban		0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.22	0.23
		Rural		0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.22	0.23
Shops	Boracay	Yapak	4.40	4.48	4.57	4.66	4.76	4.85	4.95	5.05	5.15	5.25	5.36	
		Balabag	4.40	4.48	4.57	4.66	4.76	4.85	4.95	5.05	5.15	5.25	5.36	
		Manoc Manoc	4.40	4.48	4.57	4.66	4.76	4.85	4.95	5.05	5.15	5.25	5.36	
	Mainland of Malay	Urban	kg/shop/day	4.40	4.49	4.58	4.67	4.76	4.86	4.96	5.05	5.16	5.26	5.36
		Semi-urban		4.40	4.44	4.49	4.53	4.58	4.62	4.67	4.72	4.76	4.81	4.86
		Rural		4.40	4.44	4.49	4.53	4.58	4.62	4.67	4.72	4.76	4.81	4.86
Institutions	Boracay	Yapak	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
		Balabag	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
		Manoc Manoc	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
	Mainland of Malay	Urban	kg/office/day	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01
		Semi-urban		3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01
		Rural		3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01
Beach	Boracay	Yapak	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	
		Balabag	35.75	35.75	35.75	35.75	35.75	35.75	35.75	35.75	35.75	35.75	35.75	
		Manoc Manoc	35.75	35.75	35.75	35.75	35.75	35.75	35.75	35.75	35.75	35.75	35.75	
	Mainland of Malay	Urban	kg/km/day	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55
		Semi-urban		29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55
		Rural		29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55	29.55
Street	Boracay	Yapak	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	
		Balabag	12.76	12.76	12.76	12.76	12.76	12.76	12.76	12.76	12.76	12.76	12.76	
		Manoc Manoc	12.76	12.76	12.76	12.76	12.76	12.76	12.76	12.76	12.76	12.76	12.76	
	Mainland of Malay	Urban	kg/km/day	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	
		Semi-urban		9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	
		Rural		9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	

Source: JICA Study Team

## 2. Projected Total Waste Generation

To estimate the waste generation in the future, future socio economic profiles such as population, tourist arrivals, number of shops or offices as well as length of roads and beaches was estimated. The waste generation from households will increase in proportion to population increase. The waste generation of hotels and restaurants will increase in proportion to tourist increase. The waste generation from shops will increase according to the increase of population and tourists. Regarding institutions, it is assumed that the number will be constant from 2007 to 2017. It is assumed that the streets and beaches will gradually increase according to the development of the roads and beaches toward 2017.

According to the assumptions of the unit generation rate of solid waste and amount of waste generation sources, total waste generation in the future was projected as follows.

### Projected Total Waste Generation

Generation Source	Area	Unit	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Households	Boracay	Yapak	0.845	0.901	0.960	1.022	1.089	1.174	1.236	1.302	1.370	1.442	1.518	
		Balabag	2.654	2.801	2.955	3.117	3.289	3.512	3.661	3.816	3.978	4.146	4.322	
		Manoc Manoc	2.567	2.708	2.857	3.014	3.180	3.396	3.540	3.690	3.846	4.009	4.179	
		Sub-total	6.066	6.410	6.772	7.153	7.558	8.082	8.437	8.808	9.194	9.597	10.019	
	Mainland of Malay	Urban	t/day	2.355	2.515	2.685	2.868	3.063	3.271	3.494	3.732	3.986	4.257	4.548
		Semi-urban		2.096	2.174	2.255	2.339	2.427	2.517	2.610	2.707	2.807	2.911	3.018
		Rural		0.822	0.849	0.877	0.906	0.936	0.968	1.000	1.034	1.068	1.104	1.141
		Sub-total		5.273	5.538	5.817	6.113	6.426	6.756	7.104	7.473	7.861	8.272	8.707
	Total		11.339	11.948	12.589	13.266	13.984	14.838	15.541	16.281	17.055	17.869	18.726	
	Hotels	Boracay	Yapak	0.15	0.40	0.49	0.59	0.70	0.82	0.94	1.07	1.21	1.35	1.41
Balabag			3.45	3.62	3.92	4.15	4.42	4.61	4.87	5.03	5.27	5.41	5.64	
Manoc Manoc			1.29	1.36	1.41	1.51	1.55	1.64	1.65	1.73	1.73	1.80	1.88	
Sub-total			4.89	5.38	5.82	6.25	6.67	7.07	7.46	7.83	8.21	8.56	8.93	
Mainland of Malay		Urban	t/day	0.26	0.29	0.31	0.34	0.36	0.38	0.40	0.42	0.44	0.46	0.48
		Semi-urban												
		Rural												
		Sub-total		0.26	0.29	0.31	0.34	0.36	0.38	0.40	0.42	0.44	0.46	0.48
Total			5.15	5.67	6.13	6.59	7.03	7.45	7.86	8.25	8.65	9.02	9.41	
Restaurants		Boracay	Yapak	0.13	0.21	0.23	0.29	0.31	0.37	0.39	0.46	0.48	0.56	0.59
	Balabag		1.79	1.90	2.06	2.17	2.32	2.41	2.54	2.62	2.74	2.81	2.93	
	Manoc Manoc		0.96	1.02	1.11	1.15	1.22	1.25	1.32	1.34	1.40	1.40	1.46	
	Sub-total		2.88	3.13	3.40	3.61	3.85	4.03	4.25	4.42	4.62	4.77	4.98	
	Mainland of Malay	Urban	t/day	0.32	0.39	0.42	0.49	0.52	0.60	0.64	0.72	0.75	0.84	0.88
		Semi-urban												
		Rural												
		Sub-total		0.32	0.39	0.42	0.49	0.52	0.60	0.64	0.72	0.75	0.84	0.88
	Total		3.20	3.52	3.82	4.10	4.37	4.63	4.89	5.14	5.37	5.61	5.86	
	Shops	Boracay	Yapak	0.22	0.36	0.39	0.49	0.52	0.63	0.66	0.78	0.82	0.95	0.99
Balabag			3.05	3.23	3.50	3.69	3.93	4.09	4.32	4.45	4.66	4.76	4.97	
Manoc Manoc			1.63	1.73	1.88	1.95	2.08	2.13	2.24	2.27	2.37	2.38	2.48	
Sub-total			4.90	5.32	5.77	6.13	6.53	6.85	7.22	7.50	7.85	8.09	8.44	
Mainland of Malay		Urban	t/day	0.55	0.66	0.71	0.84	0.89	1.03	1.08	1.22	1.28	1.43	1.49
		Semi-urban												
		Rural												
		Sub-total		0.55	0.66	0.71	0.84	0.89	1.03	1.08	1.22	1.28	1.43	1.49
Total			5.45	5.98	6.48	6.97	7.42	7.88	8.30	8.72	9.13	9.52	9.93	
Institutions		Boracay	Yapak	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	Balabag		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
	Manoc Manoc		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
	Sub-total		0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	
	Mainland of Malay	Urban	t/day	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
		Semi-urban		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Rural		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sub-total		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Total		0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	
	Beach	Boracay	Yapak	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Balabag			0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.12	
Manoc Manoc			0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	
Sub-total			0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	
Mainland of Malay		Urban	t/day	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Semi-urban		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Rural		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sub-total		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total			0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	
Street		Boracay	Yapak	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Balabag		0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	
	Manoc Manoc		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
	Sub-total		0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	
	Mainland of Malay	Urban	t/day	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
		Semi-urban		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Rural		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sub-total		0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Total		0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	
	Boracay Total	Yapak	t/day	1.40	1.92	2.12	2.45	2.67	3.04	3.28	3.66	3.93	4.36	4.56
Balabag			11.14	11.75	12.64	13.53	14.16	14.82	15.59	16.13	16.86	17.34	18.07	
Manoc Manoc			6.54	6.91	7.35	7.72	8.12	8.51	8.84	9.12	9.44	9.68	10.10	
Mainland of Malay Total	Urban	t/day	3.50	3.87	4.15	4.55	4.85	5.30	5.63	6.11	6.48	7.01	7.41	
	Semi-urban		2.10	2.17	2.26	2.34	2.43	2.52	2.61	2.71	2.81	2.91	3.02	
	Rural		0.82	0.85	0.88	0.91	0.94	0.97	1.00	1.03	1.07	1.10	1.14	
	Total	t/day	6.42	6.89	7.28	7.79	8.22	8.78	9.24	9.85	10.35	11.02	11.57	
Grand Total		25.49	27.47	29.39	31.28	33.17	35.15	36.95	38.77	40.58	42.40	44.30		

Note: There may be some inconsistency parts of the calculation due to rounding-off adjustments.

Source: JICA Study Team

### Appendix II-9.1.1 Basic Consideration of Construction Planning

#### 1. Working Condition

Ground condition in construction sites of proposed facilities on the Mainland of Malay and Boracay Island is generally clayey soil layer. Slope stability in steep cutting may be expected under construction works. But the traffic capability in the site will be worse during rainy season.

The weather is clearly divided into two seasons of rainy and dry. The rainy season is normally recognized as southwest monsoon period from June to December. Most annual rainfall concentrates in those three months with squall and strong western wind blowing. On the other hand, the dry season continues from January to May under the northeast monsoon period. In accordance with past 20 years rainfall data (1971-2000) at a meteorological station in Roxas City, average monthly rainfall and number of rainy days which have more than 10 mm/day are summarized as follows:

#### Average Monthly Rainfall

(Unit: mm)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
87.3	44.9	56.5	72.2	121.9	253.8	235.2	216.8	214.1	294.8	252.9	177.1	2,027.5

Source: Roxas Station

#### Monthly Rainy Days

(Unit: day)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
12	9	6	5	9	16	16	15	16	18	17	15	154

Source: Roxas Station

The annual net workable days for construction work are determined on the basis of the above rainfall data, number of national holidays in the Philippines and the following criteria:

- i) Work is suspended on Sunday and national holidays
- ii) Work is suspended by the rainfall as follows:
 

10-20 mm/day	: 0.5days
More than 20 mm/day	: 1 day

The average monthly workable day is estimated at 20.7 days as shown below.

#### Monthly Workable Day

(Unit: days)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
26.0	25.0	26.0	21.1	22.2	17.6	20.0	19.0	19.1	19.2	17.9	19.0	20.7

Source: JICA Study Team

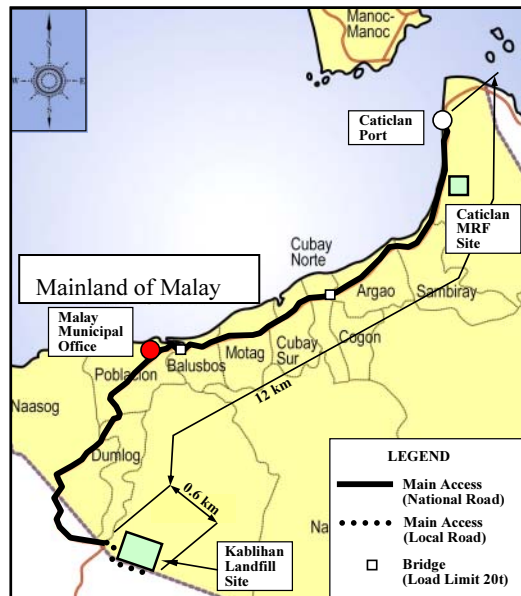
#### 2. Access to the Sites

Main access road to the Kabulihan SLF is the concrete paved national road. The national road runs through the Caticlan jetty port and the Malay municipal office, and locates in about 600 m from the entrance of the SLF. Width of the road is about 6 m from the Caticlan port

to the municipal office in spite of 3-4 m from the municipal office to the SLF site. Although the present road is properly maintained basically, the road in many sections has been left without concrete pavement in the latter sections. In addition, heavy vehicle limitation is set at 20 tons in some bridge sections on the road. The distance from the Caticlan jetty port to the junction of an access road of the site is about 13 km.

Gravel road has been developed already as an access road from the National Road to the proposed site in the distance of 600 m. As the road connects in the sharp angle with steep slope at the junction of National Road, the 10 tons dump truck can not turn smoothly.

Main access road on Boracay Island is the Main Road having concrete pavement in 5-6 m wide. Present three MRFs are located beside the Main Road. Old dump site is located along the Lapus-Lapus Road near the Mt. Luho View Deck. Lapus-Lapus Road is gravel road with 3-4 m wide and connects to the Main Road in both ends. Distance from the Main Road to the old dump site is about 2 km in nearest side.



Access to the Site on the Mainland of Malay

Landing point of procured construction equipment and material are selected from the following three points:

i) Bel-at beach landing

Bel-at Beach is located in the north coast of the island. Temporary jetty has been developed at the Bel-at beach for landing of heavy equipments and construction materials utilized to the private resort development project. The jetty may be available if required. Small gravel road runs from the jetty and connects to the Main Road near the Yapak elementary school. The width of gravel road is 3-4 m. Distance from the jetty to the Main Road is about 1.2 km.

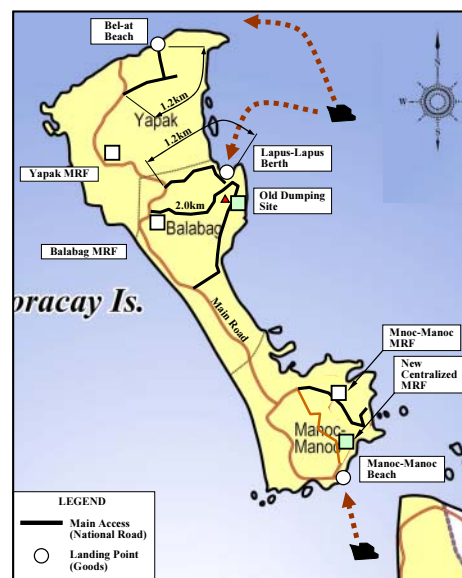
ii) Lapus-Lapus berth

The Lapus-Lapus berth is located at the south end of Lapus-Lapus beach in the east coast of Boracay Island. The Lapus-Lapus berth is a concrete paved berth with the extent of 36 m long and 21 m wide. A truck crane with the capacity of 35 tons may be available at the berth. The large scale barge can be connected to this berth. Location of this berth is closest to the old dump site as compared with the other landing points. Paved road with 4-5 m wide goes through a private golf link and connects to the Main Road with the distance of 1.2 km from the berth.

iii) Manoc-Manoc beach landing

Manoc-Manoc beach is located in the south coast of the island and utilized to the goods landing. Small scale barge in the class of 100 tons is only allowable to berth the beach in order to avoid any damage to the underwater utilities of water and power supply running in 70 m south of landing point. This landing point is neighboring to the Main Road.

Most suitable landing point should be selected from the above mentioned landing points taking into account inland transportation of construction equipments and materials.



Access to the Site on the Boracay Island

3. Available Construction Resources

1) Construction workers

Available locally either direct hiring or through local contactors.

2) Construction materials

- i) Materials such as fine and coarse aggregates for concrete, cement, reinforcement steel bars, lumber, hardware, fuel and oil products are usually available from the local suppliers. Other construction materials such as structural steel, roofing, paints, tiles, PVC and steel pipes and other special items can be procured in Kalibo City or from Manila by ship via Batangas City.
- ii) Earth material for embankment and backfilling can be obtained from excavation work for the SLF while the earth material for the rehabilitation of old dumping site can be taken from the Mainland of Malay and is transported to the island by barge.
- iii) Clay material for the liner facility of the SLF can be obtained in situ.
- iv) Pre-cast concrete pipe are available from the local manufacturers within the province.

3) Construction equipment

Major construction equipment such as a bulldozer, excavator, loader, dump trucks, roller/compactor, grader, crane, and generator can be rented from the local contractors operating in the province.

## Appendix II-9.1.2 Unit Prices

Item No.	Description of Works	Unit	Unit Price (Malay Area)	Unit Price (Boracay Area)
<b>1.0</b>	<b>GENERAL REQUIREMENTS</b>			
1.1	Mobilization and Demobilization			
1.1.1	Personnel and Equipment	sum	837,200.00	837,200.00
1.1.2	Standard Safety Measures	sum	121,900.00	121,900.00
1.1.3	Licenses, Permits & Clearances	sum	268,180.00	268,180.00
1.2	Supplemental			
1.2.1	Removal and Relocation of Existing Public Utilities	sum	268,180.00	268,180.00
1.2.2	Survey Works	sum	1,049,506.56	1,049,506.56
1.2.3	Statistical Report and As-Built Drawings	sum	119,462.00	119,462.00
1.2.4	Maintenance of the Existing Road and Traffic	sum	2,493,103.40	2,493,103.40
1.3	Facilities for the Engineer			
1.3.1	Provision for Field Office and Living Quarters	sum	1,828,500.00	1,828,500.00
1.3.2	Operate and Maintain Field Office and Living Quarters	sum	300,426.00	300,426.00
1.3.3	Provision for Furnitures, Equipment and Supplies for the Office and Living Quarters	sum	390,080.00	390,080.00
1.3.4	Provide, Operate and Maintain 4 x 4 Pick-up Units	sum	3,249,026.00	3,249,026.00
1.3.5	Progress Photographs	sum	73,140.00	73,140.00
1.4	Contractor's Temporary Facilities			
1.4.1	Construction Camp	sum	1,532,840.70	1,532,840.70
1.4.2	Workshops and Warehouse	sum	1,349,990.70	1,349,990.70
1.4.3	Office	sum	839,125.01	839,125.01
1.4.4	Power and Water Supply	sum	609,500.00	609,500.00
<b>2.0</b>	<b>EARTHWORKS</b>			
2.1	Clearing & Grubbing	m <sup>2</sup>	37.04	37.04
2.2	Clearing & Grubbing (swamp area with trees & shrubs)	m <sup>2</sup>	n.a.	143.26
2.3	Common excavation (manual)	m <sup>3</sup>	176.85	176.85
2.5	Common excavation (by backhoe)	m <sup>3</sup>	79.16	79.16
2.6	Common excavation (by dozer)	m <sup>3</sup>	47.68	47.68
2.7	Filling and Compaction of excavated material (manual)	m <sup>3</sup>	191.54	191.54
2.8	Filling and Compaction of excavated material (machine)	m <sup>3</sup>	91.16	91.16
2.9	Filling and Compaction of borrowed material (common soil)	m <sup>3</sup>	439.71	439.71
2.10	Embankment of borrowed material (common soil)	m <sup>3</sup>	449.01	449.01
2.11	Embankment of borrowed material (clay soil)	m <sup>3</sup>	519.10	519.10
2.13	Disposal of surplus materials (1 - 2 km)	m <sup>3</sup>	72.47	72.47
2.14	Disposal of surplus materials (5 km)	m <sup>3</sup>	104.81	104.81
2.15	Levelling	m <sup>2</sup>	116.85	116.85
2.16	Clay lining	m <sup>3</sup>	564.37	1,474.85
2.17	Gravel bedding for concrete structure	m <sup>3</sup>	949.49	1,559.48
2.18	Hauling of excavated materials from new landfill by truck (6 km)	m <sup>3</sup>	104.52	104.52
2.19	Hauling of excavated materials from new landfill by truck (15 km)	m <sup>3</sup>	380.56	380.56
2.20	Hauling of excavated materials by truck (2 km)	m <sup>3</sup>	156.24	156.24
2.21	Hauling of excavated materials by barge (15 km)	m <sup>3</sup>	449.17	449.17
<b>3.0</b>	<b>CONCRETE WORKS</b>			
3.1	Concrete (3,000 psi)	m <sup>3</sup>	4,637.62	5,740.14
3.2	Concrete (2,500 psi)	m <sup>3</sup>	4,235.35	5,297.64
3.3	Lean Concrete	m <sup>3</sup>	3,296.72	4,265.15
3.4	Reinforcing Steel Bars (Grade 40)	kg	65.64	65.64
3.5	Reinforcing Steel Bars (Grade 33)	kg	60.27	62.96
3.6	Formworks and Scaffoldings	m <sup>2</sup>	315.44	385.86

Source: JICA Study Team

Item No.	Description of Works	Unit	Unit Price (Malay Area)	Unit Price (Boracay Area)
<b>4.0</b>	<b>PIPING</b>			
4.1	Perforated PVC pipe for leachate collection			
	a) 110 mm dia. uPVC pipe	m	677.17	677.17
	b) 160 mm dia. uPVC pipe	m	1,268.54	1,268.54
	c) 225 mm dia. uPVC pipe	m	2,399.98	2,399.98
	d) 280 mm dia. uPVC pipe	m	4,245.66	4,245.66
	e) 310 mm dia. uPVC pipe	m	5,740.31	5,740.31
4.2	HDPE pipe for common use			
	a) 110 mm dia.	m	1,161.41	1,161.41
	b) 160 mm dia.	m	2,391.76	2,391.76
	c) 225 mm dia.	m	4,849.37	4,849.37
	d) 280 mm dia.	m	7,669.82	7,669.82
	e) 310 mm dia.	m	9,876.02	9,876.02
	f) HDPE Sheets	m <sup>2</sup>	1,024.96	1,024.96
4.3	PVC pipe for gas ventilation			
	a) 63 mm dia.	m	251.57	251.57
	b) 75 mm dia.	m	349.10	349.10
	c) 90 mm dia.	m	483.81	483.81
	d) 110 mm dia.	m	673.81	673.81
	e) 160 mm dia.	m	1,416.56	1,416.56
	f) 225 mm dia.	m	3,142.77	3,142.77
	g) 280 mm dia.	m	5,597.52	5,597.52
<b>5.0</b>	<b>ROAD WORKS</b>			
5.1	Subgrade Preparation	m <sup>2</sup>	58.42	58.42
5.2	Aggregate Sub-base Course, 200 mm thick	m <sup>3</sup>	844.74	1,405.48
5.3	Aggregate Base Course, 200 mmthick	m <sup>3</sup>	984.92	1,545.66
5.4	Aggregate Surface Course	m <sup>3</sup>	956.16	1,516.90
5.5	Bituminous Asphalt Pavement, 50mm thick	m <sup>2</sup>	373.97	455.32
5.6	Portland Cement Concrete Pavements, 200mm thick	m <sup>2</sup>	1,133.68	1,268.00
5.7	Concrete Curb and Gutter	m	875.83	1,049.66
5.8	Sidewalks, 100mm thick	m <sup>2</sup>	653.75	801.77
5.9	Sodding	m <sup>2</sup>	147.98	147.98
<b>6.0</b>	<b>DRAINAGE AND SLOPE PROTECTION STRUCTURES</b>			
6.1	Reinforced Concrete Pipe (RCP), Class II Standard (excluding excavation, bedding & backfilling)			
	a) 200mm dia.	lin.m.	418.85	498.70
	b) 300mm dia.	lin.m.	479.80	559.65
	c) 460mm dia.	lin.m.	1,203.46	1,344.98
	d) 610mm dia.	lin.m.	1,472.12	1,614.38
	e) 760mm dia.	lin.m.	2,422.10	2,715.42
	f) 910mm dia.	lin.m.	2,938.05	3,228.12
	g) 1070mm dia.	lin.m.	3,815.15	4,234.48
	h) 1220mm dia.	lin.m.	4,675.18	5,164.82
6.2	Wet Rubble Masonry	m <sup>3</sup>	2,133.60	3,108.80
6.3	Grouted Riprap	m <sup>3</sup>	1,917.11	2,800.88
6.4	Gabion Protection, zinc coated, 0.50 x 1.00 x 3.00	m <sup>2</sup>	897.89	1,371.94
6.5	Gabion Protection, zinc coated, 1.00 x 1.00 x 3.00	m <sup>2</sup>	1,381.50	2,329.61
6.6	Boulder Fill (50 - 300 mm dia.)	m <sup>3</sup>	661.73	1,466.27
6.7	Geotextile, 400 gm/m <sup>2</sup>	m <sup>2</sup>	257.25	257.25
6.8	Geotextile, 600 gm/m <sup>2</sup>	m <sup>2</sup>	331.00	331.00
6.9	Geotextile, 800 gm/m <sup>2</sup>	m <sup>2</sup>	404.75	404.75

Source: JICA Study Team



Item No.	Description of Works	Unit	Unit Price (Malay Area)	Unit Price (Boracay Area)
6.10	Drainage Gutter, 6 inch CHB wall	m	3,840.04	4,516.31
6.11	Storm water ditch, wet masonry	m	2,982.97	4,242.19
<b>7.0</b>	<b>MISCELLANEOUS WORKS</b>			
7.1	Perimeter Fence (Cyclone Wire Fence, Steel Post & Barb Wire)	m	2,186.31	3,198.28
<b>8.0</b>	<b>BUILDING WORKS</b>			
8.1	Office House	m <sup>2</sup>	15,000.00	18,000.00
8.2	Storage House	m <sup>2</sup>	10,000.00	12,000.00
8.3	Bio-reactor Houe	m <sup>2</sup>	10,000.00	12,000.00

Source: JICA Study Team

### Appendix II-10.1.3 Institutional Framework for the Environment in the Philippines

1. Department of Environment and Natural Resources (DENR)

The primary government institution with the mandate for environmental protection and pollution control at the national level is the DENR pursuant to Executive Order 192 of 1987. The DENR is composed of several line bureaus, each one is tasked to perform respective regulatory and management functions related to the environment and natural resources. The following line bureaus of DENR are mandated thus:

- (1) The Environmental Management Bureau (EMB), formerly known as the National Environmental Protection Council (NEPC), is responsible for monitoring and enforcement of water and air quality standards. It is also tasked to implement the Environmental Impact Statement (EIS) system pursuant to Presidential Decree 1586 of 1978 and its revised implementing rules and regulations.
- (2) The National Protected Area System (NPAS) Act No 7586 of June 1992 designates the responsibility for managing such areas as belonging to the Protected Areas and Wildlife Bureau (PAWB). Projects that are located in Environmentally Critical Area (ECA) are required to seek the approval and endorsement by the Protected Area Management Board (PAMB). The PAMB is a multi-stakeholder body chaired by the DENR-Regional Executive Director and co-chaired by the Provincial Governor under whose jurisdiction the protected area belongs. The PAMB is represented by the Protected Area Superintendent who sits as a member of the board along with representatives of concerned municipalities/cities, NGOs and other relevant national government agencies.
- (3) The Forest Management Bureau (FMB) essentially has responsibility for all lands with over 18% slope, which are categorized as forestlands, grazing lands and all forest reservations including watershed reservations. The FMB is responsible for the protection, development, management, regeneration and reforestation of these lands as well as regulating their occupancy and extraction of products there from. The management of mangrove areas also comes under the responsibility of the FMB. The FMB takes charge of issuing appropriate tenurial instruments to private or juridical entities for the use of timberland areas for various purposes in conformity with the approved Forest Land Use Plans of the areas.
- (4) The management of Alienable and Disposable (A&D) lands rests with the Bureau of Lands. The Bureau issues land titles to interested claimants, subject to pre-conditions of continuous use and occupancy of the land by the claimant and duly approved survey plan of the area, among others.
- (5) Responsibility for management and regulation of the extraction of metallic and non-metallic mineral resources rests with the Mines and Geo-sciences Bureau (MGB). A Geologic Assessment Report (GAR) or Geologic Investigation Report (GIR) is usually required of projects that have potential to cause or be affected by geo-hazards.

The MGB issues an Area Clearance as part of the requirements for issuance of ECC. In The MGB also regulates activities that require movement and extraction of earth materials (metallic as well as non-metallic, including quarrying of sand and gravel or ordinary earth or clay materials). This is covered by another ECC requirement, which is pre-requisite for the granting of a Mining Permit or Quarry Permit.

- (6) The Provincial Environment Officer (PENRO) and/or Community Environment Officer (CENRO) are designated by the DENR-Regional Director to represent his office on matters relating to the resolution of environmental and forest land use issues in the field level. The PENRO and/or CENRO usually sit as member(s) of the Multipartite Monitoring Team (MMT).

## 2. Other National Government Agencies (NGAs)

Other government line agencies share in the task of environmental management. The Department of Agriculture (DOA) has the responsibility for managing all lands having slopes of 18% and lower, otherwise categorized as alienable and disposable (A & D) lands. The DOA is mandated to ensure the country's food security by improving the productivity of the crops, livestock and fisheries sectors.

The management of soil and water resources for agricultural development rests with the Bureau of Soil and Water Management (BSWM). The responsibility for regulating the importation and use fertilizers and pesticides in agriculture rests with the Fertilizer and Pesticide Authority (FPA). The management of coastal and marine areas and the fisheries resources is the responsibility of the Bureau of Fisheries and Aquatic Resources (BFAR).

## 3. Local Government Units (LGUs)

LGUs carry out land use planning, including zoning, as part of the local integrated area planning process at the municipality/city level. Municipal comprehensive land use plans (CLUPs) become the basis for the formulation of provincial CLUPs. CLUPs are prepared side by side with the 5-year (medium-term) and 10-year (long-term) Comprehensive Development Plans (CDPs) and capital investment plans (CIPs) at the municipal/city, provincial and regional levels.

The social acceptability clause in the EIA guidelines is meant to guarantee that there is no major public resistance to the implementation of project. Moreover, it ensures that all relevant stakeholders have been properly and adequately consulted and that the issues and concerns affecting them are properly addressed in the course of the EIA Study. The scoping and public consultations are prescriptive tools to achieve social acceptability and are built-in processes in the EIS system.

The LGUs play a crucial role as one of the key stakeholders affected by any project undertaking. The EIA guidelines require the prior informed consent of LGUs, usually in the form of a resolution passed by the legislative council at various levels (barangay,

city/municipality, province as the case may be) interposing no objection to the project. Clearance is sought, particularly in terms of conformity with present zoning and land use prescriptions in the project area, coherence with the LGU's present and planned development objectives, compliance with local ordinances and permitting procedures and adequacy of measures to mitigate impacts on the locality's natural and human environments.

The LGUs issue business permits for private undertakings as well as pertinent land use clearances, sanitary permits, building permits and the like for all project undertakings. Compliance with such permit requirements is a standard condition stipulated in ECCs.

The LGUs have respective environmental offices that take over the devolved environmental functions by virtue of the Local Government Code (RA 9160). The provinces have a Provincial Environment Office to protect local watersheds and Provincial Mines Regulatory Board (PMRB) to regulate small-scale mining and quarrying, including extraction of ordinary earth and clay materials. The municipal and city governments down to the barangay levels have respective environment offices which oversee the implementation of ecological solid waste management plans (ESWMP) and other environmental projects at the grassroots level. Legislative councils in all three levels have respective Environment Committees that spearhead the legislation of local laws in support of national environmental policies. These Committees also review requests for endorsements of proposed projects within their jurisdictions.

**APPENDIX III:**  
**FEASIBILITY STUDY FOR**  
**THE PRIORITY PROJECTS**

### Appendix III-1.2.1 Results of Water Quality Survey at the Proposed SLF

#### Result of Surface Water Quality Survey at the Proposed SLF

No.	Parameter	Unit	7-Jun-07			20-Sep-07			Standard
			SW-1	SW-2	SW-3	SW-1	SW-2	SW-3	
1	Temperature	oC	27.90	27.80	31.30	26.40	27.10	26.40	3.0
2	pH	-	7.80	7.20	7.70	6.50	6.70	7.80	6.5-8.5
3	Color	PCU	5.00	5.00	5.00	10.00	15.00	<5	50.0
4	Turbidity	NTU	1.00	0.20	0.02	7.00	11.00	17.00	-
5	Dissolve Oxygen	mg/L	6.70	6.30	6.70	7.00	4.00	8.00	5.0
6	Total Suspended Solids	mg/L	23.00	3.00	1.00	5.00	2.00	57.00	50.0
7	Total Dissolved Solids	mg/L	160.00	92.00	193.00	58.00	92.00	244.00	1,000.0
8	Conductivity	mS/cm	277.00	256.00	396.00	148.00	159.00	139.00	-
9	Oil/Grease (Petroleum Ether Extract)	mg/L	3.00	5.00	1.00	3.00	<1	2.00	1.0
10	BOD5	mg/L	1.00	<1	2.00	<1	<1	1.00	5.0
11	COD	mg/L	4.00	8.00	4.00	12.00	41.00	85.00	-
12	Chloride as Cl	mg/L	5.00	5.00	5.00	3.00	4.00	14.00	250.0
13	Ammonia Nitrogen	mg/L	0.01	0.01	0.01	0.04	0.03	0.03	-
14	Sulphate	mg/L	14.00	19.00	12.00	32.00	36.00	33.00	-
15	Sodium	mg/L	12.00	11.00	4.00	4.50	5.00	3.80	-
16	Potassium	mg/L	1.00	0.90	1.00	0.50	0.50	0.80	-
17	Calcium	mg/L	47.00	32.00	86.00	5.10	22.00	94.00	-
18	Magnesium	mg/L	5.00	5.00	4.00	1.10	0.90	3.90	-
19	Iron	mg/L	0.30	0.20	ND	0.20	0.40	0.30	-
20	Lead	mg/L	ND	ND	ND	ND	0.50	ND	0.05
21	Copper	mg/L	ND	ND	ND	ND	0.07	ND	1.00
22	Cadmium	mg/L	ND	ND	ND	ND	ND	ND	0.01
23	Chromium(Cr) Hexavalent	mg/L	0.01	0.01	ND	ND	ND	ND	0.05
24	Total Mercury	mg/L	ND	ND	ND	ND	ND	ND	0.002
25	Organophosphate	mg/L	ND	ND	ND	ND	ND	ND	nil
26	Total Coliform Count	MPN/100mL	2,400.00	5,000.00	1,300.00	9,200.00	3,500.00	5,400.00	1,000.00

Note: SW -1 = Surface Water (Creek), N 11o 52' 29", E 121o 54' 26"

SW -2 = Surface Water (Creek), N 11o 53' 31", E 121o 55' 30"

SW -3 = Surface Water (Spring), N 11o 53' 04", E 121o 53' 27"

ND = Not detectable

Standard-1: DAO No.34, Class A

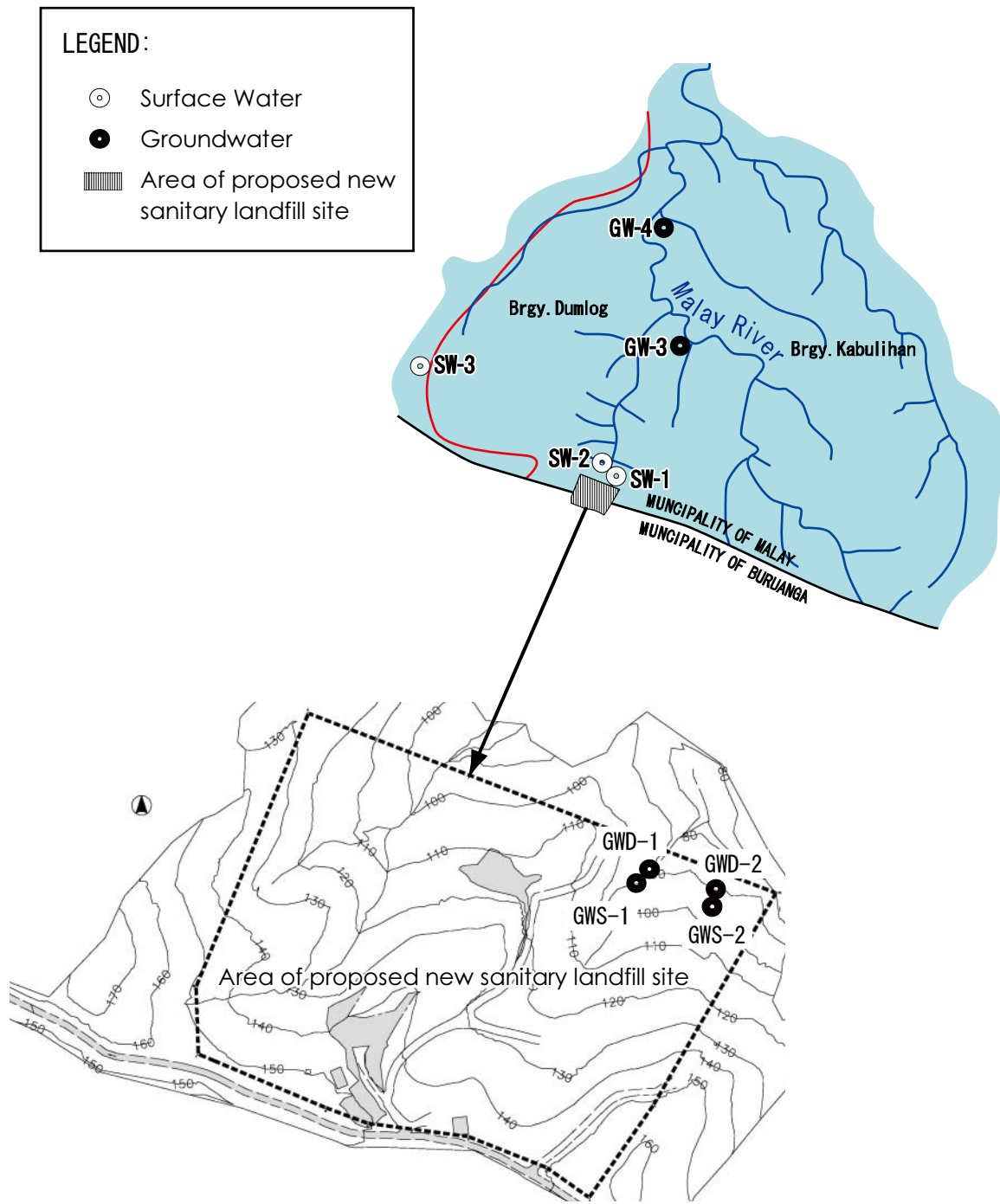
Source: JICA Study Team

**Result of Groundwater Quality Survey at the Proposed SLF**

No.	Parameter	Unit	20-Jul-07				20-Sep-07				Standard		
			GWS-1	GWD-1	GWS-2	GWD-2	GWS-1	GW D-1	GWS-2	GWD-2		GW-3	GW 4
1	Temperature	oC	28.00	28.60	28.70	29.00	27.20	27.60	26.80	27.10	26.20	26.10	-
2	pH	-	6.60	6.60	7.00	7.80	6.40	6.00	6.70	7.20	6.50	6.70	6.5-8.5
3	Color	PCU	10.00	40.00	10.00	10.00	15.00	5.00	<5	5.00	<5	5.00	5.00
4	Turbidity	NTU	658.00	992.00	57.00	17.00	148.00	166.00	118.00	153.00	0.40	1.00	5.00
5	Dissolve Oxygen	mg/L	4.00	4.00	1.00	3.00	7.00	7.00	7.00	8.00	5.00	5.00	-
6	Total Suspended Solids	mg/L	970.00	1,386.00	76.00	33.00	159.00	387.00	122.00	146.00	<1	2.00	-
7	Total Dissolved Solids	mg/L	126.00	92.00	141.00	158.00	94.00	79.00	302.00	259.00	2.00	99.00	500.00
8	Conductivity	mS/cm	172.00	178.00	165.40	278.10	172.00	168.00	369.00	558.00	359.00	327.00	-
9	Oil/Grease (Petroleum Ether Extract)	mg/L	1.00	1.00	1.00	1.00	4.00	1.00	2.00	4.00	2.00	3.00	-
10	BOD5	mg/L	6.00	6.00	9.00	17.00	1.00	4.00	2.00	6.00	<1	<1	-
11	COD	mg/L	45.00	45.00	65.00	29.00	41.00	44.00	12.00	77.00	8.00	8.00	-
12	Chloride as Cl	mg/L	4.00	9.00	7.00	9.00	4.00	5.00	3.00	11.00	4.00	4.00	250.00
13	Ammonia Nitrogen	mg/L	0.08	0.09	0.12	0.06	0.20	0.20	0.20	0.20	0.03	0.01	-
14	Sulphate	mg/L	4.00	4.00	3.00	1.00	7.00	33.00	6.00	37.00	34.00	36.00	250.00
15	Sodium	mg/L	17.00	18.00	10.00	22.00	10.80	7.70	6.10	19.00	6.40	10.00	200.00
16	Potassium	mg/L	1.00	2.00	2.00	2.00	0.50	0.20	0.50	1.20	0.40	0.60	-
17	Calcium	mg/L	10.00	7.00	39.00	28.00	7.50	4.30	41.00	82.00	22.00	19.00	-
18	Magnesium	mg/L	54.00	63.00	10.00	8.00	1.80	0.80	2.40	3.90	7.00	6.00	-
19	Iron	mg/L	6.00	2.00	2.00	1.00	0.60	1.30	2.60	2.30	ND	0.06	1.000
20	Lead	mg/L	ND	ND	ND	ND	ND	ND	0.08	ND	ND	ND	0.010
21	Copper	mg/L	ND	0.10	ND	ND	0.04	ND	ND	ND	0.06	ND	1.000
22	Cadmium	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003
23	Chromium(Cr) Hexavalent	mg/L	ND	ND	ND	ND	0.01	ND	ND	0.01	ND	ND	0.050
24	Total Mercury	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001
25	Organophosphate	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-
26	Total Coliform Count	MPN/100mL	2,300	2,000	3,300	7,000	2,400	450	680	92,000	2,400	2,400	not det. In 100 mL sample

Note: GWS-1 = Groundwater Monitoring Well No. 1 -shallow well, N 11o 52' 25", E 121o 54' 18"  
 GWD-1 = Groundwater Monitoring Well No. 1 -Deep well, N 11o 52' 25", E 121o 54' 18"  
 GWS-2 = Groundwater Monitoring Well No. 1 -Shallow well, N 11o 52' 24", E 121o 54' 19"  
 GWD-2 = Groundwater Monitoring Well No. 1 - Deep well, N 11o 52' 24", E 121o 54' 19"  
 GW3 = Ground water well at Barangay Kabulihan, N 11o 53' 50", E 121o 55' 43"  
 GW4 = Ground water well at Barangay Kabulihan, N 11o 53' 22", E 121o 55' 41"  
 ND = Not detectable

Source: JICA Study Team



**Location of Water Quality Survey Points in and around the Proposed SLF**

Source: JICA Study Team



### Appendix III-1.8.1 O&M Cost of Sanitary Landfill Site

Operation and maintenance (O&M) costs of the proposed Kabulihan SLF mainly consist of personnel costs and operational costs of facilities and equipment to be used at the SLF.

The personal costs were calculated by unit costs which have been set based on the current monthly salary of the workers on Boracay Island. Because the SLF will not be operated daily, the monthly personal expenditure for each worker was estimated based on the estimated their working hours.

As for the operational costs of the facilities, they were estimated based on the assumed monthly operational cost in the past experiences in the Philippines. Unit costs used for the estimation are shown in the table below. The estimated costs were divided by the amount of hauled waste in order to produce the unit cost per tone of the waste as PhP 549/ton.

**Unit Cost Used to Estimate O&M Cost of the SLF**

Item		Operating Hours [hr/month]	Cost per Hour [PhP/hr]	Cost [PhP/month]
Personnel Expenditure	Landfill Manager (Engineer)	20	120	2,400
	Supervisor	168	80	13,440
	Clerk	240	80	19,200
	Operators	84	68.6	5,760
	Labor	600	50	30,000
	Security Guard	720	40	28,800
Operation Cost of Facility and Equipment	Backhoe Loader	20	1,200	24,000
	Bulldozer	12	1,500	18,000
	Dump Truck	20	800	16,000
	Service Vehicle	32	200	6,400
	Pump(s)	43	180	7,740
Others	Miscellaneous	-	-	15,700
	Environmental Monitoring	-	-	10,000
Total		-	-	197,440
Cost per ton		-	-	549

Source: JICA Study Team

Consequently, the annual cost of O&M of the Kabulihan SLF was estimated based on the multiplication of unit cost per ton and the amount of residual waste to be hauled to the SLF as shown in the table below:

**Estimated O&M Cost of the SLF**

(Unit:  $\times 10^3$  PhP)

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
O&M Cost	(2,145)	(2,275)	2,478	2,601	2,406	2,341	2,224	2,097	2,100	2,102

Note: Costs in 2008 and 2009 include the ones for management of temporal storage of the residual waste to be hauled to the SLF site.

Source: JICA Study Team

**Appendix III-1.10.1 Conditions Suggested in the ECC dated June 5, 2007 for the Development of Kabulihan SLF and Measures to be Taken**

**(1) Environmental Management**

No.	Conditions of ECC	Measures to be Taken
1.	Two monitoring wells shall be established within the project site. Baseline data of both the surface water (within the intermittent creek and Malay River) and underground water (from the wells) shall be taken and submitted to the EMB Regional Office prior to project operation. The data shall include heavy metals such as but not limited to lead, mercury, cadmium, chromium, arsenic; pH; total and fecal Coliform; BOD; phosphates; and nitrates.	<ul style="list-style-type: none"> <li>- Four monitoring wells have been installed in the site.</li> <li>- During the environmental and social study for the amendment of ECC, the quality of groundwater at the four installed wells and surface water at three locations of Malay River were analyzed. The MOM will submit the results as one of the parts of the amended IEE report to the EMB Regional Office before the project operation.</li> </ul>
2.	An efficient drainage system shall be constructed parallel to the slopes of the project area to effectively collect and divert surface run-off during the rainy season. All other recommendations stated in the Geological Assessment Report of the Mines and Geosciences Bureau Region 6 shall be complied with and strictly implemented by the proponent during the construction and operation of the sanitary landfill.	<ul style="list-style-type: none"> <li>- Peripheral drainage system will be installed to prevent storm water from running into the SLF and off the surrounding catchment.</li> <li>- Recommendations stated in the Geological Assessment Report will be incorporated into the EMMP and implemented during the construction and operation phase.</li> </ul>
3.	A clay liner with minimum thickness of 0.75 m and permeability of $1 \times 10^{-6}$ cm/sec or less, or geomembranes with minimum thickness of 1.5 mm and permeability of $1 \times 10^{-14}$ cm/sec or less, or Geosynthetic Clay Liners (GCL) with minimum thickness of 6.4 mm and a permeability of $1 \times 10^{-9}$ cm/sec or less or a composite liner (clay under geomembrane) in which the thickness of the clay liner may be reduced to 0.60 mm, as per Rule XIV Operations of Sanitary Landfills, Section 1 (j) of DAO 2001-34, Implementing Rules and Regulations of R.A. 9003, must be properly laid out on the flat bottom of the landfill cell to prevent leachate infiltration into the groundwater.	<ul style="list-style-type: none"> <li>- In order to reduce the percolation of the leachate to groundwater, a liner system will be installed on the bottom of cells.</li> <li>- Based on the soil test conducted on in situ soil materials, there is enough quantity for soil liners that met the required criteria, <math>1 \times 10^{-6}</math> m/sec stipulated in DAO No. 2001-34 and IRR of RA 9003.</li> </ul>

No.	Conditions of ECC	Measures to be Taken
4.	<p>Waste to be accepted and processed at the sanitary landfill as stated in the submitted document shall be limited to only non-hazardous and non-toxic household, market, mixed municipal waste, agricultural, and commercial wastes. Pre-treated health care wastes shall be allowed to be disposed of provided a specially-designed cell for pre-treated health care wastes shall be constructed. The proposed pre-treatment process for the health care wastes shall be submitted to the EMB Regional Office within 30-days upon receipt of the ECC for evaluation. Construction of such special cell will comply with the requirements under R.A. 6969. No other toxic or hazardous wastes specified under R.A. 6969 shall be accepted in the landfill. The EMB Regional Office shall be properly informed of any plan of accepting such wastes, if it warrants an amendment or another EIA.</p>	<ul style="list-style-type: none"> <li>- The new SLF will receive non-hazardous and non-toxic waste only.</li> <li>- The new SLF will accommodate pre-treated HCW, so a specially-designed cell will be established for its disposal following the requirements stipulated by RA 6969.</li> <li>- Based on the proposal in the 10-year SWM Plan, the HCW will be treated by using an autoclave before transfer to the new SLF. The MOM will submit the treatment process for the HCW to the EMB Regional Office within 30-days after issuance of the amended ECC.</li> </ul>
5.	<p>A gas collection system shall be installed to prevent gas accumulation and migration. Measures to prevent deliberate or accidental fires and gas explosions within the landfill area shall be strictly undertaken. Monthly gas monitoring shall be undertaken to ensure the safety of the workers. A gas measuring device shall be made available at the site for regular monthly gas monitoring for the safety of the workers.</p>	<ul style="list-style-type: none"> <li>- A gas venting facility and collection system will be installed in the new SLF.</li> <li>- The MOM will monitor landfill gases monthly at the installed gas venting facilities. The parameters will be temperature, methane (CH<sub>4</sub>), carbon dioxide (CO<sub>2</sub>), hydrogen sulfide (H<sub>2</sub>S) and ammonia (NH<sub>3</sub>).</li> </ul>
6.	<p>Quarterly monitoring of the receiving surface body of water and monitoring wells shall be undertaken by the proponents to ensure early detection of the occurrence of water contamination. Parameters to monitor shall include BOD, pH, nitrates, phosphates, total and fecal Coliform and heavy metals. Likewise, a quarterly monitoring of effluent discharge shall be undertaken in terms of total and fecal Coliform, phosphate, nitrated and heavy metals.</p>	<ul style="list-style-type: none"> <li>- The MOM will continuously monitor the quality of groundwater and the surface water of Malay River.</li> <li>- The groundwater quality will be monitored monthly at the four installed wells and two existing wells downstream of Malay River.</li> <li>- The surface water quality will be monitored monthly at three locations in Malay River.</li> </ul>
7.	<p>A buffer zone along the periphery of the project area shall be planted with at least two rows of hardwood trees. A minimum of 200 meters distance from nearest settlements area shall be maintained.</p>	<ul style="list-style-type: none"> <li>- Greenbelt-tree area behind the existing stockpiled waste will be maintained as buffer zones to mitigate air pollution and bad odor.</li> </ul>

No.	Conditions of ECC	Measures to be Taken
8.	Implementation of landfill capping operation to stabilize the soil and to remediate the contamination brought about by leachate through the planting of trees, shrubs and grasses appropriate for phytoremediations shall be undertaken.	<ul style="list-style-type: none"> <li>- A clay cap upon the individual cells will be applied to minimize generation of leachate, air pollution and bad odor, overlain by a layer of agricultural soil suitable for vegetation growth.</li> </ul>
9.	One month stockpile of intermediate soil cover material for the landfill must always be available on site. This shall be properly stockpiled and stored in a covered area. The active landfill site must be covered with soil after each day of operation or whenever appropriate.	<ul style="list-style-type: none"> <li>- Stockpile of soil cover material and covering with soil on a daily basis will be incorporated in the management plan for the new SLF.</li> </ul>
10.	Immediate compaction of loosened and newly exposed areas shall be undertaken. Install sediment traps/settling ponds whenever necessary and install perimeter fence.	<ul style="list-style-type: none"> <li>- Compaction of dumped area will be undertaken on a daily basis.</li> <li>- Leachate treatment facilities and stormwater drainage system will be installed.</li> <li>- Approximately 350 m of chain link fence with an entrance gate will be installed.</li> </ul>

**(2) General Conditions**

No.	Conditions of ECC	Measures to be Taken
1.	The design shall strictly adhere to the criteria for the establishment of a Sanitary Landfill as per DAO 2001-34, Implementing Rules and Regulations of R.A. 9003, particularly the liners, leachate collection and treatment system, gas control system, cover and groundwater monitoring well system. All other criteria for the construction and establishment of a sanitary landfill as stated in the Implementing Rules and Regulations of R.A. 9003 shall also be considered.	<ul style="list-style-type: none"> <li>- The design of the new SLF will follow requirements in terms of liners, leachate collection and treatment system, gas control system, cover, groundwater monitoring well system and other criteria stipulated by IRRs of RA 9003.</li> </ul>
2.	A comprehensive Landfill Operations Manual based on R.A. 9003 and its Implementing Rules and Regulations shall be submitted to EMB for review and approval within three months from the issuance of the ECC.	<ul style="list-style-type: none"> <li>- The MOM will prepare and submit a comprehensive Landfill Operations Manual based on RA 9003 and its IRRs to the EMB Regional Office within three months upon the issuance of the amended ECC.</li> </ul>

No.	Conditions of ECC	Measures to be Taken
3.	<p>All leachate generated by the project shall be treated in a Leachate Treatment Facility (LTF) prior to its discharge to the environment. In case leachate discharged will exceed the effluent standards, R.A. 9275 otherwise known as the Clean Water Act shall apply and undergo due process of whatever fine/penalty shall be imposed. A Discharge Permit shall be secured from the EMB Regional Office prior to the operation of the LTF and renewed thereafter. Leachate treatment facilities shall be lined with impervious material such as clay, synthetic liners or concrete to prevent contamination of the groundwater.</p>	<ul style="list-style-type: none"> <li>- Leachate treatment facility will be established in the new SLF. Leachate will be treated at the facility till it will meet or exceed the effluent standards set by RA 9275 before discharged into the environment. The MOM will secure the Discharge Permit from the EMB Regional Office before the project operation.</li> </ul>
4.	<p>Any other development, activity, process or operation inherent in the project which has pollution, toxic or hazardous potential should be subject to pertinent provisions of P.D. 984, R.A. 9275, R.A. 8749 and R.A. 6969, 'The Pollution Control Law', 'The Clean Air Act', 'Clean Water Act' and 'The Toxic and Hazardous and Nuclear Waste Control Act' respectively, and their Implementing Rules and Regulations.</p>	<ul style="list-style-type: none"> <li>-</li> </ul>
5.	<p>The proponent shall maintain an available budget for the implementation of its Environmental Management Plan (EMP) based on the project schedule as indicated in the submitted EMP including the summary for the implementation of the project and proposed mitigation measures in the construction and operation phase. A copy of the Work and Financial Plan (WFP) shall be submitted to the EMB Regional Office within thirty days of receipt of the ECC. An accomplishment report on the implemented mitigation measures and the corresponding costs of the EMP activities shall be submitted to the EMB Regional Office on a quarterly basis for monitoring.</p>	<ul style="list-style-type: none"> <li>- During the construction and operation phase, the MOM will implement the proposed environmental management and monitoring plan (EMMP). For adequate implementation of the EMMP, the MOM will establish an Environmental Management Fund (EMF).</li> <li>- The MOM will organize a Multi-partite Monitoring Team (MMT) which will monitor the MOM's compliance with conditions stipulated in the ECC and EMMP. The MMT will be composed of various stakeholders such as representatives of DENR-EMB, PENRO, CENRO, MOM, Barangay Kabulihan, NSWMC and NGOS.</li> <li>- The MMT will prepare a Work and Financial Plan (WFP) and submit it to the EMB Regional Office within 30 days after issuance of the amended ECC.</li> <li>- The MOM will prepare a Self-monitoring Report (SMR) and submit it to the EMB Regional Office to clarify their commitments stipulated in the EMMP and ECC on a semi-annual basis.</li> </ul>

No.	Conditions of ECC	Measures to be Taken
6.	<p>An Environmental Monitoring Fund (EMF) shall be established by the proponent to be used to support the activities for the compliance monitoring and organizing a Multi-partite Monitoring Team (MMT) to achieve broader participation, greater vigilance and appropriate check and balance in the monitoring of project implementation. A copy of the approved Work and Financial Plan (WFP) shall be submitted to the EMB Regional Office within 30 days of receipt of the ECC.</p>	<p>– Refer to measures to be implemented for condition 5 above.</p>
7.	<p>The proponent should strictly follow DAO No. 99-21 dated June 11, 1999, 'Procedures in the Retention Areas Within Certain Distances Along the banks of rivers, streams, and shores of seas, lakes and oceans for environmental protection' to wit;</p> <p>a) Urban areas: 3 meters b) Agricultural areas: 20 meters c) Forest areas: 40 meters</p>	<p>– The design of the new SLF will be established strictly following DAO No. 99-21.</p>
8.	<p>The proponent shall set up an Environmental Unit who shall handle the environmental aspects of the project, which shall have the following responsibilities:</p> <ol style="list-style-type: none"> <li>1. Monitoring requirements as defined under the EMP. Monitor actual project impact vis-à-vis predicted impacts and management measures in the EMP</li> <li>2. Make recommendations for the revision of the EMP as necessary</li> <li>3. Ensure that post-assessment permits are in place</li> <li>4. Ensure compliance with all the conditions and restrictions of the approved ECC and ensure that monitoring and reporting are undertaken</li> <li>5. Submit environmental monitoring reports or Self Monitoring Report (SMR) on semi-annual basis using the ECC compliance monitoring report form (Self-monitoring Report EMB-EIA form No. 03)</li> <li>6. Ensure that all relevant conditions of the Certificate of ECC and the EMPs shall be properly compiled with by its commissioned contractors and shall be included in the Terms of Reference (TOR) of the contractors</li> </ol>	<p>– The MOM will organize a Sanitary Landfill Management Unit (SLFMU) that corresponds to environmental issues during all project cycles. The SLFMUU's main responsibilities are summarized in the left column.</p>

No.	Conditions of ECC	Measures to be Taken
9.	<p>A 2*4' billboard containing this message: 'Notice to the public, This project (title of the project) of (name of the proponent) has been issued an Environmental Compliance Certificate (ECC number) by the Environmental Management Bureau of the Department of Environment and Natural Resources, Region ____, on (date).' This message must be installed at all entry and exit points and at all perimeters of the project facing the road to inform the general public within 30 days from receipt of the certificate. This billboard must be displayed within the duration/existence of the project and a copy of the certificate shall also be posted by the proponent at the Barangay bulletin board of the affected Barangays within 30 days from receipt of the certificate. An accomplishment report which shall include picture verification of compliance with the posting of notices and the billboards shall be submitted to the EMB Regional Office within 90 days from the receipt of the ECC.</p>	<p>The MOM will establish billboards based on requirements stipulated in the ECC.</p>
10.	<p>The proponent shall allow entry of DENR-ENB, CENRO, PENRO personnel, EMB Region 6 Focal Persons, into the project site at all times to conduct monitoring and to validate the project's compliance with the ECC conditions and EMP stipulated therein, and in case there is a need for additional conditions in this ECC, the same shall be imposed by the EMB-Regional Office upon inspection if found necessary.</p>	<p>The MOM and responsible organizations, such as the DENR-ENB, CENRO, PENRO personnel and EMB Region 6 Focal Persons, will cooperate in monitoring MOM's commitments of the EMMP. If necessary, the MOM will take further actions on additional conditions imposed by the responsible organizations.</p>
11.	<p>An abandonment plan shall be submitted to DENR-EMB Regional Office for approval six months before actual abandonment/closure. The plan shall be based on R.A.9003 and its Implementing Rules and regulations particularly on the Management of Post Closure Landfill Site guidelines.</p> <p>Source: ECC and JICA Study Team</p>	<p>The MOM will submit an abandonment plan to the EMB Regional Office following the requirement stipulated in the ECC.</p>

**Appendix III-1.10.2 Proposed Environmental Management and Monitoring Plan (EMMP) for Development of the Kabulihan SLF**

**(1) Environmental and Social Impacts and its' Mitigation Measures for the SLF**

Predicted Environmental and Social Impact	Degree of Impact	Possible Environmental Impacts	Mitigation Measures	Responsible Institution
<b>I. Construction Phase</b>				
Air pollution	MS, T Negative	<ul style="list-style-type: none"> <li>Construction equipment may cause air pollution, such as suspended particulates, NO<sub>x</sub> and SO<sub>x</sub>.</li> </ul>	<ul style="list-style-type: none"> <li>Regularly sprinkle water on exposed areas especially during dry and windy seasons.</li> <li>Periodic inspection and maintenance of construction equipment and vehicles.</li> <li>Proper handling and storing of excavated soil.</li> <li>Monitoring the air quality at the project site.</li> </ul>	MOM, Contractor
Water pollution	MS, T Negative	<ul style="list-style-type: none"> <li>Construction activities may cause increase of turbidity and siltation in the water environment.</li> <li>Oil and grease discharged from construction activities may pollute the water environment.</li> </ul>	<ul style="list-style-type: none"> <li>Prevent inflow of rainwater to the construction site.</li> <li>Appropriate collection and treatment system for discharged water.</li> <li>Proper handling and storing of excavated soil.</li> <li>Proper equipment maintenance and operation to mitigate spilling of oil and grease into the water environment.</li> <li>Undertake regular monitoring of the water quality.</li> </ul>	MOM, Contractor
Soil pollution	MS, T Negative	<ul style="list-style-type: none"> <li>Oil and grease discharged from construction activities may pollute soil in/around the site.</li> </ul>	<ul style="list-style-type: none"> <li>Same measures as for water pollution would be applied.</li> </ul>	MOM, Contractor
Noise and vibration	MS, T Negative	<ul style="list-style-type: none"> <li>Construction equipment may cause noise and vibration around the site.</li> <li>Construction vehicles may cause a noise and vibration impact along roads.</li> </ul>	<ul style="list-style-type: none"> <li>Schedule construction activities during daytime.</li> <li>Speed of construction vehicles should be regulated.</li> <li>Training drivers of construction equipment and trucks.</li> </ul>	MOM, Contractor
Geographical features	MS, P Negative	<ul style="list-style-type: none"> <li>Geographical features will be changed due to the construction of the SLF.</li> <li>Soil erosion, siltation and landslides may occur due to construction activities.</li> </ul>	<ul style="list-style-type: none"> <li>It is recommended that clearing and excavating works would be planned for execution during the dry season.</li> <li>Excessive clearance of land should be prohibited.</li> <li>Proper handling and storing of excavated soil.</li> </ul>	MOM, Contractor
Biota and ecosystem	MS, T Negative	<ul style="list-style-type: none"> <li>Ecological conditions are diverse around the site. Site clearance may cause an adverse impact on the terrestrial ecosystem.</li> <li>Increase of turbidity, siltation and pollution in the water environment may impact the aquatic ecosystem around the site.</li> </ul>	<ul style="list-style-type: none"> <li>Excessive clearance of land should be prohibited.</li> <li>Same measures as for water pollution will be applied.</li> </ul>	MOM, Contractor



Predicted Environmental and Social Impact	Degree of Impact	Possible Environmental Impacts	Mitigation Measures	Responsible Institution
Accidents	MS, T Negative	<ul style="list-style-type: none"> <li>Accidents may happen during the construction phase.</li> </ul>	<ul style="list-style-type: none"> <li>Safety measures in transportation and construction are to be secured.</li> <li>Training drivers of construction equipment and truck.</li> </ul>	MOM, Contractor
Local economy	MS, T Positive	<ul style="list-style-type: none"> <li>The construction can provide local residents with job opportunities.</li> </ul>	<ul style="list-style-type: none"> <li>Require contractor(s) to utilize workforce from qualified locals.</li> <li>Local sub-contractors and suppliers of construction materials and equipment will be prioritized.</li> </ul>	MOM, Contractor
Local conflict of interests	MS, T Negative	<ul style="list-style-type: none"> <li>Local concerns would be raised against developing the SLF unless the consultation with local communities is well organized.</li> </ul>	<ul style="list-style-type: none"> <li>The MOM held a public consultation meeting aiming to share the information and hear local opinions. The MOM will continue disclosure of information through public consultation meetings.</li> </ul>	MOM
Infectious diseases such as HIV/AIDS	MS, T Negative	<ul style="list-style-type: none"> <li>There will be an inflow of new workers. The possibility of outbreaks of infectious diseases from such workers cannot be neglected.</li> </ul>	<ul style="list-style-type: none"> <li>Precautious measures such as health education are necessary to minimize potential impacts.</li> </ul>	MOM, Contractor
<b>2. Operation Phase</b>				
Air pollution	MS, T Negative	<ul style="list-style-type: none"> <li>Though traffic volume will not be large, waste transportation vehicles may deteriorate air quality, such as dust condition, along roads.</li> <li>Disposed waste may emit landfill gas.</li> </ul>	<ul style="list-style-type: none"> <li>Periodic maintenance of transportation vehicles.</li> <li>Speed of transportation vehicles should be regulated.</li> <li>A gas ventilation system will be installed in the SLF.</li> <li>Applying a clay cap upon the individual cells, overlain by a layer of agricultural soil suitable for vegetation growth.</li> <li>Buffer zone will be established along the periphery of the SLF.</li> <li>Landfill gas will be monitored regularly.</li> </ul>	MOM, Operator

Predicted Environmental and Social Impact	Degree of Impact	Possible Environmental Impacts	Mitigation Measures	Responsible Institution
Water pollution	S, T Negative	<ul style="list-style-type: none"> <li>Stormwater running into the SLF may increase the volume of leachate.</li> <li>Leachate from the SLF may pollute groundwater and surface water, especially in Malay River, around the site.</li> <li>Waste water from the maintenance workshop may contaminate surface water and groundwater around the site.</li> </ul>	<ul style="list-style-type: none"> <li>Peripheral drainage systems will be installed to prevent storm water from running into the SLF and off the surrounding water environment.</li> <li>Leachate control systems will be installed. Retention and recirculation facility associated with aeration of the leachate is recommended.</li> <li>In order to reduce the percolation of the leachate to groundwater, installment of a liner system on the bottom of cells is recommended.</li> <li>The wastewater from the maintenance workshop will be treated before being discharged.</li> <li>Applying a clay cap upon the individual cells to reduce generation of leachate.</li> <li>Regular monitoring on Malay River, groundwater, and leachate will be planned.</li> </ul>	MOM, Operator
Soil pollution	MS, T Negative	<ul style="list-style-type: none"> <li>Without proper treatment, leachate may contaminate the soil environment around the site.</li> <li>If hazardous waste would be mixed in the waste, the soil in/around the SLF site may be contaminated.</li> </ul>	<ul style="list-style-type: none"> <li>Same measures as for water pollution will be applied.</li> <li>Hazardous waste disposal in the SLF should be restricted.</li> <li>The HCW will be disposed of in a separated special cell.</li> </ul>	MOM, Operator
Noise and vibration	MS, T Negative	<ul style="list-style-type: none"> <li>Though the traffic volume will not be large, waste transportation vehicles may deteriorate the noise and vibration environment along roads.</li> </ul>	<ul style="list-style-type: none"> <li>Speed of construction vehicles should be regulated.</li> <li>Regular maintenance of trucks is necessary.</li> </ul>	MOM, Operator
Offensive odor	MS, T Negative	<ul style="list-style-type: none"> <li>Though the SLF will accept only residual waste, the disposed waste may cause bad odors.</li> <li>Bad odors may annoy residents around the site and workers at the SLF.</li> </ul>	<ul style="list-style-type: none"> <li>Regular cover soil is essential for prevention of bad odors.</li> <li>Aeration of the leachate retention pond is necessary.</li> <li>Buffer zone will be established along the periphery of the SLF.</li> <li>Regular monitoring of odor condition in/around the SLF is recommended.</li> </ul>	MOM, Operator
Biota and ecosystem	MS, T Negative	<ul style="list-style-type: none"> <li>Leachate and discharged water may cause an adverse impact on the aquatic ecosystem in the water environment.</li> <li>Landfill gas may cause an impact on the terrestrial ecosystem around the site.</li> </ul>	<ul style="list-style-type: none"> <li>Same measures as for water pollution will be applied.</li> <li>Same measures as for air pollution will be applied.</li> </ul>	MOM, Operator

Predicted Environmental and Social Impact	Degree of Impact	Possible Environmental Impacts	Mitigation Measures	Responsible Institution
Water usage	MS, T Negative	<ul style="list-style-type: none"> <li>Surface water and groundwater pollution due to the leachate and discharged water from the SLF could affect the water utilization by local residents.</li> </ul>	<ul style="list-style-type: none"> <li>Same measures as for water pollution will be applied.</li> </ul>	MOM, Operator
Accidents	MS, T Negative	<ul style="list-style-type: none"> <li>A risk of traffic accidents involving waste transportation vehicles will increase.</li> </ul>	<ul style="list-style-type: none"> <li>Periodic maintenance of transportation vehicles.</li> <li>Speed of transportation vehicles should be regulated.</li> </ul>	MOM, Operator
Local economy	MS, T Positive	<ul style="list-style-type: none"> <li>Operation of SLF can provide local residents with job opportunities.</li> <li>The SLF will not attract scavengers because it will receive only residual waste.</li> </ul>	<ul style="list-style-type: none"> <li>Require the operator to source workforce from qualified local people.</li> </ul>	MOM, Operator
Others	MS, T Negative	<ul style="list-style-type: none"> <li>Propagation of disease vectors such as flies annoy workers and residents in surrounding areas.</li> </ul>	<ul style="list-style-type: none"> <li>Preventive measures, such as soil cover and cleaning the site, will be applied.</li> </ul>	MOM, Operator

S: Significant impact; MS: Moderately significant impact

T: Temporary impact; P: Permanent impact

Negative: negative impact; Positive: positive impact

(2) **Environmental Monitoring Plan for the SLF**

Project Phase	Components	Parameters	Measurements	Monitoring Points	Frequency	Reference Standards	Responsibility
Construction	Groundwater	Temperature, pH, Color, Turbidity, Dissolved Oxygen, Total Suspended Solids, Total Dissolved Solids, Conductivities, Oil/Grease, BOD, COD, Chloride as Cl, Ammonia Nitrogen, Calcium, Magnesium, Iron, Lead, Copper, Cadmium, Chromium Hexavalent, Mercury, Coliform	DAO No. 34 and 35	Four installed monitoring wells in the site and two existing wells downstream of Malay River	Monthly	Philippine Standard for Drinking Water (PSDW)	MOM, Contractor
	Surface Water	Discharge, temperature, pH, Color, Turbidity, Dissolved Oxygen, Total suspended solids, Total dissolved solids, Conductivities, Oil/Grease, BOD, COD, Chloride as Cl, Ammonia Nitrogen, Calcium, Magnesium, Iron, Lead, Copper, Cadmium, Chromium Hexavalent, Mercury, Coliform	DAO No. 34 and 35	Three points (upstream of the site, near the site and downstream of the site)	Monthly	DAO No. 34 (Class A)	MOM, Contractor
Operation	Leachate	Discharge, temperature, pH, Color, Turbidity, Dissolved Oxygen, Total Suspended Solids, Total Dissolved Solids, Conductivities, Oil/Grease, BOD, COD, Chloride as Cl, Ammonia Nitrogen, Calcium, Magnesium, Iron, Lead, Copper, Cadmium, Chromium Hexavalent, Mercury, Coliform	DAO No. 34 and 35	Outflow point from the SLF	Volume, Temperature and pH: everyday; Others: Monthly	DAO No. 35 (Category II)	MOM, Contractor
	Discharged water (Leachate)	Discharge, temperature, pH, Color, Turbidity, Dissolved Oxygen, Total suspended solids, Total dissolved solids, Conductivities, Oil/Grease, BOD, COD, Chloride as Cl, Ammonia Nitrogen, Calcium, Magnesium, Iron, Lead, Copper, Cadmium, Chromium Hexavalent, Mercury, Coliform	DAO No. 34 and 35	Point discharge to the water environment	Volume, Temperature and pH: everyday; Others: Monthly	DAO No. 35 (Category II)	MOM, Contractor
	Groundwater	Temperature, pH, Color, Turbidity, Dissolved Oxygen, Total suspended solids, Total dissolved solids, Conductivities, Oil/Grease, BOD, COD, Chloride as Cl, Ammonia Nitrogen, Calcium, Magnesium, Iron, Lead, Copper, Cadmium, Chromium Hexavalent, Mercury, Coliform	DAO No. 34 and 35	Four installed monitoring wells in the site and two existing wells downstream of Malay River	Monthly	Philippine Standard for Drinking Water (PSDW)	MOM, Contractor
	Surface water	Discharge, temperature, pH, Color, Turbidity, Dissolved Oxygen, Total suspended solids, Total dissolved solids, Conductivities, Oil/Grease, BOD, COD, Chloride as Cl, Ammonia Nitrogen, Calcium, Magnesium, Iron, Lead, Copper, Cadmium, Chromium Hexavalent, Mercury, Coliform	DAO No. 34 and 35	Three points (upstream of the site, near the site and downstream of the site)	Monthly	DAO No. 34 (Class A)	MOM, Contractor

Project Phase	Components	Parameters	Measurements	Monitoring Points	Frequency	Reference Standards	Responsibility
Operation	Landfill gas	Gas temperature, Methane (CH <sub>4</sub> ), Carbon Dioxide (CO <sub>2</sub> ), Hydrogen Sulfide (H <sub>2</sub> S), Ammonia (NH <sub>3</sub> )	Measurement of ambient concentrations (1999 Philippine Clean Air Act)	At installed gas venting facilities	Monthly	1999 Philippine Clean Air Act	MOM, Contractor
	Offensive odors	Check 'unpleasantness'	'Unpleasantness' by surveyor	Three points at the site	Everyday	-	MOM, Contractor
Post-closure	Extent of disease vectors	-	Visual check	The areas where waste is disposed	Weekly	-	MOM, Contractor
	Leachate	Discharge, temperature, pH, Color, Turbidity, Dissolved Oxygen, Total suspended solids, Total dissolved solids, Conductivities, Oil/Grease, BOD, COD, Chloride as Cl, Ammonia Nitrogen, Calcium, Magnesium, Iron, Lead, Copper, Cadmium, Chromium Hexavalent, Mercury, Coliform	DAO No. 34 and 35	Outflow point from the SLF	Volume, Temperature and pH: everyday; Others: Monthly	DAO No. 35 (Category II)	MOM
	Discharged water (Leachate)	Discharge, temperature, pH, Color, Turbidity, Dissolved Oxygen, Total suspended solids, Total dissolved solids, Conductivities, Oil/Grease, BOD, COD, Chloride as Cl, Ammonia Nitrogen, Calcium, Magnesium, Iron, Lead, Copper, Cadmium, Chromium Hexavalent, Mercury, Coliform	DAO No. 34 and 35	Point discharge to the water environment	Volume, Temperature and pH: everyday; Others: Monthly	DAO No. 35 (Category II)	MOM
	Groundwater	Temperature, pH, Color, Turbidity, Dissolved Oxygen, Total suspended solids, Total dissolved solids, Conductivities, Oil/Grease, BOD, COD, Chloride as Cl, Ammonia Nitrogen, Calcium, Magnesium, Iron, Lead, Copper, Cadmium, Chromium Hexavalent, Mercury, Coliform	DAO No. 34 and 35	Four installed monitoring wells in the site and two existing wells downstream of Malay River	Monthly	Philippine Standard Drinking Water (PSDW)	MOM
	Surface water	Discharge, temperature, pH, Color, Turbidity, Dissolved Oxygen, Total suspended solids, Total dissolved solids, Conductivities, Oil/Grease, BOD, COD, Chloride as Cl, Ammonia Nitrogen, Calcium, Magnesium, Iron, Lead, Copper, Cadmium, Chromium Hexavalent, Mercury, Coliform	DAO No. 34 and 35	Three points (upstream of the site, near the site and downstream of the site)	Monthly	DAO No. 34 (Class A)	MOM
	Landfill gas	Gas temperature, Methane (CH <sub>4</sub> ), Carbon Dioxide (CO <sub>2</sub> ), Hydrogen Sulfide (H <sub>2</sub> S), Ammonia (NH <sub>3</sub> )	Measurement of ambient concentrations (1999 Philippine Clean Air Act)	At installed gas venting facilities	Monthly	1999 Philippine Clean Air Act	MOM

Source: JICA Study Team

### Appendix III-2.2.3 Results of Water Quality Surveys around the Old Dump Site

#### Result of Sea and Surface Water Survey around the Old Dump Site

No.	Parameter	Unit	Sea -Downstream of Dumpsite					Surface Water			Standard-1	Standard-2
			2007/9/19 (High Tide)		2007/9/20 (Low Tide)			17-Aug-07		19-Sep-07		
			Sea -1	Sea-1	Sea -2	Sea -1	Sea -2	SW-1	SW-2	SW-2		
1	Temperature	oC	30	28	29	28	28	30	30	28	3	3
2	pH		8	8	8	8	8	8	8	8	6.0-8.5	6.5-8.5
3	Color	PCU	5	<5	<5	<5	<5	70	80	250	(c)	50
4	Turbidity	NTU	0	0	0	8	0	1955	254	180	-	-
5	Dissolve Oxygen	mg/L	6	7	7	7	6	6	6	5	5	5
6	Total Suspended Solids	mg/L	8	10	27	10	30	1197	139	199	<30	50
7	Total Dissolved Solids	mg/L	35802	33118	33108	33422	23016	132	339	610	-	1000
8	Conductivity	mS/cm	56	147	151	148	148	220	186	160	-	-
9	Oil/Grease (Petroleum Ether Extract)	mg/L	4	2	2	1	<1	3	5	3	-	1
10	BOD5	mg/L	<1	<1	5	6	5	4	5	2	-	5
11	COD	mg/L	148	106	151	135	143	59	101	8	-	-
12	Chloride as Cl	mg/L	19159	16644	18099	15697	17693	39	4	135	-	250
13	Ammonia Nitrogen	mg/L	0	0	0	0	0	2	2	0	-	-
14	Sulphate	mg/L	2423	346	344	348	342	ND	1	31	-	-
15	Sodium	mg/L	57000	154	9855	8724	9086	30	3000	66	-	-
16	Potassium	mg/L	475	413	406	385	406	7	125	45	-	-
17	Calcium	mg/L	523	461	444	473	417	107	108	65	-	-
18	Magnesium	mg/L	940	810	802	826	800	93	300	16	-	-
19	Iron	mg/L	ND	ND	ND	ND	0	321	190	5	-	-
20	Lead	mg/L	ND	ND	ND	ND	ND	0	0	ND	0	0
21	Copper	mg/L	ND	ND	ND	ND	0	1	0	ND	0	1
22	Cadmium	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0	0
23	Chromium(Cr) Hexavalent	mg/L	ND	ND	ND	ND	ND	0	ND	ND	0	0
24	Total Mercury	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0	0
25	Organophosphate	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
26	Total Coliform Count	MPN/100mL	<20	45	20	<18	45	350000	110000	49000	1000	1000

Note: Sea - 1: Monitoring station No. 1 at the sea (Downstream of old dump site) N 11o 58' 54", E 121o 55' 51"

Sea - 2: Monitoring station no. 2 at the sea, N 11o 58' 53", E 121o 55' 52"

SW - 1: Surface water upstream of dump site, N 11o 58' 42", E 121o 55' 39"

SW - 2: Surface water on-site of dump site, N 11o 58' 46", E 121o 55' 41"

ND = Not detectable

(c): no abnormal discoloration from unnatural causes

Standard-1: DAO No.34, Class SB, for coastal and marine water

Standard-2: DAO No.34, Class A, for fresh water

Source: JICA Study Team

### Result of Ground Water Survey around the Old Dump Site

No.	Parameter	Unit	17-Aug-07		19-Sep-07 (High Tide)		20-Sep-07 (Low Tide)		Standard
			GW 1	GW 2	GW1	GW 2	GW 1	GW 2	
1	Temperature	oC	Upstream	Downstream	28.5	28.3			-
2	pH		7.7	7.4	7.6	7.6	7.6	7.6	6.5-8.5
3	Color	PCU	10.0	10.0	10.0	5.0	15.0	5.0	5.00
4	Turbidity	NTU	1.0	1.0	11.0	1,930.0	4.0	1,464.0	5.00
5	Dissolve Oxygen	mg/L	-	-	2.0	7.0	-	7.0	-
6	Total Suspended Solids	mg/L	36,720.0	46,280.0	27,260.0	2,710.0	32,210.0	1,324.0	-
7	Total Dissolved Solids	mg/L	438.0	710.0	624.0	13,742.0	669.0	14,457.0	500.00
8	Conductivity	mS/cm	558.0	172.0		20.7	1,252.0	20.74	-
9	Oil/Grease (Petroleum Ether Extract)	mg/L	25.0	19.0	14.0	2.0	13.0	5.0	-
10	BOD5	mg/L	50.0	46.0	55.0	3.0	47.0	3.0	-
11	COD	mg/L	1,638.0	1,858.0	912.0	286.0	966.0	570.0	-
12	Chloride as Cl	mg/L	29.0	14.0	53.0	7,036.0	57.0	7,578.0	250.00
13	Ammonia Nitrogen	mg/L	0.1	0.2	1.0	0.3	1.0	0.3	-
14	Sulphate	mg/L	9.0	93.0	24.0	248.0	33.0	260.0	250.00
15	Sodium	mg/L	46.0	37.0	131.0	4,202.0	9,568.0	4,383.0	200.00
16	Potassium	mg/L	6.0	28.0	12.0	157.0	6.5	156.0	-
17	Calcium	mg/L	255.0	80.0	6,388.0	946.0	1,221.0	679.0	-
18	Magnesium	mg/L	8.0	4.0	97.0	492.0	36.0	504.0	-
19	Iron	mg/L	55.0	7.0	43.0	6.0	23.0	3.3	1.000
20	Lead	mg/L	ND	ND	1.0	0.2	0.2	0.2	0.010
21	Copper	mg/L	0.1	ND	0.3	ND	0.1	ND	1.000
22	Cadmium	mg/L	ND	ND	ND	ND	ND	ND	0.003
23	Chromium(Cr) Hexavalent	mg/L	0.0	0.0	ND	ND	0.0	ND	0.050
24	Total Mercury	mg/L	ND	ND	ND	ND	ND	ND	0.001
25	Organophosphate	mg/L	ND	ND	ND	ND	ND	ND	-
26	Total Coliform Count	MPN/100mL	240,000	240,000	46,000	7,000	23,000	9,200	not det. In 100 mL sample

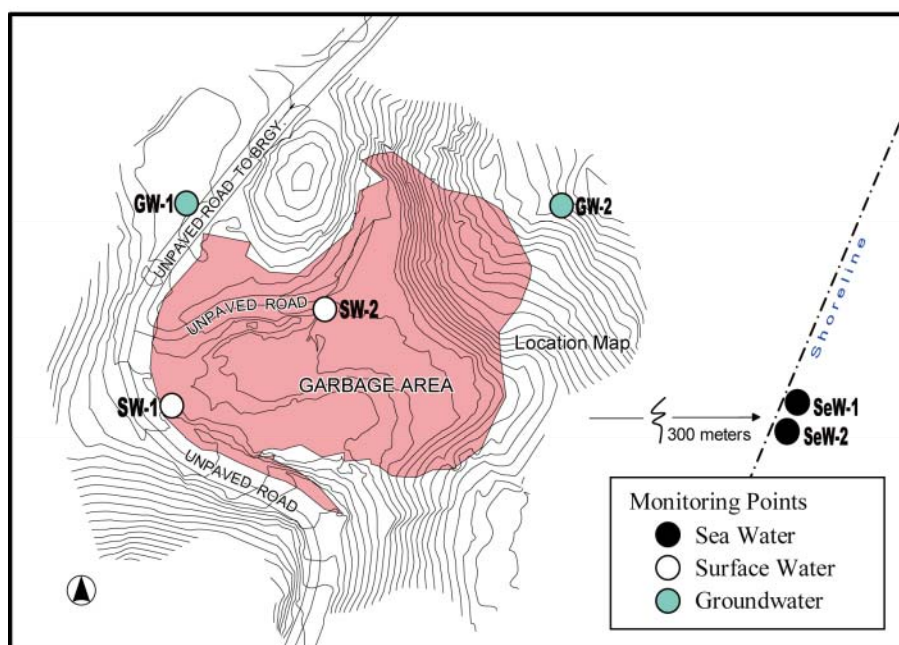
Note3: GW-1: Groundwater Monitoring Well, No.1 (upstream), N 11o 58' 46", E 121o 55' 39"

GW-2: Groundwater Monitoring Well, No.2 (downstream), N 11o 58' 47", E 121o 55' 43"

ND: Not Detectable

Standard: Philippine Standard for Drinking Water (PSDW)

Source: JICA Study Team



Location of Survey Points in and around the Old Dump Site

### Appendix III-3.8.1 O&M Cost of the Manoc-Manoc Centralized MRF

Operation and maintenance (O&M) costs of the proposed Manoc-Manoc Centralized MRF mainly consist of personnel costs and operational costs of facilities and equipment to be used at the MRF.

The personal costs were calculated by unit costs which have been set based on the current monthly salary in the three MRFs on Boracay Island and the number of persons to be worked at the MRF. As for the operational costs of the facilities, they were estimated based on the following conditions:

- The operational cost of bioreactor was calculated based on the amount of biodegradable waste.
- The operational costs of pulvelizer and baling machine were calculated based on the amount of the residual waste treated by respective equipments.
- The operational cost of collection vehicle was calculated based on the fuel cost and estimated transportation distance.
- The operation cost of equipment for carbonization, shredder, belt conveyor and glass crusher was assumed to be 5% of the procurement cost.
- The operational cost of office operation was calculated based on the current office operation costs in the three MRFs.
- The maintenance cost of above equipment was assumed to be 30% of the operational cost.

The quantity of work requirements for O&M of the centralized MRF including collection and transport of the waste on Boracay Island was estimated as shown in the table below:

**Quantity Estimated for O&M of the Centralized MRF**

Category	Item	Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Personnel Expenditure	Supervisor	person	3	3	3	3	1	1	1	1	1	1
	Field supervisor	person	3	3	3	3	1	1	1	1	1	1
	Leader	person	2	2	2	2	4	4	4	4	4	4
	Secretary	person	2	2	3	3	1	1	1	1	1	1
	Drivers of collection truck	person	9	9	12	12	6	6	6	6	6	6
	Truck helpers	person	16	16	22	22	12	12	12	12	12	12
	Eco-aide	person	17	17	17	17	8	8	8	9	9	9
	Beach cleaner	person	13	13	13	13	20	20	20	25	25	25
	Street sweeper	person	11	11	11	11	20	20	20	25	25	25
	Sorting staff	person	19	19	24	24	6	6	6	8	8	8
	Technical Staff	person	5	5	7	7	2	2	2	2	5	6
	Weigh bridge operator	person	0	0	0	0	1	1	1	1	1	1
	Environmental monitor	person	5	5	10	10	20	20	20	25	25	25
Operation Cost of Facility and Equipment	Collection vehicle	km	36,333	40,900	45,000	48,533	57,267	59,133	61,200	62,900	64,833	64,833
	Bioreactor (including pretreatment)	ton/day	1.7	2.6	3.9	5.9	6.5	6.9	7.1	7.4	7.6	7.9
	Green charcoal	year	0	0	0	0	1	1	1	1	1	1
	Shredder (0.5ton/day)	year	0	0	0	0	1	1	1	1	1	1
	Belt conveyor (Electricity)	year	0	0	0	0	1	1	1	1	1	1
	Glass crusher (800kg/hr)	year	0	1	1	1	1	1	1	1	1	1
	Pulvelizer	ton/day	0	0.5	1	1.5	2	2	2	2	2	2
	Bailing machine	ton/day	0	0.5	1	1.5	2	2	2	2	2	2
	Office (including office utilities)	ton/day	12.8	14.4	15.9	17.1	17.5	18.6	19.2	20.0	22.6	21.3

Source: JICA Study Team



The O&M of the centralized MRF including the cost of collection and transport of the waste on Boracay Island was estimated as shown the table below:

**Estimated O&M Cost of the Centralized MRF**

(Unit: x10<sup>3</sup> PhP)

Category	Item	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Personnel Expenditure	Supervisor	239	239	239	239	80	80	80	80	80	80
	Field supervisor	239	239	239	239	80	80	80	80	80	80
	Leader	159	159	159	159	318	318	318	318	318	318
	Secretary	102	102	153	153	51	51	51	51	51	51
	Drivers of collection truck	572	572	763	763	382	382	382	382	382	382
	Truck helpers	814	814	1,119	1,119	611	611	611	611	611	611
	Eco-aide	865	865	865	865	407	407	407	458	458	458
	Beach cleaner	661	661	661	661	1,018	1,018	1,018	1,272	1,272	1,272
	Street sweeper	560	560	560	560	1,018	1,018	1,018	1,272	1,272	1,272
	Sorting staff	967	967	1,221	1,221	305	305	305	407	407	407
	Technical Staff	318	318	445	445	127	127	127	127	318	382
	Weigh bridge operator	0	0	0	0	64	64	64	64	64	64
	Environmental monitor	254	254	509	509	1,018	1,018	1,018	1,272	1,272	1,272
	<b>Total</b>		<b>5,750</b>	<b>5,750</b>	<b>6,933</b>	<b>6,933</b>	<b>5,479</b>	<b>5,479</b>	<b>5,479</b>	<b>6,394</b>	<b>6,585</b>
Operation Cost of Facility and Equipment	Collection vehicle	1,090	1,227	1,350	1,456	1,718	1,774	1,836	1,887	1,945	1,945
	Bioreactor (including pretreatment)	64	96	144	216	236	251	260	270	278	287
	Green charcoal	0	0	0	0	5	5	5	5	5	5
	Shredder (0.5ton/day)	0	0	0	0	18	18	18	18	18	18
	Belt conveyer (Electricity)	0	0	0	0	30	30	30	30	30	30
	Glass crusher (800kg/hr)	0	8	8	8	15	15	15	15	15	15
	Pulvelizer	0	73	146	219	292	292	292	292	292	292
	Bailing machine	0	22	44	66	88	88	88	88	88	88
Maintenance	346	428	507	589	720	742	763	781	801	804	
Office (inculding office utilities)	937	1,054	1,160	1,252	1,275	1,356	1,404	1,457	1,501	1,553	
Other Expense	Micellenaus for collection (including administration cost)	238	530	702	635	361	330	293	570	535	542
	Micellenaus for MRF (including administration cost)	602	1,241	1,384	1,263	725	726	726	647	490	464
O & M Cost of collection and transportation		4,861	4,982	5,835	5,906	5,848	5,890	5,933	6,785	6,825	6,832
O & M Cost of MRF		4,166	5,038	6,081	6,223	4,516	4,577	4,612	4,980	5,046	5,123
<b>Total</b>		<b>9,027</b>	<b>10,020</b>	<b>11,916</b>	<b>12,129</b>	<b>10,364</b>	<b>10,467</b>	<b>10,545</b>	<b>11,765</b>	<b>11,871</b>	<b>11,955</b>

Note: Because the number after decimal point is rounded, the summation of first digit is not as same as the described number.

Source: JICA Study Team

**APPENDIX IV:**  
**RECOMMENDATIONS**

## Appendix IV-1.1.1 Technical Exchange on SWM between Malay Municipality, the Philippines, and the Experts of the Republic of Palau

### 1. Purpose

- To understand the background and framework of the legislation for waste reduction in Philippines
- To find key points to promote source separation based on observation of the situation
- To observe how to operate MRF (Mottainai yard in Palau may have a part in the function of the MRFs in the Philippines)
- To exchange experiences between Palau and the Philippines

### 2. Contents

- Observation of waste collection and source separation activities with observation and instruction
- Site visit to MRFs and the proposed landfill site
- Exchange meetings

### 3. Program

Date	Program	Activities
Nov. 23 (Fri.)	Moving from Palau to the Philippines	
Nov. 24 (Sat.)	Courtesy call to Mayor of Malay Municipality	<ul style="list-style-type: none"> <li>- Experts of Palau talked with mayor of Malay municipality in addition to courtesy visit.</li> <li>- The main topics were characteristics of each island and background of waste issues, etc. They also discussed the importance of exchanging experiences with each other.</li> </ul>
Nov. 25 (Sun.)	Explanation on the condition of SWM in the Philippines, RA9003 and activities of Malay and others	<ul style="list-style-type: none"> <li>- Experts of Palau discussed cost management under the limited budget, importance of development of alternative recycling technology based on the information on background of waste issues in the Philippines and RA9003.</li> <li>- Especially, they were interested in recycling technology for plastics that account for a large percentage of waste composition in both countries.</li> <li>- They also discussed the necessity of laws or ordinances to oblige the use of restructured products.</li> <li>- Partnership between Malay and Palau would benefit each other.</li> <li>- After discussions, barangay captain showed the tiles made of polystyrene to the experts of Palau.</li> </ul>
Nov. 26 (Mon.)	Observation of collection, source separation and monitoring activities	<ul style="list-style-type: none"> <li>- Experts of Palau followed refuse collection vehicles. They observed how to collect and load waste, and how to monitor discharged waste by the environmental monitoring team.</li> </ul>
	Visit to MRFs (Manoc-Manoc, Balabag, Yapak), old dump site and sludge drying bed	<ul style="list-style-type: none"> <li>- Experts of Palau observed unloading waste from refuse a collection vehicle at a MRF and loading sorted recyclable onto the vehicle of a recycler.</li> <li>- They observed workers produce the tiles from polystyrene and shred food waste, etc. for composting with equipment.</li> <li>- They were interested in labor control by time records and recording and documentation with a computer.</li> <li>- They directly interviewed monitoring staff about how to instruct waste generators.</li> </ul>

Date	Program	Activities
	Discussion on the agenda for the exchange meeting Preparation for the exchange meeting	- The agenda for the exchange meeting was discussed among experts of Palau, Malay officer and the JICA study team.
Nov. 27 (Tue.)	Exchange meeting - JICA Technical Cooperation Project & M-doc Land fill Site Rehabilitation - Waste Segregation and Recycling Activities in Koror States - Implementation of SWM in Malay - Discussion on how to promote waste reduction activities including source separation	- The meeting was held with 20 participants, including the JICA Study Team, representatives of SB, BFI and BCCI and the MOM. - In the morning, presentations were done both from three experts of Palau and the MOM. - In the afternoon, five topics were discussed among the participants: 1) How to operate and maintain a landfill site, 2) How to promote source separation, including IEC and monitoring, 3) How to manage and operate recycling facilities, 4) Tourism and SWM, 5) How to establish the relationship between Palau and Malay regarding SWM. - There was a productive exchange of ideas and experiences between Palau and Malay (a representative of SB promised to issue a resolution to establish a partnership initially focused on SWM and tourism between Koror States and Malay Municipality)
Nov. 28 (Wed.)	Visit to the proposed landfill site Visit to NSWMC Visit to MRF in Quezon City (Bgy. Holy Sprit) Retuning to Palau	- Experts of Palau watched the proposed landfill site with explanation of current condition and specification. - Experts of Palau were told about the background of waste issues in the Philippines and RA9003.

#### 4. List of Participants

Participants	Position
<b>Republic of Palau</b>	
Mr. Calvin Ikesiil, Jr	Manager, Bureau of Public Works-SWM Office, National Government of Palau
Mr. John Ngiraked , Jr.	Manager, Public Works Department-SWM Office, Koror State Government
Mr. Travis August	Technical Assistant, Public Works Department –SWM Office, Koror State Government
<b>Municipality of Malay</b>	
Councilor Gideon Siñel	Sangguniang Bayan, Committee on Environment
Councilor Cristina Prado	Sangguniang Bayan, Committee on Appropriations
Ms. Alma Belejerto	Municipal Planning Officer
Engr. Arnold Solano	Municipal Engineer and Over-all SWM Manager
Engr. Manuel de los Reyes	Head, EMS Unit
Ms. Delilah Maugerii	CENRO-SWM Coordinator
Ms. Marianne Salvacion	EMS Staff
Mr. Jahaziel Gelito	Local DILG
Ms. Lyzelle Ceralde	BCCI, Secretary General
Mr. Fermin Dayao	BFI Board Member
Ms. Nysa Aguirre	Administrative Secretary of SB
Mr. Nysa Taunan	BFI Staff
Mr. Evan Jay Aliansa	EMS Staff
<b>NSWMC</b>	
Atty. Zolio Andi	Executive Director, National Solid Waste Management Commission (NSWMC)
<b>JICA Study Team</b>	
Mr. Satoshi Higashinakagawa	3R Activity Promotion Plan / Recycling Facility Plan / Coordinator
Mr. Norihisa Hirata	Financial Plan / Private Sector Exploitation Plan
Dr. Ma. Judea Millora	Local expert

**Appendix IV-3.1 Contradistinction between TOC of the proposed 10-year SWM Plan and Annotated Outline**

Final Report (Part II)				Annotated Outline
CHAPTER 1 INTRODUCTION	1.1		Purpose	1.1 Purpose
	1.2		Approach	1.2 Approach
CHAPTER 2 PROFILE OF MALAY MUNICIPALITY	2.1		Location	2.1 Location
	2.2		History	2.1 History
	2.3		Population	2.2 Population
	2.4		Economic Profile and Land Use	2.3 Economic Profile/Land Use
	2.5		Physical Characteristics	2.4 Physical Characteristics
CHAPTER 3 CURRENT CONDITIONS OF SOLID WASTE MANAGEMENT	3.1		Institutional Arrangements	3.1 Institutional Arrangements
		3.1.1	Legislation	5.1 Local Laws and Regulations
		3.1.2	Organizations	3.1 Institutional Arrangements 5.2 Roles 5.3 City/Municipal Solid Waste Management Board 5.4 Barangay Solid Waste Management Committees 5.5 Stakeholders Participation
			Inventory of Equipment and Staff of the Municipality of Malay and Barangays	3.2 Inventory of Equipment and Staff
			Information, Education and Communication (IEC)	3.10 IEC
			Public Awareness	
		3.1.6	Costs and Revenue	3.11 Costs and Revenues
	3.2		Waste Characterization	-
		3.2.1	Waste Generation	4.3 Generated Waste
		3.2.2	Waste Diversion	4.2 Diverted Waste
		3.2.3	Disposed Waste	4.1 Disposed Waste (from WACS)
		3.2.4	Current Waste Flow	-
	3.3		Technical Aspects	
		3.3.1	Source Reduction	3.3 Source Reduction
		3.3.2	Sweeping and Collection	3.4 Collection
		3.3.3	Transport	3.5 Transfer
		3.2.4	Processing Facilities (MRFs)	3.6 Processing Facilities
3.3.5		Final Disposal	3.7 Final Disposal	
		(1) New Landfill Site		
		(2) Old Dumping Site		
3.3.6	Special Waste	3.8 Special Wastes 3.8.1 Health Care Wastes		
3.3.7	Market for Recyclables	3.9 Markets for Recyclables, 7.8 Market Development		
3.4		Identified Key Issues of Solid Waste Management	3.12 Key Issues	
CHAPTER 4 FUTURE FRAMEWORK	4.1		Socio Economic Framework	-
	4.1.1		Population	2.2 Population
	4.1.2		Tourist Arrival	2.3 Economic Profile/Land Use

Final Report (Part II)				Annotated Outline	
		4.1.3	Other Socio-Economic Situations		
	4.2		Projected Solid Waste Generation	-	
		4.2.1	Municipal Solid Waste	4.3 Generated Waste	
		4.2.2	Health Care Waste	3.8 Special Wastes 3.8.1 Health Care Wastes	
CHAPTER 5 PLAN STRATEGY	5.1		Structure of the 10-year SWM Plan	-	
	5.2		Vision and Goals	6.1 Vision	
	5.3		Target	6.2 Targets	
	5.4		Strategies	6.3 Strategies	
	5.5		Comparison of Technical Options	-	
	5.6			-	
			5.6.1	Future Waste Flow	-
		5.6.2	Diversion Projection	8.2 Diversion Projections	
CHAPTER 6 TECHNICAL SYSTEM OF SOLID WASTE MANAGEMENT	6.1		Source Reduction	7.1 Source reduction	
	6.2		Sweeping	-	
	6.3		Collection and Transport	-	
			6.3.1	Collection	7.2 Collection
			6.3.2	Transport	7.4 Transfer (if applicable)
	6.4		Intermediate Reduction at MRF	7.3 Segregation, Recycling, and Composting, 7.5 Alternative Technologies for Residual	
	6.5		Disposal	7.6 Disposal	
			6.5.1	Development of SLF	
		6.5.2	Rehabilitation of the Old Dump Site		
6.6			Special Waste	7.7 Special Waste, 7.7.1 HCW	
CHAPTER 7 INSTITUTIONAL, ORGANIZATIONAL SYSTEM OF SOLID WASTE MANAGEMENT	7.1		Information, Education and Communication (IEC)	7.8 Information, Education and Communication (IEC)	
	7.2		Introduction of Incentive Program	8.4 Incentive Programs	
	7.3		Implementation of Market Development	7.3.4 Marketing	
	7.4		Legal System Arrangement	9.2 Legal	
	7.5		Organizational Set Up	9.1 Roles	
	7.6		Capacity Development	-	
CHAPTER 8 IMPLEMENTATION PLAN	8.1		Implementation Plan	-	
			8.1.1	Implementation Schedule of the 10-year SWM Plan 12. Phases and Responsibilities 12.3 Implementation Schedule	
			8.1.2	Responsible Organizations 9.1 Roles	
			8.1.3	Monitoring Program 8.3 Monitoring Program 12.2 Milestones	
	8.2			Priority Projects	
CHAPTER 9 COST ESTIMATE AND FINANCIAL ASPECT	9.1		Cost Estimate of the 10-year SWM Plan	11.1 Investment Cost	
	9.2		Annual Costs	11.2 Annual Costs	
	9.3		Funding Options	11.3 Funding Options	
	9.4		Cost Sharing		
	9.5		Setting Up Local Common Fund		

Final Report (Part II)				Annotated Outline
	9.6		Cost Recovery	11.4 Cost Evaluation and Comparison
	9.7		Cost Evaluation and Comparison	
CHAPTER 10 SOCIAL AND ENVIRONMENTAL ASPECTS	10.1		Environmental Policy Framework of the Philippines	-
	10.2		Social and Environmental Aspects	10.1 Social Aspects 10.2 Environmental Aspects
	10.3		Initial Environmental Examination (IEE)	
CHAPTER 11 EVALUATION				-

Source: JICA Study Team

**Appendix IV-3.3.1 Document Tracking for the Land Issue at the SLF  
(August 1 to December 3, 2007)**

Date	Subject	From	For
August 1, 2007	Investigation Report re: Amendment of Approved Plan FP-060405-006865 in the name of the heirs of Conrado Acosta situated in Barangay Mayapay , Buruanga, Aklan	Special Investigator Pedy de Pedro	Regional Technical Director-Land Management Services, DENR- Region 6
August 2, 2007	Survey Returns re: Amendment of the Approved Plan FP-060405-006865 in the name of the heirs of Conrado Acosta situated in Barangay Mayapay, Buruanga, Aklan	PENR Officer, Kalibo , Aklan Officer-in-charge, CENR Officer, Kalibo, Aklan	Regional Technical Director-Land Management Services, DENR- Region 6
August 16, 2007	Notice of Barricade of 23,682 square meter of land at the SLF site	Mr. Rogelio Acosta	Mayor Ceciron Cawaling
September 4, 2007	Notice of agreement and conformity to the boundaries between Acosta claims and the proposed SLF site set by survey of Engr. Vivien Alvarez	Regional Executive Director DENR- Region 6	Mayor Ceciron Cawaling
September 5, 2007	Subdivision Plan for a parcel of land surveyed in the name of the heirs of Conrado Acosta and sanitary landfill site located at Barangay Mayapay, Buruanga, Aklan	PENR-CENR Officer, Kalibo, Aklan	Regional Executive Director DENR- Region 6
September 12, 2007	Request for Cancellation of Approved Survey Plan for a parcel of land surveyed in the name of the heirs of Conrado Acosta	PENR-CENR Officer, Kalibo, Aklan	Regional Technical Director-Land Management Services, DENR- Region 6
September 14, 2007	Subdivision /Amendment of FP-060405-006865 in the name of the heirs of Conrado Acosta located at Mayapay, Buruanga, Aklan	Regional Technical Director-Land Management Services, DENR- Region 6	PENR-CENR Officer, Kalibo, Aklan
September 14, 2007	Request for the Approval of the Amendment Plan Prepared for the heirs of Conrado Acosta and for the Cluster Sanitary Landfill Site	Engr. Vivien Alvarez Special Investigator Pedy de Pedro	PENR-CENR Officer, Kalibo, Aklan
September 17, 2007	Request to remove barricade and await decision of the DENR- Bureau of Lands, Region 6	Mayor Ceciron Cawaling	Mr. Rogelio Acosta
September 25, 2007	Request for cancellation of approved survey plan for a parcel of land surveyed in the name of heirs of Conrado Acosta	PENR-CENR Officer, Kalibo, Aklan	Regional Executive Director DENR- Region 6
October 4, 2007	Order for the immediate cancellation of Survey Plan FP-060405-006865 issued to heirs of Conrado Acosta	Regional Executive Director DENR- Region 6	Regional Technical Director-Land Management Services, DENR- Region 6



Date	Subject	From	For
October 15, 2007	Demand to remove barricade at the sanitary landfill site within 10 days	Mayor Ceciron Cawaling	Mr. Rogelio Acosta
October 25, 2007	Petition For Special Injunction with TRO and preliminary Injunction	Mr. Roger Acosta	Regional Trial Court
November 7, 2007	Answer to the Petition for TRO	Mayor Ceciron Cawaling	Regional Trial Court
November 7, 2007	Order Directing Cancellation of the Approved Survey issued to the heirs of Conrado Acosta	Regional Executive Director DENR- Region 6	Regional Technical Director-Land Management Services, DENR- Region 6
November 14, 2007	Order of Cancellation of the Survey Plan of Hrs. of Conrado Acosta	Regional Technical Director-Land Management Services, DENR- Region 6	RED, PENRO, CENRO , Heirs of Conrado Acosta , Mayor Ceciron Cawaling
November 14, 2007	SB Resolution No. 049 s. 2007 Vesting Mayor Ciceron Cawaling the authority to avail of the services of Atty. Julius Leonida as Legal Counsel to represent LGU-Malay	SB, Malay	Regional Trial Court
November 20, 2007	Reminder for Application for Tenorial Instrument	CENRO	Mayor Ciceron Cawaling
November 21 , 2007	Hearing of the Case		
November 29, 2007	Answer to Reply	Mayor Ciceron Cawaling	Regional Trial Court
December 3, 2007	Hearing of the Case		

Source: MOM

**APPENDIX V:  
SELECTED PHOTOS**

## Appendix V SELECTED PHOTOS



1st Steering Committee  
(March, 2007)



Municipal Solid Waste Management Board Meeting  
(May, 2007)



Waste Discharge Condition  
(March, 2007)



Primary Collection to Waste Collection Point  
(March, 2007)



Waste Collection (Curbside Collection)  
(June, 2007)



Waste Collection (Station Collection)  
(June, 2007)



Hauled Waste to the Balabag MRF  
(June, 2007)



Waste Segregation for Recyclable at the Balabag  
MRF (June, 2007)



A Junkshop on the Mainland of Malay  
(April, 2007)



Bioreactor at the Balabag MRF  
(April, 2007)



Loading Residual Waste at the Balabag MRF  
(June, 2007)



Loading Residual Waste to Pump Boat at the  
Manoc-Manoc Port (June, 2007)



Unloading Residual Waste from Pump Boat at the Caticlan Port (June, 2007)



Loading Residual Waste to Dump Truck to Transport to the Proposed SLF (June, 2007)



Temporary Stored Residual Waste at the Proposed SLF (June, 2007)



Storage of Health Care Waste in a Clinic (July, 2007)



Medical Tomb for Health Care Waste (July, 2007)



Old Dump Site (May, 2007)



Waste Characterization Survey  
(May, 2007)



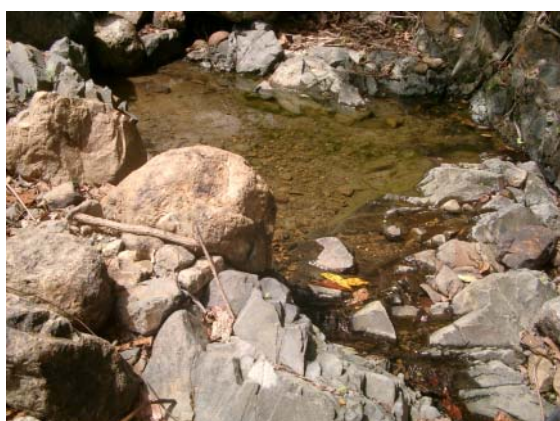
Public Awareness Survey  
(June, 2007)



Time and Motion Survey  
(June, 2007)



Boring for Geological Survey at the Proposed SLF  
(June, 2007)



Water Quality Sampling Point near the Proposed  
SLF (June, 2007)



Boring Survey at the Old Dump Site  
(June, 2007)



Storage Area of Recyclable Waste at the Caticlan MRF (October, 2007)



A Booth for Collection of Environmental and Admission Fee (November, 2007)



Field Inspection by the Experts from Palau at the Balabag MRF (November, 2007)



Technical Exchange Meeting with the Experts from Palau (November, 2007)



6th Steering Committee  
(February, 2008)



Technology Transfer Seminar  
(February, 2008)