

12.2 Administration and Organization

12.2.1 Selection of the Best Administration and Organizational System

The types of institutional systems adopted in Latin America – listed below – are discussed.

- a) Direct municipal management
- b) Autonomous institution
- c) Operation under contract
- d) Operation under concession
- e) Concession to community organizations
- f) Private suppliers
- g) Combined models

a. Direct Municipal Management

This operation lies directly on the municipality that provides its own personnel, vehicle, and equipment. Depending on the city size, the authority in charge of MSW can be under a manager, a department, or included in the structure for health, public works, urban development, and public services. Generally, with respect to the allocation of political and financial resources, SWM is given a lower priority within the municipality's hierarchy compared to other sectors.

The legal framework and administrative procedures reduce efficiency and effectiveness with respect to: acquisition of equipment, spare parts, and tools; personnel mobilization, salary allocation; and coordination with legal authorities, promotion sectors, public communication, and audit counseling.

Solid waste collection services, often given a lower hierarchic level within the municipality, are always vulnerable to political interference in appointment of personnel and acquisition of machinery, equipment, and services. With this type of model, it is difficult to implement modern management techniques as problems become magnified when the service coverage level is increased. Also private sector involvement usually is limited to supplying vehicles for collection and final disposal operations. At times it provides waste collection services and operates sanitary landfills under contract. The central budget should finance the services for which the municipality, in turn, should charge tariffs and fees linked to the price of the land, water, and electricity directly to the clients.

Taking into account these complicated SWM problems in most Latin American cities, the direct management system is being replaced by other institutional models in the same way as other public services, such as water supply, sewerage, telecommunications, and electricity.

b. Autonomous Institution

As the cities grow, the management of infrastructure becomes more complex. As some services have already been contracted to the private sector, the possibility to establish other institutional models for SWM is being analyzed to reduce restrictions from procedures and regulations imposed by municipal governments. Several types of institutions, such as foundations, corporations, public organizations, quasi-

governmental enterprises, and public enterprises have been established, with a structure similar to the private sector, although the capital is provided by the government. This type of organization intends to reduce these restrictions. Administrative autonomy will be achieved which will be financially sustained by billing the recipients of the services.

These new entities are becoming a success in Latin America where management decisions are not swayed by political considerations, especially in personnel appointments and fixing the level of fees.

c. Operation Under Contract

In a similar fashion to other works done under contract, the municipalities are contracting out goods and services related to SWM to the private sector. These contracts include rental of equipment and machinery, total or partial collection services, sweeping, transfer and final disposal operations. In addition, private consultants have been hired for engineering works, supervision and monitoring services, and environmental auditing.

This is the most fundamental form of "privatization", i.e., the private sector is delegated specific activities that are paid based on time, volume, weight, and number of units supplied, among others.

On the other hand, the contractor can also use public goods (workshops, office, equipment, machinery, etc.) in order to provide the service without the added burden of initial investment to procure such items. Marginal areas can be serviced by "micro-enterprises", formed by the residents, initially supported by the municipal or national government.

d. Operation Under Concession

In Latin America, the overall management of several public services is being conceded to the private sector (e.g., electricity, telephone, water supply, sewerage, roads, etc.). The concessionary periods usually last longer than twenty years, during which the concessionaire is granted more responsibility and the state's role is limited to supervision of the quality of service and billing practices. As the private sector acquires the assets and directly bill the users for the service provided, it has a tendency to become a monopoly during the concessionary period.

e. Concession to Community Organizations

In general, because marginal areas have a lower service level there are more problems that need to be taken care of. Bad roads, steep slopes, the residents' low education level and low income are some of the characteristics of these areas. In order to employ members of these community groups, organizational forms are being developed that make use of labor intensive methods and unconventional tools and equipment.

Marginal community organizations execute primary collection and, in general, charge the residents directly. The municipality can cooperate to ensure that secondary collection is provided, with subsidies, by removal of waste from fixed collection points and provision of final disposal services.

f. Private Suppliers

In this model, the contractor provides services directly to the user, the service area is undefined, and there is no need for government intervention. Usually there is an operator – with just one vehicle – whose clients are mainly large MSW generators (e.g., institutions, factories, hotels, and markets). The government only sets minimum requirements on the type of vehicle and protection measures to prevent waste from littering the roads.

g. Combined Models

Taking into account urban characteristics of Latin American cities, a combination of models mentioned previously is also prevalent, where the government take on a more participatory role. The main goal of a combined model is to gain the advantages of each model to create a more appropriate model.

h. Conclusion

On examining the models currently used in Latin America, option b) "Establishment of an autonomous institution" has been selected as the best administration and organizational system; it should also obtain advantages of the characteristics of each of these models. The objectives are as follows.

- Rapid urban development is generating a permanent demand for public services, mainly waste collection and cleansing of public areas.
- The city's topography requires adequate planning and application of various engineering techniques to service both the downtown area (with high generation rates and narrow streets) and urban areas that have developed on hills located around the city (both high and low income areas).
- The quality and functioning of public services mainly depend on clients' fees and tariffs that are subsidized; they depend upon the payment capacity, quantity of MSW produced and its sources. In general, the residents are willing to pay a fair and an appropriate amount of fees if services improve.
- In order to efficiently administer the services, a mechanism that can enable technical and financial planning in the medium term and the long term is required. In addition, the mechanism will also facilitate both rapid and precise decisions to be made on a daily basis. With the current restrictions posed by the legalities and the institutional framework it is almost impossible to have an acceptable performance level.
- The long list of problems that have been mentioned previously confirm that it is necessary to introduce drastic institutional reforms.

12.2.2 Proposed New Administration and Organizational System

The proposed autonomous entity, the Municipal Cleansing Corporation (MCC), will be entirely administratively and financially autonomous, and will have the purpose of achieving an integrated municipal solid waste management in the Central District. The objectives of this entity will be:

- To halt and reverse environmental deterioration caused by the provision of waste services.
- To rehabilitate, to renew, and to expand the infrastructure.
- To guarantee the quality of services with appropriate controls.
- To improve and to simplify contacts with clients.
- To contribute to the recovery of the environment.

The goals projected to be achieved in the first 5 years of operation are:

- To beautify the city.
- To reach a coverage rate of 100% for areas accessible to the collection vehicles and a coverage rate of 80%, with private sector participation, for other areas.
- To maintain the roads in a clean condition by mechanical and manual street sweeping methods and by placing waste bins along the sidewalk.
- To achieve sanitary landfill operations for the final disposal of MSW to safeguard environmental quality.
- To strengthen the administrative, the commercial, the technical, and the financial structure that ensures high quality and sustainability of this service.
- To develop a highly qualified human resource that is motivated and loyal.
- To promote public participation in all the institutional activities.

12.2.3 Organizational System of the Municipal Cleansing Corporation

The administrative structure for the new proposed autonomous institution is shown in Figure 12-1. It is very similar to a private company with the same degree of independence and autonomy; all its features are within the judicial framework established by the laws of the Republic for public enterprises.

Prior to the implementation of the administrative structure for the proposed autonomous institution, a solid waste management unit (SWEU; see Chapter 12.6 for details) that has a structure similar to the existing Cleansing Department – but placed at a higher level in the existing organizational structure – should be established. It should begin as soon as possible with the improvement of the SWM in the Central District.

In other words, the actual Cleansing Department will turn into an administrative unit in charge of SWM, linked directly to the Mayor's office, keeping the personnel, plants, equipment, and the existing infrastructure. All the personnel will have proper

assignment of duties and their performance controlled strictly. The unit will be assisted by an advisor, with recognized experience in SWM, who will support administrative actions, train the people in charge of SWM, and perform the administrative procedures in direct line with the mayor when necessary. After the establishment of the SWEU is approved by the municipal council, the administrative unit will operate during a transition period between the total municipal operation to the partial privatization with proper planning, bidding, contracting, and supervision.

Figure 12-1 shows the proposed structure of the autonomous institution which will hire the required number of well-qualified, well-paid personnel who would be able to attend the different functions assigned to each section. Some activities could be executed at a central level utilizing the actual administrative structure of the AMDC. The financial area should be given careful considerations because the sustainability of the SWM will depend on its successful administration.

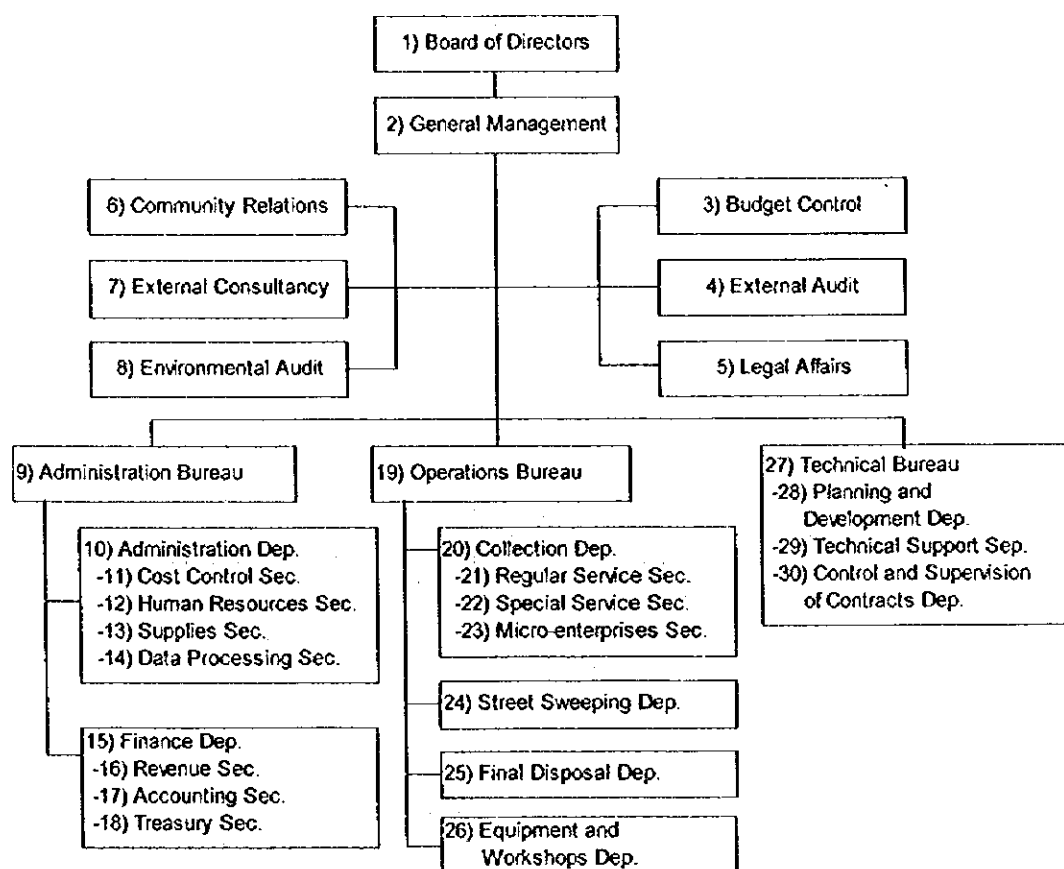


Figure 12-1: Proposed Administrative Structure of the SWM Organization

1) Board of Directors

The board of directors represents the 'Director' within the institution and will be formed by the following seven members.

- The mayor of Tegucigalpa who will be the president.
- Three council members from Tegucigalpa municipality; they will be appointed by the municipal legislative council.
- One representative from the Health Ministry.
- One representative from the College of Civil Engineers in Honduras.
- One representative from the Chamber of Commerce and Industries of Honduras.

These members were selected for the proposed Board of Directors so that the municipal council – the competent authority for SWM – Tegucigalpa, Comayagilela, and marginal areas are evenly represented. In addition, a member each from the Ministry of Health, the College of Civil Engineers, and the Chamber of Commerce and Industries were selected to represent the main public health authority, the civil engineering society, and the private sector of Honduras.

Function:

- Policies
- Supervision
- Approval

Responsibilities:

- To establish the policies of the institution.
- To approve the annual budget and its results.
- To supervise the administrative, the technical, and the financial activities.
- To approve the appointment and the dismissal of officials.
- To approve and to supervise contracts with the private sector.
- To approve the level of fees.

2) General Manager

The General Manager represents the executive body of the institution; it will be headed by a civil engineer or a sanitary engineer with a minimum of five years' experience in solid waste management and business administration. He or she will be the legal representative of the institution and will respond to generalities regarding the management of the administrative, the technical, and the financial activities. If there is no qualified person available, a consultant or an expert having the experience of solid waste management, who assists the general manager to perform the duties, will be employed on a full-time basis.

Function:

- Representation
- Authorization

- Control

Responsibilities:

- To prepare the budget.
- To control the budgeting processes.
- To authorize contracts and expenditures.

3) Budget Control

The role of the Budget Control Division is to enforce, to verify, and to authorize the institution's budget. A professional with a solid background in economics and in business administration will be in charge of this area.

Function:

- To prepare
- To authorize
- To control

Responsibilities:

- To prepare the budget.
- To control the execution of the budget.
- To authorize contracts and expenses.

4) External Audit

A firm of independent auditors – from Honduras – will be hired under contract to satisfy legal and auditing requirements and to ensure administering and financing practices are satisfactory.

Function:

- Institutional Auditing

Responsibilities:

- To evaluate and to investigate the administrative, the economic, and the final institutional activities.
- To verify the application of legal norms that govern institutional activities.
- To present an annual auditing report to the Board of Directors.

5) Legal Aspects

A lawyer with experience in public administration will oversee and supervise all legal aspects of the proposed autonomous institution.

Function:

- To represent
- To defend
- To assist
- To supervise

Responsibilities:

- To represent and defend the interests of the institution.
- To propose necessary legal procedures.
- To legally assist the Board of Directors and the officials.
- To prepare legal documents.

6) Community Relations

Community Relations are to promote, to establish, and to maintain public participation and cooperation with the activities of the institution. A person with a background in public relations will be in charge of this area.

Public participation is vital to sustain the development of SWM services and the institution. In general, it is necessary to instill a sense of pride and self-esteem among residents, especially among those who visit the downtown area and those who live in marginal areas. Little can be achieved by applying the best engineering and administrative practices if the population can not participate and cooperate fully.

Functions:

- Public Relations
- Promotions
- Formulation and design
- Implementation
- Evaluation

Responsibilities:

- Relations with the public and the media.
- Reception and processing complaints and suggestions from clients.
- Promotion of the institution's image.
- Production and execution of educational campaigns.
- Evaluation of educational activities.

7) External Consultancy

In order to strengthen the institution and develop its human resources – initially – it is necessary to hire outside consultants for a minimum of two years. So far, efforts that have been made to improve services (in the form of vehicle and equipment) have shown limited success. A large proportion of this is due to lack of an experienced and a motivated human resource to closely plan, operate and monitor service activities; the human resources must also be able to operate, maintain, and fix damaged equipment that are used for waste collection and final disposal operations.

Even if collection, sweeping, and final disposal services are expanded by awarding contracts to the private sector, this does not mean that the public sector is exempt from its responsibilities. It is the complete the opposite. It will become even more essential to have professional staff with better training to plan, to supervise, and to monitor the quality of services provided under contract.

Function:

- To consult
- To train

Responsibilities:

- To train human resources on service quality.
- To provide consultations on planning, development, operations, monitoring, supervision, and control of the private sector operating under contract.

8) Environmental Audit

Public acceptance is closely linked to the operation and the efficiency of services, it is also linked to the city's environmental quality associated with SWM. In addition to mitigation measures, goals and parameters will be fixed to constantly monitor the quality of services and the impact of SWM on the environment.

The auditing office will submit monthly reports to the general manager.

Environmental auditing will be contracted to a firm specializing in this field.

Function:

- Control
- Monitoring

Responsibilities:

- To control the quality of services.
- To analyze complaints from clients.
- Environmental monitoring:
 - * Storage
 - * Collection
 - * Sweeping
 - * Haulage
 - * Final Disposal
- Define the impact on the environment and mitigation measures.

9) Administration Bureau

The Administrative Bureau – divided into the Administration Department and Finance Department – will provide administrative support for the institutional operation. Under the Administration Department, there will be sections responsible for cost control, human resources, supply, and data processing. Under the Finance Department, there will be a Revenue Section, an Accounting Section, and a Treasury Section. A person with a background in business administration will be in charge of the Administrative Bureau.

10) Administration Department

The Administration Department will gather information related to the operational outcomes and will select, train and supply the necessary human resources. It will also acquire, store, and distribute supplies. The use of supplies will also be monitored by this section. Institutional activities will be registered, ordered, reported, and filed.

11) Cost Control

This section will request and analyze information of the use of resources, which will be presented as a report; where the resources are spent and its performance will be monitored.

Function:

- To register
- To analyze
- To report

Responsibilities:

- To request information on how resources are being used.
- To register information.
- To analyze and evaluate the use of resources with respect to expected and real performance.
- To report on findings and propose adjustments.

Indicators on performance and productivity are listed below.

(1) Collection (compactors and dump trucks)

1.1	Number of trips/vehicle/day	No./day
1.2	Time elapsed in collection routes	Hours
1.3	Transportation time to the disposal site	Hours
1.4	Time spent on maintenance	Hours
1.5	Distance covered for collection	km
1.6	Distance covered for haulage to the landfill	km
1.7	Average velocity during collection	km/hr
1.8	Average velocity during haulage to the landfill	km/hr.
1.9	Time spent in the sanitary landfill	Hours
1.10	No. of vehicles in operation/day	No./day
1.11	Amount of waste collected by each vehicle in a day	ton/day
1.12	Amount of waste collected each day in a given area	ton/km/day
1.13	Capacity being used/trip	%
1.14	Drivers/vehicle	No.
1.15	Assistants/vehicle	No.
1.16	Workers/vehicle	No.
1.17	Amount of waste collected by each assistant	ton/day
1.18	Useful time/total time	%

(2) Collection (containers)

2.1	Number of trips a vehicle makes in one day	No./day
2.2	Time elapsed to replace container	Hours
2.3	Haulage time to the disposal site	Hours
2.4	Time for maintenance	Hours
2.5	Distance covered for haulage	km
2.6	Average velocity for haulage to the site	km/hr
2.7	Time spent in the sanitary landfill	Hours
2.8	No. of vehicles in operation/day	No./day
2.9	Amount of waste collected by each vehicle in a day	ton/day
2.10	Amount of waste collected by each container in a day	ton/trip
2.11	Capacity being used/trip	%
2.12	Drivers/vehicle	No.
2.13	Assistants/vehicle	No.
2.14	Workers/vehicle	No.
2.15	Amount of waste collected by each assistant in a day	ton/day
2.16	Useful time/total time	%

(3) Street Sweeping (manual)

Sweeping Work

3.1	Time spent to meet and take the workers to the site	Hours
3.2	Time elapsed in routes	Hour
3.3	kg/km per route	kg/km
3.4	Useful time/total time	%

Transportation

3.5	Number of trips made by each vehicle in a day	No./day
3.6	Time elapsed in collection routes	Hours
3.7	Transportation time	Hours
3.8	Time for maintenance	Hours
3.9	Distance covered during collection routing	km
3.10	Distance covered during transportation	km
3.11	Average velocity during collection routing	km/hr
3.12	Average velocity during transportation	km/hr
3.13	Time spent in the sanitary landfill	Hours
3.14	No. of vehicles in operation/day	No./day
3.15	Amount of waste collected by each vehicle in a day	ton/day
3.16	Amount of waste collected each day in a given district	ton/km/day
3.17	Drivers/vehicle	No.
3.18	Assistants/vehicle	No.
3.19	Useful time/total time	%

(4) Sweeping (mechanical)

4.1	Time to mobilize to beginning of route	Hours
4.2	Time spent on collection routes	Hours
4.3	Time for maintenance	Hours
4.4	Distance covered in collection routes	km
4.5	Average velocity in collection routes	km/hr
4.6	Sweeping machines operating/day	No.
4.7	Amount of waste collected by each machine in a day	ton/day
4.8	Amount of waste collected each day in a given district	ton/km/day
4.9	Useful time/total time	

Transportation

(same as points 3.5 to 3.19)

(5) Sanitary Landfill

5.1	Amount of waste dumped into the landfill/day	ton/day
5.2	Volume of cover material/day	m ³ /day
5.3	m ³ of volume used/week	m ³ /week
5.4	Compacted density	kg/m ³
5.5	No. of vehicles into the site/day	No. of days
5.6	Number of fast vehicles	No.
5.7	Number of slow vehicles	No.
5.8	Time spent on the work front (fast vehicles)	Hours
5.9	Time spent on the work front (slow vehicles)	Hours
5.10	Equipment cost per day	Lps./day
5.11	Equipment cost for compaction	Lps./ton
5.12	Equipment cost for cover material	Lps./m ³
5.13	Personnel cost	Lps./day
5.14	Total cost per ton of waste disposed	Lps./ton

12) Human Resources

This area will provide suitable personnel for the institution.

Function:

- Personnel recruitment
- Selection
- Training
- Task assignment

Responsibilities:

- To propose a development policy for human resources.
- To recruit personnel.
- To select and evaluate.
- To constantly train the human resources.
- To assign to different areas.

- Working relations.

13) Supplies

The Supplies Section will be responsible for supplying goods and services on time and appropriately.

Function:

- To identify
- To specify
- To request prices and deadlines
- To bid and to grant
- To contract out
- To store and to distribute

Responsibilities:

- To prepare the TOR for bidding.
- To prepare technical specifications.
- To request prices.
- To analyze offers.
- To award contracts.
- To verify quality and conditions.
- To receive and store supplies.
- To distribute and follow up.

14) Data Processing

The Data Processing Section will process necessary information and will provide support and assistance to other departments of the institution.

Function:

- To process
- To produce
- To assist

Responsibilities:

- To process institutional information.
- To prepare reports, studies, statistics, etc.
- To provide assistance about data processing to other departments in the institution.

15) Finances

Through its sections, it will control and promote activities linked to the institutional finances. It will analyze and check the financial situation and will identify, locate, and record services provided to the clients. It will bill and charge the clients for the services provided; it contracts special services. Based on good accounting practices, it will record all cash flow; it protects and safeguard the institution's assets (both its own assets and those under its care as bonds); it issues checks. A public accountant will be in charge of this area.

16) Revenue

It will generate institutional incomes through billing and fee collection based on the services provided to the beneficiaries.

Function:

- To identify
- To locate
- To bill
- To collect
- To contract out

Responsibilities:

- To identify and locate residential clients.
- To identify, locate, and eventually contract out the billing operations to institutions, to commercial enterprises, and to service industries.
- To bill and to collect waste fees either directly or through a private company operating under contract.

17) Accounting

The Accounting Department will record and analyze the institution's income and expenditure, capital and fixed assets. It should also prepare an annual balance and monthly reports about the situation.

Function:

- To register
- To analyze
- To inform

Responsibilities:

- To register all financial and economic movements.
- To keep accounts in order.
- To prepare annual balance reports and monthly reports about the situation.
- To keep informed sections of Cost Control (use of funds), Revenue (income due to services and arrears of payment), Treasury (fund availability), Budget Control (income and expenditure by item), and Supplies (funds availability and variation on heritage).

18) Treasury

To manage and supervise all the institutions assets, both its own and those provided as a bond or security when services are contracted out to the private sector.

Function:

- To manage and supervise
- To monitor
- To issue checks
- To receive payments

Responsibilities:

- To manage institutional funds.
- To issue checks to pay for goods and services.
- To receive payments for services provided.
- To monitor its assets and those provided as bonds.

19) Operations Bureau

The Operations Bureau will be responsible for providing SWM services in an efficient and environmentally acceptable manner. It will direct, coordinate, and control the following aspects of waste management: storage; collection; sweeping; haulage; and final disposal. It will also manage the maintenance of equipment and vehicles.

Either a sanitary engineer or a civil engineer who has at least five years' experience in solid waste management will be in charge.

20) Collection

The Collection Department will be responsible for managing the collection of all the city's MSW through regular services provided to: residences; institutions; businesses; industries; and establishments that provide services (as opposed to sale of goods).

Through direct contracts, it will provide "special services" for large MSW generators and for generators of special waste. It will support primary collection activities, provided by micro-enterprises or community groups, in marginal areas. The department will support these activities by placing, transporting, and cleaning the containers.

21) Regular Service

Regular Services will be responsible for services provided to residential areas, businesses, industries, institutions, and service providers on a regular basis. Depending on the frequencies and the schedule already fixed, it should collect waste generated in five areas of the city: El Pastel; El Picacho; Kennedy; Loarque; and Toncontin.

For these large areas, collection routes will be designed which should be related to waste amount from each area. The reason for this is to maintain a higher efficiency level for vehicles and cost control.

All MSW produced by institutions, businesses, industries and service establishments will be collected together with residential MSW, except for waste, due to its quantity, its volume, or its type, which is collected through "special services". Taking vehicle shortage into account, containers will be used to provide waste services in marginal areas. The containers will be hauled to the sanitary landfill by a hoist truck.

Function:

- Collection
- Haulage

Responsibilities:

- To collect MSW from residences, institutions, commercial and industrial plants, and service establishments.
- To strictly follow preset frequencies and schedules.
- To achieve efficiency and productivity targets.
- To maintain a service that is environmentally acceptable.

22) Special Services

Special Services will manage MSW not covered by regular collection services due to size, weight, quantity, special handling requirements, type, or quality. Special services will be provided under a contract at the request of the client.

Function:

- To defray the expenses
- To collect
- To haul

Responsibilities:

- To analyze and propose handling procedures.
- To analyze and propose service costs.
- To provide storage (if necessary), collection, and haulage services.
- To identify potential clients:
 - * Large generators (e.g., markets, hotels, restaurants, commercial sites, institutions)
 - * Non-toxic and non-hazardous special waste (industries, horticulture, cattle raising, aviculture, etc.)
 - * Yard waste from parks and gardens.
 - * Construction waste

23) Micro-enterprises

Micro-enterprises can provide collection services in marginal areas where access to collection vehicles is hindered by the harsh topographical features (steep slopes) and the poorly planned city layout. It is usually organized by residents from these areas, as seen through several successful experiences in Latin American countries (Perú, Bolivia, Colombia). This system makes use of cheap unconventional tools and vehicles. In many instances, micro-enterprises provide their services under a concession system, i.e., a fixed fee is collected by the micro-enterprises directly from the clients. Street sweeping services can also be assigned to micro-enterprises. Recently, street sweeping has been contracted to group of individuals. Micro-enterprises are required to operate as a legal entity so that they can have access to credit.

This section will be in charge of relations and promotion of micro-enterprises that conduct collection and sweeping services. A social promoter (PR manager) should be responsible for this section. The autonomous institution may provide the necessary containers and haul them to the final disposal site. The institution will also be responsible for promotion, planning, and technical assistance.

Function:

- To analyze
- To promote
- To organize
- To plan
- To support
- To supervise

Responsibilities:

- To evaluate the feasibility of establishing a micro-enterprise in a specific area.
- To promote the establishment of a micro-enterprise and its acceptance.
- To support the organization.
- To plan the services and its operation.
- To provide technical assistance.
- To coordinate the collection, the replacement, and the transportation of containers.
- To monitor service quality.

24) Street Sweeping

Street sweeping services maintain the cleanliness of roads and public areas. This section will direct cleansing and sweeping activities conducted by its own personnel and will supervise those working under a contract. It will clean public waste bins by efficiently collecting the waste disposed by pedestrians. A technician who has some engineering experience in middle management levels will be in charge of this section.

Functions:

- To operate
- To supervise
- To provide information to other sections and departments.

Responsibilities:

- To keep roads and public areas clean.
- To organize task groups and check their performance.
- To monitor the amount of waste swept and collected in an area.
- To monitor the amount of waste collected in public waste bins in an area.
- To supervise the performance and the quality of services provided by private contractors.
- To provide special sweeping and cleansing services after large public events (e.g., cultural and religious festivals, sports events, political rallies, etc.).
- To coordinate the collection section on frequencies and work schedule.

25) Final Disposal

The Final Disposal Department should ensure that MSW disposal activities are environmentally acceptable. A civil engineer or a sanitary engineer should be in charge of this department.

Functions:

- To control
- To record
- To operate
- To verify
- To provide information to other sections and departments

Responsibilities:

- To ensure that all MSW is disposed of in the landfill, following both the design and the technical specifications.
- To prevent the entry of prohibited substances into the landfill site.
- To record the following information from vehicles that enter the site:
 - * Date and time when the vehicles enter and leave the site.
 - * Vehicle registration number and type of vehicle.
 - * Origin and type of waste.
 - * Weight of vehicle (both full and empty)
 - * Weight of waste
 - * Area in landfill site where waste was deposited.
 - * Amount billed for disposal services.
- To record the amount of waste deposited (ton) and cover material used (m³) on a daily basis.
- To record the time spent by type of machinery and equipment, personnel and material involved in waste management and excavation, haulage, and placement of cover material each day.
- To record landfill progress (total volume utilized) each week.
- To record rainfall data.
- To estimate the amount of leachate produced.
- To record flowrates and pumping times of leachate recycling system.
- To verify efficiency of leachate treatment every three months
- To construct and provide maintenance of physical infrastructure and surrounding vegetation (green buffer zone).
- To prevent unauthorized persons from entering the site.
- To provide information about operation results and costs.

26) Equipment and Workshops

This section will provide preventive maintenance programs to ensure a high performance level of equipment and machinery. A mechanical engineer should be in charge of this area.

a. Efficiency on collection equipment maintenance

$$\frac{\text{Operative equipment}}{\text{Operative equipment} + \text{Reserve maintenance equipment}} \times 100 (\%)$$

b. Efficiency of preventive maintenance

$$\frac{\text{Preventive maintenance Cost}}{\text{Preventive maintenance cost} + \text{Maintenance cost}} \times 100 (\%)$$

Functions:

- To maintain
- To repair
- To record

Responsibilities:

- To keep a record for each vehicle and machinery; this record should include:
 - * Vehicle registration number and identification
 - * Make of car, model, type, year
 - * Motor and chassis numbers
 - * Engine capacity and fuel consumption in kilometers per gallon of fuel (both with and without a load).
 - * Tire size and battery type.
 - * Repairs made, spare parts used, and amount of time mechanics have spent on repairs. Date the vehicle went into the workshop and when it left the site, odometer record.
 - * Preventive maintenance. Date, type of maintenance, and products used. Odometer record.
- Record of minor equipment, tools, products used, spare parts purchased, and used. Personnel working hours.

27) Technical Bureau

The Technical Bureau will provide technical support to the service operations and will achieve higher coverage and effectiveness. A civil or a sanitary engineer with at least 5 years' experience in SWM will be in charge of this area.

This bureau will plan service developments with a minimum target of 10 years. This target will take into account the following factors: the city's urban development trends; population growth and migration (demographic changes); projected production of MSW and its characteristics (population growth + economic growth - GDP); sanitary landfill size and location; and quantity and type of vehicles and machinery. It will also provide technical support for the various departments in the institution. This bureau will control the quality of services provided by both the municipality and the private sector, and will operate closely with the External Consultancy.

28) Planning and Development

It will produce the institution's technical medium term and long term projects, and designs its development. The chief engineer of the Technical Bureau will be in charge of this area.

Function:

- To analyze
- To plan
- To design
- To support
- To control and to supervise

Responsibilities:

- To participate in the analysis and the decision making processes of the city's urban development plans (METROPLAN).
- To monitor the growth of population, new *colonias*, and new *barrios*.
- To monitor variations in the production and the characteristics of MSW.
- To plan the expansion of services.
- To produce engineering, architectural, and landscape designs.
- To elaborate operation budgets, cost analysis, technical specifications, and execution of the work schedule.

29) Technical Support

It will provide direct technical support to the service operations, and will have the capacity to assist and temporarily replace those in charge of each operative phase (collection, street sweeping, haulage and final disposal). A civil engineer or a sanitary engineer with at least three years' experience will be in charge of this section.

Function:

- To assist
- To support
- To operate

Responsibilities:

- To provide technical assistance
- To support operation activities

30) Control and Supervision of Contracts

It will verify the effectiveness of services provided based on designs, programs, coverage, specifications, costs, and quality. These controls will be applicable to services provided by both the municipality and the private sector. For the control to be effective, it is necessary to design the service operations, the performance levels to be achieved, and the cost and payments to be made.

Function:

- To verify

- To control
- To analyze
- To approve or to reject
- To authorize

Responsibilities

- To verify the provision of services.
- To control the quality and the performance of services.
- To analyze and to confirm the execution of specifications and the terms of the contract.
- To approve the services provided.
- To authorize payments.

The structure proposed to manage the autonomous waste management institution is designed to be in conformity to service needs. If all the operations are to be provided using its own equipment and personnel, enough human resources and materials should be provided; this will ensure duties are performed smoothly (see Table 12-1). On the other hand, if services are to be privatized there should be a proportional decrease in human resources and materials. In this sense, the Operations Bureau's operational level would be reduced to a minimum which would ensure services to a small sector and be free to counter emergency cases. On the other hand, the Department for Control and Supervision of Contracts would be strengthened.

In the Administration Board, all the sections' activities would be concentrated under the Department of Administration and Finances.

Table 12-1: Personnel Table

Ref. No	Position	Qualification	Number
1)	Board of Directors	Representatives	7
2)	General Management	Civil or Sanitary Engineer (more than 5 years experience)	1
3)	Budget Control	Economist or Business Administrator	1
4)	External Audit	Contracted out	-
5)	Legal Affairs	Lawyer	1
6)	Community Relations	Public Relations Person to answer complains by phone	1
7)	External Consultancy	Expert on International Cooperation	-
8)	Environmental Audit	Contracted out	-
9)	Administration Bureau	Chief Business Administrator	-
10)	Administration Department	Business Administrator	1
11)	Cost Control Section	Statistician	1*
12)	Human Resources Section	Sociologist	1*
13)	Supplies Section	Supplier	1*
14)	Data Processing Section	Programmer (System Engineer)	1*
15)	Finance Department	Public Accountant	
16)	Revenue Section	Public Accountant	1
17)	Accounting Section	Accountant I	1*
18)	Treasury Section	Accountant II	1*
19)	Operations Bureau	Civil or Sanitary Engineer (5 years experience)	1
20)	Collection Department		
21)	Regular Service Section		
22)	Special Services		
23)	Micro-enterprises Section	Social Promoter (PR Manager)	1

Ref. No	Position	Qualification	Number
24)	Street Sweeping Department	Engineering Technician	1*
25)	Final Disposal Department	Civil or Sanitary Engineer	1*
26)	Equipment and Workshops Department	Mechanical Engineer	1*
27) 28)	Technical Bureau Planning and Development Department	Civil or Sanitary Engineer (5 years experience)	1
29) 30)	Technical Support Department Control and Supervision of Contracts	Civil or Sanitary Engineer (3 years experience)	1 (1)

* Personnel who will not be needed if most of the services are contracted out to the private sector. Their functions will be assigned to the respective director.

(1) Control and Supervision of contracts would be strengthen with a professional with more experience.

12.2.4 Role of the Private Sector

The new autonomous institution can develop its activities in an 'integrated' or a 'combined' manner so that the institution as well as the private contractors are responsible for the provision of various services. This will help reduce the administration size, promote competition between the public and private sector, and improve the service.

Private participation, in general, has been beneficial because it has led to an increase in the technical level and the development of the services. One must, however, always remember that urban cleansing is a matter of public health; even if the service are privatized, the ultimate responsibility will always lie on the public authorities (Tegucigalpa Municipality and Health Ministry). Consequently, the role that the private sector can play related to SWM could be linked to the activities currently performed by the Municipality's Cleansing Department; before this can take place it is necessary that the following conditions are satisfied by the municipality:

- The municipality must have established a structure capable of controlling and monitoring service quality and to make sure contracts are being honored.
- It must have enough economic resources to make payments as scheduled.

If these basic conditions can be satisfied, the structural scheme of the autonomous institution can be reduced substantially and its main operation will be directed to manage contracts signed with the private sector.

Currently, there is a collection contract with a private enterprise for a unit amount of Lps.379/ton (US\$28.28/ton), and other contracts with small street sweeping groups (composed of nine members in each) that receive Lps.15,500/month/group. The groups operate in different areas.

The main restriction still is lack of available funds. In 1997, it was possible to collect only Lps.19,697,721.00. If this figure is divided by the amount of MSW disposed in 1997 (135,827ton/year), the result is a unit disposal cost of Lps.145/ton (US\$10.82 with an exchange rate of US\$1 = Lps.13.40).

In Latin America, it is common for the private companies to charge per ton of waste collected and disposed, which is between US\$20 to US\$50. It is clear that in order to hire a private contractor for this service, 2.5 times more funds than in 1997 should be collected.

12.2.5 Legislation and Application

The various legislation applied in Honduras, related to MSW, are listed as follows:

- a) General Law on the Environment
- b) Law on Municipalities
- c) Sanitary Code
- d) Health Code
- e) National System for Environmental Impact Assessments
- f) Sanitary Regulation for Environmental Sanitation
- g) Police Law
- h) AMDC Taxation Plan

As a result, one can observe that a specific framework covering all aspects related to an integral management of MSW does not exist. But taking into account the economic and the environmental impacts MSW generation has created, it has become necessary to produce and to approve related legislation to regulate its management. Not only should this legislation be simple and objective, it should also be in harmony with the local economy, habits, and customs. The legislation should provide incentives to those that contribute to an improvement on the quality of life and should penalize and fine transgressors of the law.

For a legislation to be applicable, the service level must be adequate so the public are more apt to cooperate by applying practices which can improve MSW management: joint operation will then become successful. The legal framework to be produced and approved should consider the following aspects:

- General dispositions
- Education
- Waste reduction, separation, reuse, and recycling
- Storage of household and public containers
- Collection, zones, frequencies, and schedules
- Cleansing of roads and public areas
- Haulage
- Transfer stations
- Composting
- Treatment and disposal
- Sanitary landfills
- Incineration, micro-wave, and autoclave
- Hazardous waste and the security of sanitary landfills
- Construction debris
- Administrative framework
- Contracting
- Setting of fees and payment methods
- Incentives and benefits
- Penalties
- Responsibilities due to damage
- Final and transitory dispositions

12.3 Management System

12.3.1 Revenue Control System

a. Functions of Revenue Control

The control of revenue is one of the most important functions to achieve the management of a financially sustainable Municipal Cleansing Corporation. The major revenue control functions are as follows.

- a) Invoice issuance
- b) Demanding and checking payments
- c) Listing habitual defaulters
- d) Maintaining the fee payers' database
- e) Analyzing the fee collection situations by zones
- f) Reporting issues from the viewpoint of revenue
- g) Developing new sources of revenue

b. Information Flow

Figure 12-2 shows the information flow of routine work.

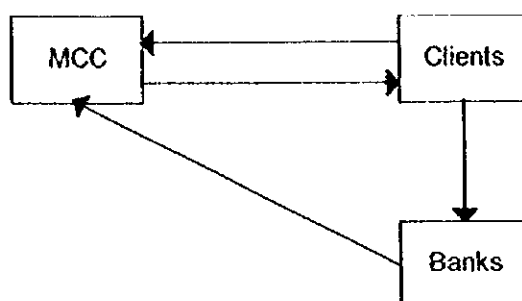


Figure 12-2: Information Flow Diagram of Waste Fee Collection

c. Database

In order to control the revenue effectively, an information system based on following database should be developed.

c.1 Client Database (1)

- a) Identification code
- b) Identification code in the ENEE database
- c) Name of the head of the house (tax payer)
- d) Telephone number
- e) Postal code
- f) Address
- g) Income bracket
- h) Records of payment (monthly)
- i) Date
- j) Amount of payment
- k) Records of non-payment

c.2 Client Database (2)

- a) Identification code
- b) Identification code in the ENEE database
- c) Either: the Name of the company or the director of company (i.e., name registered for business income tax payments)
- d) Telephone number
- e) Postal code
- f) Address
- g) Business income bracket
- h) Records of payment (monthly)
- i) Date
- j) Amount of payment
- k) Records of non-payment

c.3 Database of large dischargers and direct haulers

- a) Identification code
- b) Identification code in the ENEE database
- c) Either: the Name of the company or the director of company (i.e., name registered for tax payment)
- d) Telephone number
- e) Postal code
- f) Address
- g) Business income bracket
- h) Volume of average waste
- i) Records of payment (monthly)
- j) Date
- k) Amount of payment
- l) Records of non-payment

d. Reporting System

In order to act against non-payment of fees and to improve SWM services, the following reporting system should be established.

d.1 Monthly report of payment

- a) Number of payers
- b) Amount of payment
- c) Rate of non-payment
- d) Comparison charts of the above figures
- e) Report of payment by zone
- f) Rate of non-payment by zone
- g) List of habitual defaulters
- h) Countermeasures against non-payment

d.2 Report of change of clients

- a) Report from clients
- b) Report from the company issuing bills under a contract (BSC)
- c) Survey report of new clients

c. Tax enforcement in collaboration with the Tax Bureau

As waste fees for non-residential sources will be charged based on the business income tax, it is essential that the Tax Bureau discloses all information to the MCC as soon as businesses declare their business income tax at the end of the fiscal year. In general as habitual defaulters have a tendency to fail the payment of other taxes, it is advisable to monitor these cases closely and to enforce penalties in case of nonpayment. This should help assist in raising the collection rates, and thus the revenue, for both the business income tax and the waste fee.

12.3.2 Expenditure Control System

a. Functions of expenditure control

In order to have a financially sustainable management system, the overall service costs must correspond to the expected revenue. The Expenditure Control System should therefore consider the following functions:

- a) Initial approval for requests to acquire goods and services.
- b) Control the use of the budget.
- c) To achieve better conditions for acquisition.
- d) To register expenses in an organized manner in order to establish an effective control on costs per activity
- e) To control the quality and certify execution of contracted services; to authorize payments and to impose punitive measures against those who violate the law.

The following department and sections will be responsible for this system:

- a) Budget control
- b) Cost control
- c) Human resources
- d) Supplies
- e) Accounting
- f) Treasury
- g) Control and supervision of contracts

The Operation Department will assess the activities' efficiency by using the Performance and Productivity indicators. Success will be measured by the amount of proposed technical goals reached in relation to the expenses outlaid.

b. Information Flow

Figure 12-3 shows about "Acquisitions".

Figure 12-4 shows about "Hiring Personnel".

Figure 12-5 show about "Contracts to the Private Sector".

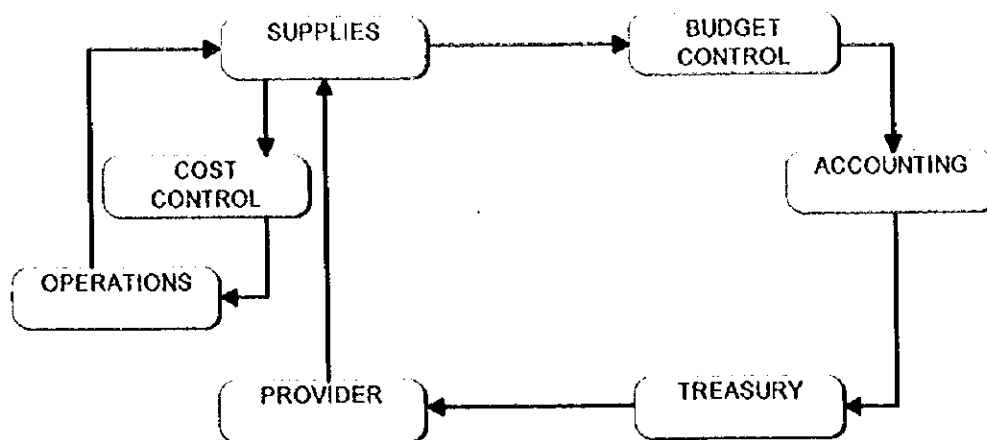


Figure 12-3: Expenditure Control System; Information Flow for Making Acquisitions

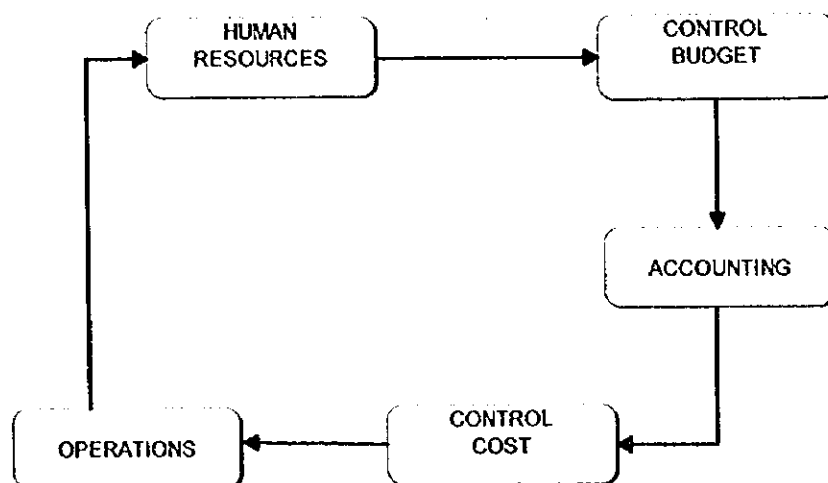


Figure 12-4: Expenditure Control System; Information Flow to Hire Personnel

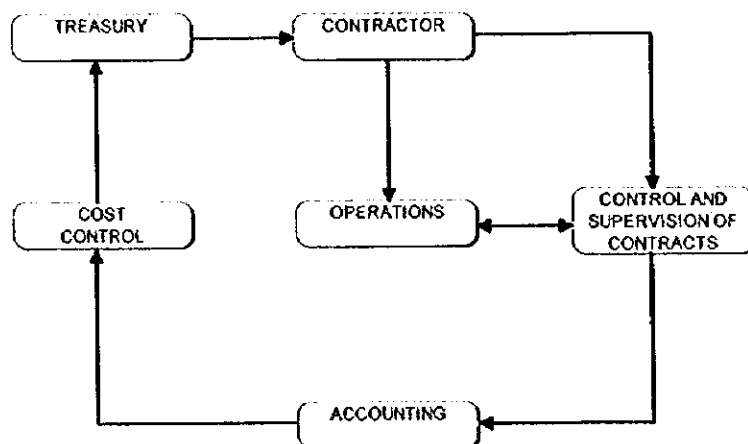


Figure 12-5: Expenditure Control System; Information Flow to Control and Supervise Contracts

c. Recording Information

In order to effectively control expenditure, an information system should be developed which should include the following data base.

c.1 Acquisitions

c.1.1 Capital Goods

- a) Brand, model, type, capacity, power
- b) Type of fuel that the equipment or vehicle uses
- c) Life span
- d) Acquisition cost
- e) Annual depreciation.

c.1.2 Goods and Materials that can be Consumed

A record will be kept for each Section

- a) Fuel, lubricants, oil, tires, etc.
- b) Spare parts
- c) Tools
- d) Construction materials
- e) Office materials
- f) Electricity, water, sewage, etc.

c.2 Personnel

A record will be kept for each section

- a) Full name
- b) Place and date of birth
- c) Nationality
- d) Address and telephone
- e) Education
- f) Date the employee started to work at the institution
- g) Initial salary and fluctuations
- h) Initial position and variations
- i) Notes about his or her performance
- j) Training

c.3 Services Contracted

- a) Name of project or service
- b) Type of service
- c) Bidding and approval dates
- d) Signing of contract date
- e) Deadline
- f) Total amount
- g) Partial payments (weekly, monthly, etc. and amount)
- h) Equipment and machinery which the contractor will be using
- i) Contractor's name, position, and responsibilities

c.4 Reports

The budget control department will present a brief monthly report containing information on expenditures and compromises acquired. This report will have the following information.

- a) Value of acquisitions.
- b) Total cost of salary for personnel.
- c) Staff turnover.
- d) Payment for services under contract.
- e) Budget balance per item.
- f) Projection of outcome for budget per item.
- g) Weight of MSW collected, swept, transported, and disposed of.
- h) Report about Cost Control.
- i) Report about Environmental Audit.

12.3.3 Private Sector Participation

As defined in the SWM system, four areas could be contracted to the private sector.

- 1) Contract A: Collection and Haulage of Municipal Solid Waste (MSW) in the City's Urban Areas
- 2) Contract B: Collection and Haulage of Municipal Solid Waste in the City's Marginal Areas
- 3) Contract C: Street Sweeping
- 4) Contract D: Sanitary Landfill Operation

Contract A: Collection and Haulage of Municipal Solid Waste (MSW) in the City's Urban Areas

It includes:

- Household services
- Businesses, industries, services, institutions
- Hospitals
- Special services for large-scale generators
- Haulage of swept MSW

The contractor will provide services with their own vehicle and personnel. Payment will be made by metric ton collected and transported to the sanitary landfill and according to the standard of quality already established.

The institution should reserve the right to directly operate at least 25% of serviced areas.

Contract B: Collection and Haulage of Municipal Solid Waste for Marginal Areas in the City

It includes:

- Collection and transport of containers located in marginal areas, where access by collection vehicles is difficult.
- Cleansing and maintenance of containers and cleansing of areas surrounding the container (approximately 30 m²/container).
- The contractor will supply its own vehicles, containers, and personnel.

Payment will be made per container collected and transported to the sanitary landfill and according to the container size (8 m³ and 10 m³) if a hoist truck is used. The amount of waste – in metric ton – collected and transported to sanitary landfill will be used as payment unit if trucks with larger capacities are used. Everything should also correspond to the quality standards already set.

Contract C: Street Sweeping

It includes:

- Manual sweeping in areas pre-established.
- Collection of USW disposed in garbage bin.
- Sweeping of public and recreational areas (green areas, sports fields, etc.).
- Sweeping special services and cleansing for areas hosting a large event (cultural, artistic, sporting, politics, etc.).
- The contractor supplies services with its own personnel, equipment, tools, and materials.

Payment will be made based on the distance of road covered by street sweeping services and in correspondence with quality standards already set.

Contract D: Sanitary Landfill Operation

It includes:

- Final disposal of MSW in a sanitary landfill (km. 6.5 highway to Olancho) in correspondence to the project of rehabilitation and operation. The institution will supply the following equipment and machinery.

Identification Code	Equipment Description	Chassis Series	Motor Series
T0-02-01	Bulldozer Caterpillar, model D7H, series II, yellow color, equipped with Caterpillar engine with 6 cylinders in line, model 3306 Japanese version, transmission series No. 1DE01191, Multishank ripper, model N07, series No.2K1100750 arrangement No. 4Y2105, horometer is in good shape which registers 4,554 working hours, cabin ROP type with high security, high wheels.	4AB05511	10Z27631
T0-02-02	Bulldozer Caterpillar, model D7H, series II, yellow color, equipped with Caterpillar engine with 6 cylinders in line model 3306, Japanese version, transmission serie No. 1DE01192, without a ripper, with tiltdozer model DD7H 7U, arrangement No. 9U8607 series No. 8GH00270, horometer is in good shape which registers 1,641 working hours, cabin type ROP with high security and high wheels.	4AB05512	10Z26732
T0-02-03	Bulldozer Caterpillar, model D7H series II, yellow color equipped with Caterpillar engine with 6 cylinders in line model 3306, Japanese version, transmission series No. 1DE01190, multishank ripper, model N07, series No. 2K1100753, arrangement No. 4Y2105, horometer is in good shape which registers currently 4,441 working hours, cabin type ROP which makes it of high security, high wheels, bulldozer with tiltdozers.	4AB05510	10Z26730
CN-01-02	Wheel Loader, make of Kumatsu, model WA180-1, yellow color, 4 tires No. 17.5 x 15 with 16 canvas, small cask with ¼ yd. ³ , canopy type roof, horometer is in good shape which registers 5,225 working hours, diesel engine with 6 cylinder turbofed, KOMATSU, model 6D95L.	13072	6D95L-122269
VI-06-01	HINO dump truck, EconoDiesel, FS, model FS271S., P.S. code SD-ES, HINO engine diesel of 6 cylinders, model EK100, ShinMaywa overturning box, model DR11-03S, series No. F4072511994,1994, 10 rolling tires with No.11-00-20 with 16 canvas, odometer works well and registers 112,000 kilometers, Plates N-14882, Register No. 41, yellow color.	10378	305394
VI-06-02	HINO dump truck, EconoDiesel, FS, model FS271S, P.S. code SD-ES, HINO engine with 6 cylinders, model EK100, ShinMaywa overturning box, model DR11-03S, series No. F4072511995,1994, 10 rolling tires with No. 11.00-20 with 16 canvas, odometer works well and registers 130,028 kilometers, Plates N-14883, Register No. 42, yellow color.	10379	305404
VI-06-03	HINO dump truck, EconoDiesel, FS, model FS271S, P.S. code SD-ES, HINO engine with 6 cylinders, model EK100, ShinMaywa overturning box, model DR11-03S, series No. F4072511993,1994, 10 rolling tires with No. 11.00-20 with 16 canvas, odometer works well and registers 112,000 kilometers, Plates N-14881, Register No. 40, yellow color.	10377	305386

The contractor will be in charge of operation, maintenance, and repair of these equipment and machinery. The contractor will provide its own personnel for all operations.

Payment will be made per metric ton of waste disposed of and according to plans and technical specifications for the sanitary landfill. Civil works to rehabilitate the sanitary landfill will be made in accordance to the budget allocated to this area.

12.3.4 Contract Systems

a. Requirements for the Introduction of the Private Sector's Involvement

Before the private sector can participate in the operation of solid waste services, a solid waste executing unit (SWEU), which would be attached to the Mayor's office, should be established (This is described in Chapter 12.6 in detail.). The following conditions should also be satisfied.

- A collection and haulage system should be designed.
- A street sweeping system should be designed.
- The rehabilitation and the operation of a sanitary landfill should be designed.
- Equipment and workshops should be strengthened.
- A system to control revenues should be established.
- A system for monitoring and supervision should be established.

a.1 Design for the Collection and Haulage System

- Urban area
- Marginal area

These designs should include the following:

- An even selection of routes, frequencies, and schedules.
- Define the number and type of vehicles, equipment, and containers.
- Determine the operational costs.
- Training for personnel involved in technical and operational aspects.

a.2 Design for the Street Sweeping System

This design should include:

- Street sweeping routes, frequencies, and schedules.
- Creation of crews.
- Location of sweeping offices (warehouses).
- Definition of operational costs.
- Promotion and establishment of small workers' organization (micro-enterprises) in order to provide the service by themselves.
- Training for micro-entrepreneurs.
- Training for technical personnel.

a.3 Design for Rehabilitation and Operation of Sanitary Landfill

It is vital to rehabilitate the current dumpsite and operate it under an environmentally acceptable condition in view of public health and acceptance by neighbors. A new image of this site as a real sanitary landfill should be produced with the purpose of gaining acceptance by neighbors for the new location for a sanitary landfill.

The design should include:

- Operation plan until the end of the sanitary landfill's lifespan.
- Stormwater collection and diversion system.
- System for the collection, conduction, and treatment of leachate.
- Collection and release of biogas (for energy purposes).

- Architecture and landscape design.
- Budget, technical specifications and execution schedule for the rehabilitation project.
- Detailed operation costs for the disposal of MSW.
- Weighbridge installation.

a.4 Equipment and Workshop Strengthening

It is necessary to integrally reorganize the Preventive and Corrective Maintenance System for equipment and machinery in the AMDC's Cleansing Department. Currently, there are neither maintenance programs nor indispensable spare parts in stock; acquisitions are made just when the equipment is out of order and then only following a long bureaucratic process (30 to 60 days).

The equipment donated by the Japanese government has been operating for four years and spare parts included in the donation have run out. FIAT (Argentinean equipment with 10 year of use), NISSAN, and HINO representatives do not have spare parts available for these type of vehicles; as a result, an emphasis should be place on acquisition of pieces and parts recommended in April, 1998 (Alvarenga). Furthermore, the personnel have no basic training, which further reduces the possibilities of providing training to others.

a.5 Establishment of a System to Control Revenues

This system is described in Section 12.3.1. It is important that enough funds for institutional and contracted operations should be provided on a timely basis to ensure the success of this service.

a.6 Establishment of a System for Monitoring and Supervision

This system is described on Section 12.3.5. Permanent control and monitoring on service quality and performance will bring about public support and loyalty to the institution.

b. Guidelines and Specifications

In order to create the best conditions for contracts, it is necessary to pre-establish (in a transparent manner) bidding and contracting procedures that will be used. The following should be considered.

b.1 Open Competition

The most important factor consists of cost reduction and introduction of the best technologies and procedures.

b.2 Precise Specifications

Technical specifications and legal requirements will be presented to the bidders in a very precise manner. An opportunity will be given to answer all questions. A draft contract will be attached.

b.3 Pre-qualification

It is advisable to set minimum requirements that bidders should satisfy such as experience in similar works, technical support, and financial capacity.

b.4 Scope of Works

Bidders should know the exact scope of works required and quality and level of service required for the contract. The following should be included where applicable.

- Area to be served
- Type and quantity of MSW to be collected
- Length of streets swept
- Frequencies and schedule
- Minimum characteristics of equipment to be used
- Level and quality of expected service
- Forms to monitor and control the works
- Proposed methods and forms of payment
- Guarantees
- Deductions (reprimand) on payment and fines
- Causes to nullify a contract
- Contract deadlines

c. Service Level and Quality

Based on the bidding and, subsequently, on the contract, the level and quality of service will be established. Differences can be established based on the type of service, urbanization, and economic level.

Standards related to storage and manner of discharge will be defined; these standards should be satisfied by all MSW generators. Standards related to collection, sweeping, transportation, and final disposal should also be honored by contractors.

c.1 Storage and Discharge Manner

Curbside discharge manners:

- Disposable containers (plastic or paper bag, cardboard box) will have a maximum capacity of 50 liters. Sharp objects should be wrapped with paper or other material to prevent injuries to workers.
- Reusable containers (e.g., metal, plastic) will have a maximum capacity of 100 liters. It will be provided with a handle and a cover; it should also be in a good condition.

c.2 Collection and Transportation

c.2.1 Frequency

- Downtown and high income areas 3 times a week
- Other areas 2 times a week

c.2.2 Schedule

- Monday to Friday 06:00 - 14:30
- Saturdays 06:00 - 10:30

Some considerations should be given to the adjustment of these schedules for a more convenient service; it can even include a night shift. For this purpose, lighting should be provided to specific areas inside the sanitary landfill.

c.2.3 Vehicles

For waste management services there should be appropriate vehicles to carry out activities in a sanitary manner and facilitate the assignments for workers. Studies undertaken by the AMDC recommend the use of compactors (8 m³ and 15 m³). In general, vehicles should appear to be in good condition, to be suitably painted, have low fumes emission levels or low noise levels. Brakes, lights, tires and windscreen should also be in good condition.

c.2.4 Workers

Workers should have uniforms and protective gear (e.g., shoes, gloves, coveralls, and goggles) and all the tools necessary for their tasks.

c.3 Street Sweeping

Street sweeping frequency will be as follows:

- City center: daily
- Residential areas with pavement: weekly

Special services and a collection system with public waste bins will be provided for public areas and places that attract a large number of people. Sweepers will have colorful uniforms to protect them from road accidents; they will have protective gear and all necessary tools to perform their assignments.

c.4 Final Disposal

The proposal is for contractors to use machinery and equipment that belong to the AMDC for around four years. The institution will completely repair three bulldozers, a wheel loader and three dump trucks that are available. Bidders should evaluate the equipment and make offers for their services based on: maintenance cost; spare parts; repairs; temporary substitution of equipment and machinery; use of oil, lubricant, grease, and filters; and provision of equipment operators, security guards, and other necessary personnel. The contractor should follow the designs and technical specifications.

d. Method and Payment Form

d.1 Collection and Haulage

d.1.1 The Sanitary Landfill with a Weighbridge

Vehicles will be weighed at the sanitary landfill. Payment will be made per ton of waste collected and transported.

d.1.2 The Sanitary Landfill without a Weighbridge

An approximate weight of MSW to be collected will be defined; bidding and contract work will be done as "lump sum" based on the approximation, i.e., a fixed amount for the area to be served. If there is a weight differential of 20% from the base contract

price, the cause will be investigated and the contract adjusted accordingly. This method requires special attention with respect to control and monitoring given that the contractor does not have the incentive to collect all MSW under their responsibility. The Department of Community Relations through its customer service (telephone assistance) will pass on complaints from neighbors.

It is recommended that a computerized weighing system is installed immediately at the sanitary landfill. This system, in addition to facilitating contracts to be made based on waste collected per ton, will also help obtain valuable information necessary to monitor the service related to SWM.

d.1.3 Secondary Collection in Marginal Areas

This service deals with the collection and replacement of containers located in marginal areas. Transportation of MSW to the sanitary landfill will be done by hoist-trucks or arm-rollers. Payment will be made per container collected, transported, and replaced according to their capacity in cubic meters.

d.2 Street Sweeping

To be contracted out to micro-entrepreneurs with manual street sweeping equipment. Routes will be contracted out and payment made per km of road swept.

d.3 Final Disposal

d.3.1 Operations

Payment will be made by weight (ton) of waste disposed of according to the operation design and technical specifications. The contractor will include in the service operation fee all costs incurred from works and materials.

d.3.2 Rehabilitation

The institution will make the project and engineering designs. The bidders will bid for a "lump sum" to undertake the proposed civil engineering and landscaping works. The payment will be made according to the advance of works.

12.3.5 Quality Control System

a. Monitoring and Supervision

The information system to monitor and control is an important resource to verify and improve SWM tasks. Most of the services are repetitive, with small variations from time to time and with special services when they are requested. Planning and design for these tasks and final evaluation of services make up the quality control system (Figure 12-6).

First, guidelines and quality levels that need to be attained (parameters) should be defined; also, procedures to be followed and activities to be monitored should be determined. This information should be provided to the general public, institution workers, and contractors.

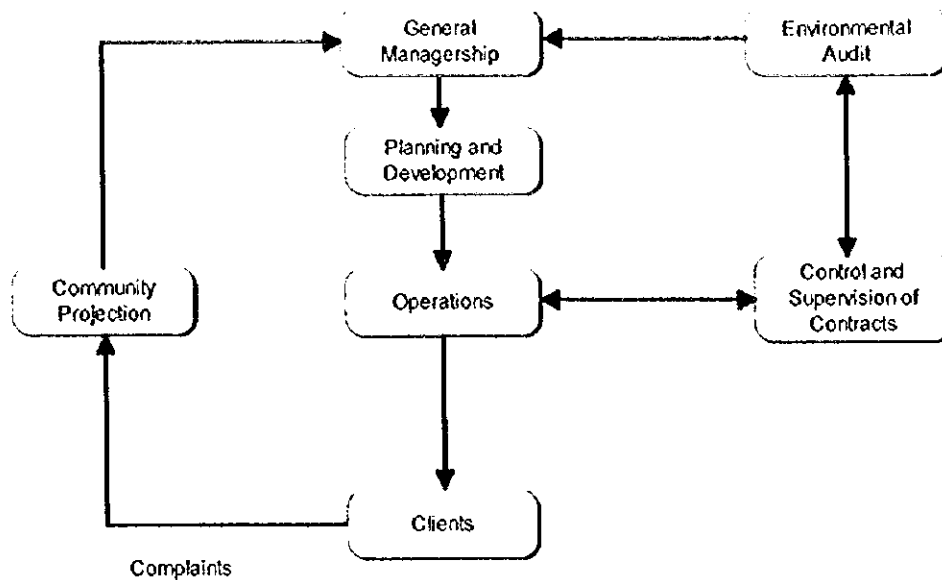


Figure 12-6: Quality Control System, Monitoring and Supervision

a.1 System Functions

- To establish physical and environmental parameters
- To provide instructions on monitoring procedures
- To verify the degree of satisfaction in attaining goals
- To recommend necessary adjustments

a.2 Basic Parameters

1	Storage and discharge	
1.1	Appropriate use of container	%
1.2	Discharge at the set schedule	%
2.	Collection	
2.1	Scattered waste	% of km covered
2.2	Noise and smoke	% of cases registered (complaints)
2.3	Frequencies and schedule executed as planned	% of cases registered (complaints)
2.4	Collection velocity	km/hour
2.5	Quantity collected per route	ton/km
2.6	Cost per ton collected	Lps./ton
3.	Street Sweeping	
3.1	Street sweeping efficiency	% swept
3.2	Productivity	km/day/sweeper
3.3	Maintenance of waste bins for public areas	% of total
3.4	Street length provided with waste bins for pedestrians	% of total streets swept
3.5	Street length swept more than once a day	% of total streets swept
3.6	Sweeping cost per km	Lps/km
3.7	Amount of waste collected during sweeping per area	kg/day
4.	Final Disposal	
4.1	MSW into the site per source	ton/source
4.2	Length of the work front	m/No. of vehicles at peak hour
4.3	Degree of compaction	Volume used in m ³ - ton into the site
4.4	Area covered	% of operational area covered
4.5	Animal and vectors	Yes/No
4.6	Scavengers	Number
4.7	Biogas	No. of vents per hectare
4.8	Leachate	Measurement (liters/second)

a.3 Reports

- On control and supervision of contracts
 - * Whether it meets parameters
 - * To verify service provision
- On Community Relations
 - * Complaints from neighbors, depending on the type of complaint

- On Environmental Audit
 - * Assessment of environmental quality
 - * Evaluate environmental impact
 - * Recommend mitigation measures

12.3.6 Human Resources Development System

The improvement of public services requires the continuous development of strength and skills of those who provide the service. This basic concept shows the objectives on training human resources. The first is to instill a sense of pride in the public servants toward their work so that they develop a positive attitude and gain public trust for the institution. The second is to provide the public servants with necessary skills to improve their work and to ensure a cleaner environment which is comfortable for their citizens.

In order to attain those objectives, it is necessary that the municipality's legislative council approves a new institutional structure and selects appropriate personnel who will provide the services.

It consists of three course training

- Public Affairs
- Operations
- Support Services

a. Public Affairs

Training on public affairs will help develop morale and good sense to help their community as a group. In this category, there are six classifications that are considered as groups.

a.1 Course for New Public Servants

It targets newcomers to the institution, such as administrators, engineers, operators, drivers, etc. They are instructed on institutional activities and indispensable issues about their duties with the objective that they can adapt quickly to their assignments.

a.2 Course for Heads of Departments and Sections

It targets directors and chief engineers. It provides them with knowledge and special skills to take care of administrative aspects of their assignments.

a.3 Course for Supervisors

This course is aimed for group leaders and sub-leaders in charge of direct field supervision of operations. It helps them to develop skills to face and solve situations and problems that may arise during operations under their supervision.

a.4 Course for Directors

This training will be for directors; the objective is to help them with their activities and help them to solve problems at the institutional and government level.

a.5 Public Relations

This course provides public servants with basic knowledge to help develop better manners that should be used to communicate with and to welcome all citizens. The public servants' behavior reflects the quality of the institution to the citizens.

a.6 Prevention of Criminal Acts

This course is directed to public employees to help them acknowledge the moral and ethical duties that they should take as public officials. This course will deal with the manners in which they should behave and how they should react when they encounter criminal and corrupt activities. Topics such as alcoholism, non-work related personal activities during office hours, tardiness, unjustified absences, corrupt activities such as sale or unauthorized removal of goods and materials belonging to the institution (oil, tires, batteries, spare parts, use of vehicles), accepting bribery in exchange for leniency towards transgressors, giving favors in contracts or purchases, etc.

b. Operations

The specific objective is to provide the institution and the personnel with technical and operational skills to improve the AMDC's SWM services in the following areas.

- Collection and haulage in urban and marginal areas
- Cleansing of roads and public areas
- Sanitary landfill operation
- Planning and development
- Control and monitoring
- Administration and finances
- Community relations
- Environmental education

To achieve these goals, training programs will be done in three manners:

- Short courses
- Service training
- Seminars and workshops

b.1 Short Courses

These courses will be done with the cooperation of academic institutions. By 1999, it is estimated that hundreds of individuals will be providing SWM services in all areas, e.g., collection, haulage, sweeping, final disposal, maintenance, administration, and finances. They will come from the private and public sector and, as a result, training should be provided to most public servants for the purpose of obtaining the best results. These courses will last approximately 20 hours in total.

Course 1: Planning and Control of SWM Activities

- Concepts on planning and control. Objectives and goals. Actions at different levels.
- Urban development (METROPLAN); population, urbanization, and income growth. MSW generation, characteristics, composition; waste reduction, reuse and recycling, market for recyclable materials.

- Operation planning in the short term, medium term, and long term. Routine and special activities.
- Control and planning of personnel, supplies and capital goods.
- Institutional budget, use of funds, and cost control.
- Quality control.
- Control and supervision of contracts with the private sector.
- Operation assessment and feedback.

Course 2: Collection and Haulage in the Marginal Area

- Primary collection. Community organization. Promotion, planning and technical assistance for micro-enterprises
- Container collection and haulage system. Routing, frequencies and schedule.
- Primary collection costs.
- Haulage to sanitary landfill costs.
- Service regulation.
- Occupational health.

Course 3: Collection and Haulage in the Urban Area

- Manner and type of discharge, containers.
- Routes, frequencies, and schedule
- Type of vehicle and collection.
- Personnel performance. Incentives.
- Operative costs and control.
- Service regulation.
- Occupational health.

Course 4: Street and Public Areas Cleansing

- Waste quantity and characteristics.
- Routes, frequencies, and schedule.
- Crew organization.
- Waste bins for public areas. Promotion and financing.
- Tools and equipment.
- Cost and control.
- Service regulation.
- Occupational health.
- Stormwater drainage system. Maintenance and cleansing.
- Quantity and type of waste collected.
- Coordination between sweeping and drainage system maintenance.

Course 5: Final Disposal

- Planning sanitary landfill operations.
- Access and weight control for MSW.
- Waste source and type.
- Machinery and equipment use.
- Compaction and cover.
- Stormwater control.
- Leachate and biogas control.

- Environmental impact control.
- Scavenger control and encouragement of their retirement from this activity.
- Operation cost and service regulation.
- Creation of an ecological park.
- Occupational health.

b.2 Training on Service

This training course is targeted to field officials (collection and sweeping workers), drivers, equipment operators, mechanics, supervisors, and engineers. The main objective is to provide the targeted group with the knowledge and the skills that are necessary to improve their daily work so that they become SWM experts.

The courses are categorized as follows: basic, intermediate, advanced, and directive.

For some officials training on SWM services in other countries will be included, in addition to specialized formal courses.

b.3 Seminars and Workshop

After a variety of short courses and training on services, seminars and workshops will be organized to instruct others of what was learned with relation to SWM improvement by the AMDC. In these activities, participation by other government and private institutions and NGOs will be encouraged.

Practical applications for SWM services based on the theory learned in short courses and training on service will be promoted.

c. Support Services

There are a number of activities that are necessary to be carried out to ensure support for SWM operations. A preliminary list of short courses should pay attention to:

- Preventive and corrective maintenance for vehicles and machinery.
- Safe driving techniques for drivers.
- Safety practices for collection, sweeping, and final disposal workers.
- Basic course on computer use.

12.4 Financial System

12.4.1 Required SWM Costs

Table 12-2 summarizes the overall costs required to implement the priority projects until 2003.

Table 12-2: Cost Summary of the Priority Projects

unit: 10³ Lps

Items	1999	2000	2001	2002	2003	Total
Investment						
Collection and Haulage	0	10,503	11,216	13,547	-	35,266
Street Sweeping	0	656	0	0	-	656
Final Disposal	6,332	12,164	0	2,961	-	21,457
Sub-total	6,332	23,323	11,216	16,508	-	57,379
O & M Cost						
Collection and Haulage	10,163	11,567	17,522	15,338	14,932	69,522
Street Sweeping	2,840	2,840	3,316	3,500	3,500	15,996
Final Disposal	3,997	5,334	5,491	5,214	6,542	26,578
Administration, etc.	2,550	2,961	4,739	4,329	4,495	19,074
Sub-total	19,550	22,702	31,068	28,381	29,469	131,170
Contracting Out						
Collection and Haulage	10,950	10,950	21,900	21,900	21,900	87,600
Street Sweeping	6,730	6,730	6,730	7,104	7,104	34,398
Sub-total	17,680	17,680	28,630	29,004	29,004	121,998
Total	43,562	63,705	70,914	73,893	58,473	310,547

a. Unit SWM Costs

Table 12-3 shows the estimated unit SWM costs for the priority projects. The costs up to 2000 exclude depreciation costs of vehicles and heavy equipment, while the costs between 2001 and 2003 include them.

Table 12-3: Unit SWM Costs

unit: Lps/ton

Items	1999-2000 average	2001- 2003 average	1999-2003 average
Collection & Haulage	175.4	249.4	224.6
Street Sweeping	920.2	974.6	953.3
Final Disposal	37.9	49.9	45.9
Administration etc.	N.A.	N.A.	N.A.
Total SWM Works	290.8	366.5	341.0

12.4.2 Projection of the Revenue through the Existing Waste Fee Collection System

The new fees for domestic waste were approved in July 1998; the basic rate rose from Lps3.75/property to Lps5.00/property and the highest rate from Lps25/property to Lps200/property. The changes in the fee rates is expected to generate a revenue of Lps 24.5 million in 1998.

The results of the self-assessment payment scheme for businesses (in early 1998) revealed that the waste fee, invoiced together with the business income tax, is expected to reach Lps20.1 million if the collection rate reaches 100%.

The following assumptions are adopted to project the revenue through the existing waste fee collection.

- For the domestic waste, the number of properties to be billed will increase in proportion to the population served. The fixed property values are revised for 2000 considering the growth of GRDP in 5 years (1.1 times the present value).
- For the commercial waste, the tax potential will increase relative to the increase in GRDP.

The following two cases of collection fee system and collection rate are considered to project the revenue under the present waste tariff system.

Case A The collection rate is gradually improved under the present waste collection fee system.

- Joint billing of residential waste fees and fixed property tax, with a gradual increase in collection rate from 48.7% (in 1998) to 63.1% in 2003.
- Joint billing of commercial waste fees and business income tax, with a gradual increase in collection rate from 73.8% (in 1998) to 81.3% in 2003.

Case B Statements will be issued together with the electricity bill starting from 2001 with a 90% collection rate.

Table 12-4: Revenue Projection for SWM

Items			1999	2000	2001	2002	2003	Total	
Residential waste	Population		882,322	917,104	953,257	990,835	1,029,895		
	No. of households*		160,422	166,746	173,319	180,152	187,254		
	No. of properties		130,751	135,708	157,372	163,419	169,698		
	Collection potential (10 ³ Lps)		32,107	36,506	42,086	43,399	44,746	198,844	
	Collection rate (%)	Case A	53.5	55.9	58.3	60.7	63.1		
		Case B	53.5	55.9	90.0	90.0	90.0		
	Revenue plan (10 ³ Lps)	Case A	17,177	20,407	24,536	26,343	28,235	116,698	
		Case B	17,177	20,407	37,877	39,059	40,271	154,791	
Non-Residential waste	GRDP (million Lps)		15,581	16,516	17,507	18,557	19,671		
	Collection potential (10 ³ Lps)		21,476	22,764	24,130	25,578	27,112	121,060	
	Collection rate (%)	Case A	76.3	77.5	78.8	80.0	81.3		
		Case B	76.3	77.5	90.0	90.0	90.0		
	Revenue plan (10 ³ Lps)	Case A	16,388	17,642	19,014	20,462	22,042	95,548	
		Case B	16,388	17,642	21,717	23,020	24,401	103,168	
	Total Revenue Plan (10 ³ Lps)		Case A	33,565	38,049	43,550	46,805	50,227	212,246
			Case B	33,565	38,049	59,594	62,079	64,672	257,959

Note: * one household is assumed to have an average of 5.5 family members.

The results of the projection reveal the following:

- In case A the total revenue from residential waste fees and non-residential waste fees amounts to only Lps 212.2 million, covering just 68% of the required SWM costs Lps 310.5 million.
- In case B, the total revenue amounts to Lps 258 million, covering just 83% of the required costs. It is still insufficient to sustain the cleansing services.

12.4.3 Examination of Waste Fee Collection System

a. Problems in Present Fee Collection System

Aside from a low collection rate, the present fee collection system has the following problems.

a.1 Problems in the Joint Billing with Fixed Property Taxes

- Almost all residents in the municipality discharge waste. The system, however, may be perceived as being biased against fixed property owners since they are the only ones who are obliged to pay. The willingness of tenants, who are indirectly responsible for the expenses, to pay for waste management expenses will decline.
- Joint billing with fixed property taxes, in accordance with the increase in housing cost, would make the collection of potential revenues difficult.
- The system is not related to a cleansing service level that reflects the characteristics of the area.
- As seen in many countries, the reappraisal of the property tax is often subject to government intervention, thus affecting waste fees indirectly.

a.2 Problems in the Joint Billing with Business Income Taxes

- The system is not related with a cleansing service level that reflects the characteristics of the service, the mean discharge amount, or the efforts of individual businesses to reduce waste volume.
- As can be seen from many countries, non-payments due to tax evasion, business reduction and bankruptcies are difficult to foresee.

b. Comparison of Waste Fee Collection System

Waste collection fees can either be collected individually or billed jointly with other municipal taxes or public utilities fees. For the latter, there are two types: one is where a single invoice is prepared, that may or may not detail the breakdown; the other is where two statements are issued – simultaneously – that the recipients settle at the same time. Table 12-5 shows the advantages and disadvantages of these three fee collection systems.

Table 12-5: Comparison of Waste Fee Collection Systems

	Advantages	Disadvantages
Individual collection	<ul style="list-style-type: none"> • This collection system clearly shows the recipients' willingness to pay waste collection service expenses. • Under this collection system, a fixed collection fee by service level can be established. • If this collection system is based on waste volume, it could strongly promote waste reduction. 	<ul style="list-style-type: none"> • The collection fee rates can be easily raised. • Measures against non-payment cannot be effectively implemented. (It would be difficult to terminate collection services)
Joint billing with	<ul style="list-style-type: none"> • Should make fee collection expenses 	<ul style="list-style-type: none"> • The billing work is complicated.

	Advantages	Disadvantages
breakdown	<p>cheaper. Effective against non-payment.</p> <ul style="list-style-type: none"> • Can encourage recipients to feel responsible for the waste collection expenses. • Under this collection system, a fixed collection system by service level can be established. 	
Joint billing without breakdown	<ul style="list-style-type: none"> • Should make fee collection expenses cheaper. Effective against non-payment 	<ul style="list-style-type: none"> • Would diminish recipients' willingness to pay waste collection fees. • Would make the establishment of a fixed collection system by service level difficult.

Most countries investigate the possibilities of joint billing for better collection rates and cheaper fee collection expenses. In the Central District, residential waste collection fees are jointly billed with fixed property taxes, and business waste collection fees with business income taxes. In spite the recognition that tax collection should be strictly enforced, the present collection rate only amounts to 48.7% thereby implying that the collection system is weak. As the same can be said of the collection rate for other taxes, leaving this problem unsolved would not improve the collection system.

c. Possibility of Joint Billing with Other Taxes or Public Utilities Fees

Table 12-6 shows the rough estimation of the number of tax and collection fee payers and the collection rate.

Table 12-6: Number of Fee Payers and Fee Collection Rate

	Tax & Utility Charges	Number of Domestic Payers	Present Fee Collection Rate	Comments
Residential Waste	Waste Collection Fee	property 125,000	about 55% of properties (about 50%)	
	Property tax	property 126,000	about 55% of properties (about 50%)	Will register over 9,000 properties
	Income tax (local)	275,000	about 30%	
	Electricity	200,000	almost 100%	
	Water supply	90,000	about 75%	
Business Waste	Waste tax	12,000	about 20% of payers (about 75%)	
	Sales tax (local)	12,000	about 20% of payers (about 85%)	
	Electricity	23,000	almost 100%	
	Water supply	5,000	almost 100%	

Note: () shows the present collection rate in terms of amount.

Based on the number of payers and the collection rate, the joint billing of waste collection fees with the electrical supply services would be the most attractive. The service currently contracts out their meter reading and invoice distribution services. If adjustments are successfully carried out in the invoice-issuing phase, no technical problems are foreseen.

12.4.4 Required Concept for the Waste Fee Collection System

A new waste fee collection system based on the most appropriate combination of the following policies is selected.

- Polluter-pays-principle (waste dischargers pay the SWM cost)
- Cross-subsidy mechanism (the affluent pay for the less well off)
- Minimization of waste fee collection costs
- Strong enforceability of the collection system
- Differentiate service levels in accordance with the amount of collection fee paid

A disposal fee will be imposed on direct waste hauliers.

12.4.5 Selection of the Best Waste Fee Collection System

A joint billing system with the electrical supply company was the most attractive alternative for three major reasons: it is a highly attractive system for collectors (strong enforceability); it is a relatively straightforward system; and it will be an extension of a system currently in place. First, electricity bills already have a fee collection rate of approximately 100% with over 200,000 households and 23,000 businesses being registered for payment. Therefore, the waste fee collection rate, thought joint billing, should equal the electricity payment rate with little effort. Second, it is easy to determine the different classification of residential sources from the electricity invoice amount (high income residents will tend to have higher monthly electricity bills), so that a waste fee amount comparable to residential income can be charged. And finally, by integrating the collection of fees into a system already in force will only help reduce the cost of waste fee collection.

The outline of the best waste fee collection system is as follows.

- a) Each invoice will be issued by both the Municipal Cleansing Corporation (MCC) and the ENEE.
- b) The billing service company (BSC) will issue and deliver the two invoices to a house or a business establishment at the same time.
- c) The invoice recipient will pay both fees at a bank or an ENEE branch.

12.4.6 Concept of the Revenue Sources for SWM Costs

In order to establish a financially sustainable SWM system, the following concepts of revenue sources shown in Table 12-7 will be introduced.

Table 12-7: Concept of Recovering SWM Cost

Costs	Payer	Comments
Residential waste	Residents	A cross-subsidy mechanism (the affluent pay for the less well off) is applied.
Non-residential waste	Business establishments	Covering the whole cost of collection, haulage, and disposal of waste.
Large waste amount (collection & haulage)	Large dischargers	Covering the costs of collection, haulage and final disposal for large waste amounts.
Direct haulage	Direct haulier	Covering the costs of final disposal.
Street sweeping etc.	High income residents and Business establishment	Included in the waste fees of in high-income residential areas and the waste tax of non-residential waste

12.4.7 New Fee System

For an accountable SWM system, it is necessary to clearly establish fees according to service level. A special collection fee will be imposed on houses or offices that demand additional services, such as door to door collection services in marginal areas or the haulage of large waste volumes. Table 12-8 shows the concept of the proposed revenue sources for services.

Table 12-8: Concept of Proposed Revenue Sources for Services

Service item		Service contents	Revenue source
Basic service		To haul waste from municipal collection points to the disposal and treatment facilities	Residential waste: waste fee set by the income level of houses. Non-residential waste: waste fee set by business income and waste collection service.
Special service	large amount	Waste collected from large dischargers	Waste fee in joint-billing with the above-mentioned tax or fee; the bill is delivered by BSC.
	door to door in marginal area	Collection from door or collection points in community to containers or municipal collection points	Waste fee set and collected by micro-enterprise, directly from the customers.

Table 12-9 shows the proposed waste collection fee rates.

Table 12-9: Proposed Waste Collection Fee Rates for the Priority Projects

Type of waste			unit		Fee Rate	
					2001-2002	after 2003
Residential waste	High income residents		Lps/house/month		63	70
	Middle income residents		Lps/house/month		22	33
	Low income residents		Lps/house/month		11	18
Non-Residential waste	Business waste	Annual business income more than Lps.4,000,000	Lps/establishment/month		500	
		Lps.3,000,001-4,000,000	ditto		450	
		Lps.2,000,001-3,000,000	ditto		400	
		Lps.1,000,001-2,000,000	ditto		250	
		Lps.500,001-1,000,000	ditto		200	
		Lps.300,001-500,000	ditto		150	
		Lps.100,001-300,000	ditto		100	
		Lps.50,001-100,000	ditto		75	
		up to Lps.50,000*	ditto		50	
	Large amount discharger		Lps/ton		480	
	Direct haulage discharger		Lps/ton		50	

Note: The basic business waste fee rate starts at Lps50/establishment/month.

12.5 Expected Revenue According to the New Rates

The expected revenue according to the proposed waste fee rates, issued together with the electricity bill, is as follows.

The fee potential for a hypothetical case, where the proposed joint billing of electricity charges and waste fees are introduced in 1998, and the actual fee potential for residential waste in 1998 are presented in Table 12-10. Table 12-11 illustrates a theoretical revenue for non-residential sources, if the waste fee system proposed in the master plan is introduced in 1998.

a. Residential waste

Table 12-10: Actual and Hypothetical Revenues from Residential Waste Fees for 1998

		Fee Potential for a Hypothetical Case in 1998	Actual Fee Potential for 1998 Under the Property Tax Joint Billing System
Total No. of Households		154,338	
High-income level	Population rate (%)	20	
	No. of Household	30,868	
	Collection Service Rate (%)	90	
	Collection Fee (Lps./month)	63	
	Fee Collection Rate (%)	90	
	Revenue Plan (10 ³ Lps.)	18,902	15,761
Middle-income level	Population rate (%)	30	
	No. of Household	46,301	
	Collection Service Rate (%)	80	
	Collection Fee (Lps./month)	22	
	Fee Collection Rate (%)	90	
	Revenue Plan (10 ³ Lps.)	8,801	5,413
Low-income level	Population rate (%)	50	
	No. of Household	77,169	
	Collection Service Rate (%)	60	
	Collection Fee (Lps./month)	11	
	Fee Collection Rate (%)	90	
	Revenue Plan (10 ³ Lps.)	5,501	3,366
Total (10 ³ Lps.)		33,204	24,540

Note: The billing for residential waste was issued combining the new fee and the old one.

b. Non-Residential Waste

Table 12-11: Hypothetical Revenues from Non-residential Waste Fees for 1998

Collection service	Business income (Lps/year)	Number of establishment (nos.)	Discharge amount (Ton/day)	Hypothetical Revenue (Lps/year)
Collected with other domestic waste	over 4,000,000	923	46.8	5,538,000
	3,000,001 to 4,000,000	207		1,117,800
	2,000,001 to 3,000,000	338		1,622,400
	1,000,001 to 2,000,000	651		1,953,000
	500,001 to 1,000,000	711		1,706,400
	300,001 to 500,000	968		1,742,400
	100,001 to 300,000	1,250		1,500,000
	75,001 to 100,000	593		533,700
	50,001 to 75,000	607		546,300
	25,001 to 50,000	1,253		751,800
	below 25,000	8,439		5,063,400
	Undeclared	N.A.		N.A.
Special collection service (large amount)	N.A.	20.0*	3,504,000	
Direct haulage	N.A.	23.4	427,050	
Total		15,940	90.2	26,006,250

Note: * Large amount is assumed to be 30% of the non-residential waste collected by AMDC.

c. Revenue Plan and Cash Flow

Based on the proposed waste collection fee, the cash flow was drawn under the following assumptions.

- The fee collection system proposed (joint billing with electric supply services) will be introduced in 2001 after the purchase of new collection vehicles.
- The proposed fees for non-residential sources will be introduced in 2001.
- The fee collection rate will rise up to 90% because of the joint billing system with electric supply services (with already a 100% collection rate).

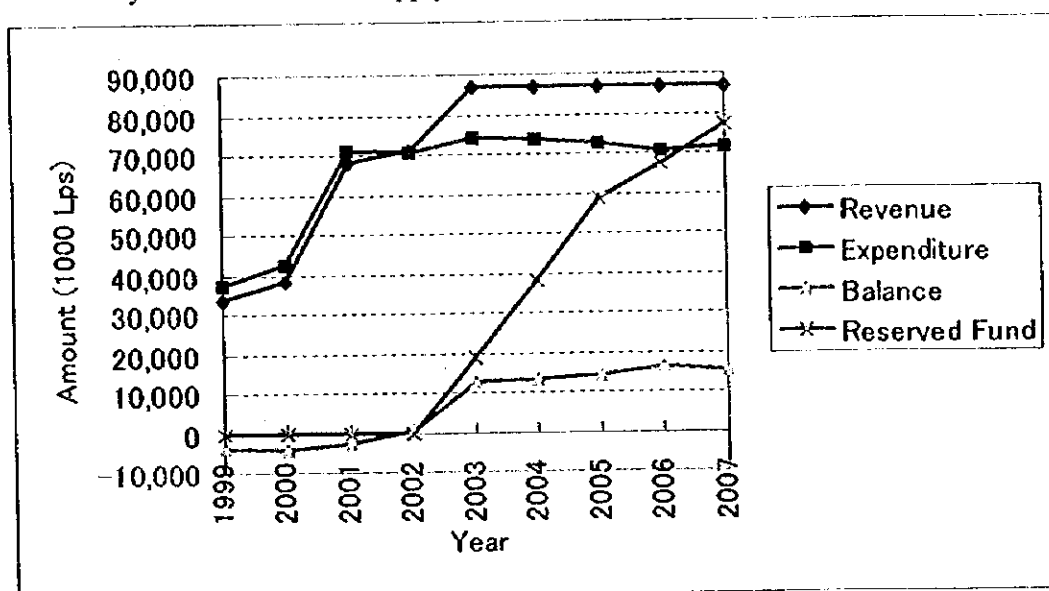
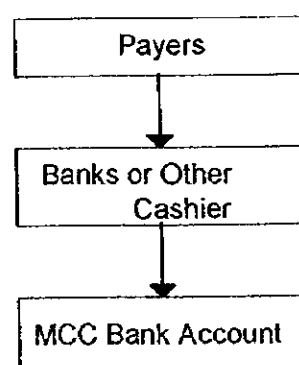


Figure 12-7: Cash Flow Diagram for Case 3 of the Priority Projects

12.5.1 Proposed Financial Stream System

When an autonomous organization is established, the financial stream should be as follows.

The Municipal Cleansing Corporation should monitor payments and immediately inform the payers when he or she does not pay the tax by issuing reminders for payment.



12.6 Transitional Institutional System

12.6.1 Solid Waste Management Executing Unit (SWEU) attached to the Mayor's office

a. General Objective

To immediately improve the management of Tegucigalpa's municipal solid waste.

b. Specific Objectives

Minor structural change of the municipality's organization with the objective to facilitate:

- Decision making
- Administrative transactions
- Collection service operations

c. Hierarchy

Similar to the PROMDECA, the SWM Executing Unit will undertake its operations directly within the Mayor's Office (refer to Figure 12-8 and Figure 12-9).

This hierarchic level will strengthen the decisions that should be taken to reorganize the service and to initiate the autonomous institution the study team is proposing.

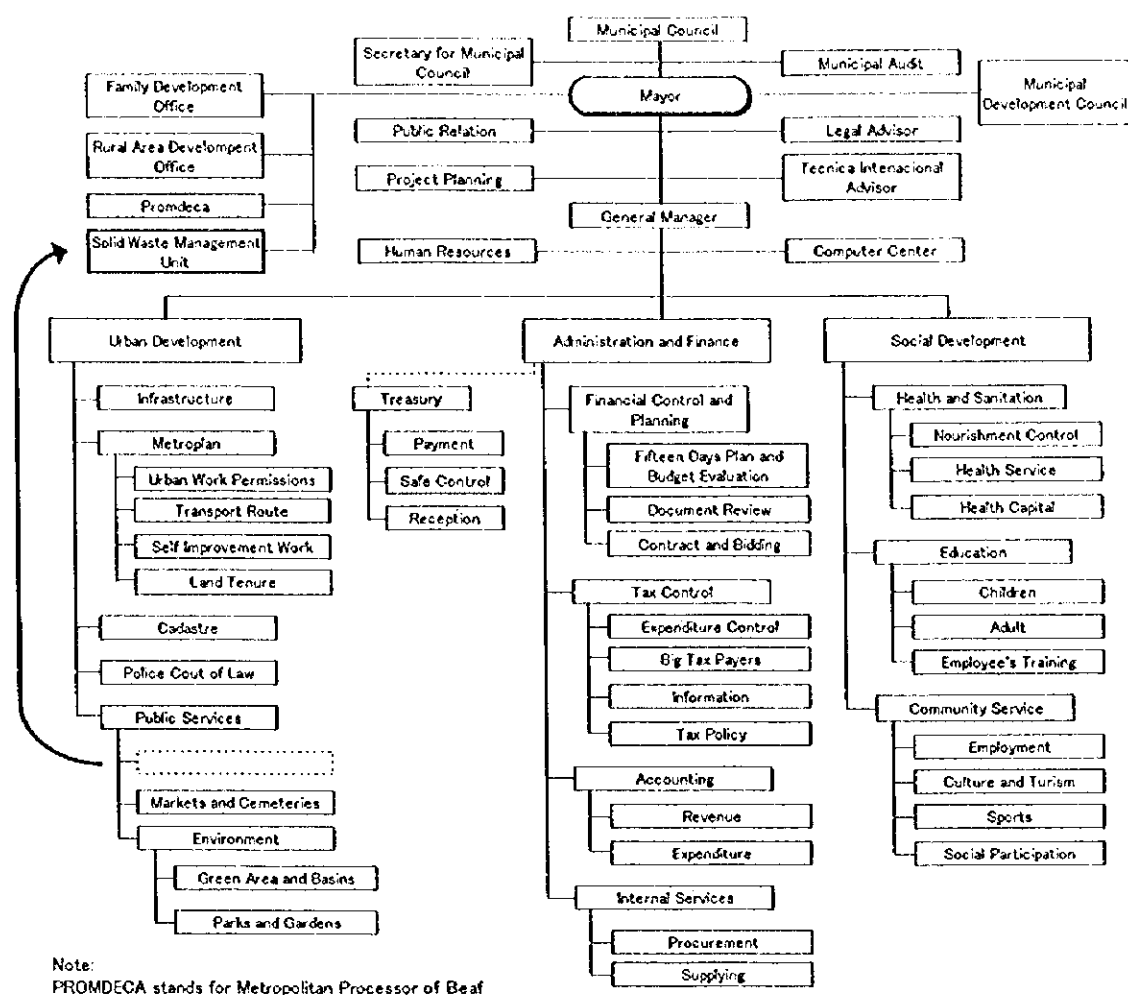


Figure 12-8: Proposed Change of the Cleansing Department in the Organization Structure of the AMDC

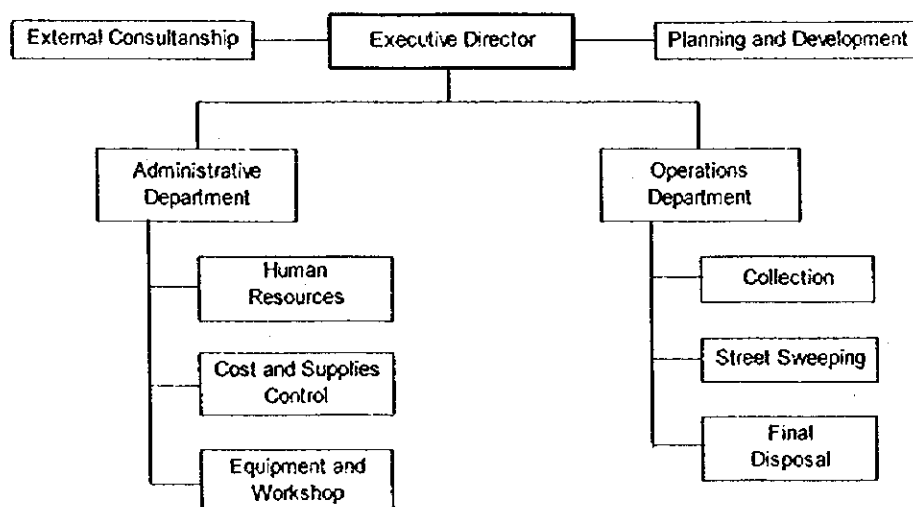


Figure 12-9: SWM Executing Unit

d. Proposed Structures

1) Executive Director

The Executive Director will direct all aspects from the Executing Unit (SWEU.) and resolve business matters directly with the Mayor.

2) Planning and Development

- Generates technical support
- Plans service expansion
- Verifies service quality
- Control execution of contracts

3) External Consultancy

The following is to be done in conjunction with an international cooperation agency that would delegate a resident expert:

- To assist and support the executive director.
- To give professional advice on the following areas: planning; development; operations; monitoring; and supervision. Also to give advice on the participation of the private sector.
- To train human resources on providing services.
- Institutional strengthening and reform.

4) Administrative Department

4.1) Human Resources

- To control the performance and the attendance of personnel.
- To assign duties to the personnel.
- To authorize payroll.
- To direct training programs.

4.2) Cost and Supplies Control

- To record and analyze operation outcome.
- To assess cost of operations.
- To propose benefit/cost adjustments.
- To determine supplies needed and to plan their acquisition.
- To request budgets and quotations.
- To assess and recommend offers.
- To receive and store supplies.
- To distribute and verify how supplies are being used.

5) Operations Department

5.1) Collection

- Management of the collection system for routes serviced by compactors and dump trucks.
- Management of the container system; cleansing and transportation of containers.

- Responsible for special services.

5.2) Street Sweeping

- Crew of municipal personnel.
- Crew of private enterprises working under contract.
- Maintenance and operation for garbage bins in public areas.

5.3) Final Disposal

- Dumpsite operation.
- Rehabilitation of the site to convert the area into a sanitary landfill.

12.6.2 Proposal for the Scheme for Private Sector Participation

The following points constitute the basis for the scheme for private sector participation.

- Satisfy pre-conditions shown in Table 12-12.
- Collection and Haulage system will be mixed (institutional and private sector) and linked to the financial conditions of the institution (payment per ton collected). Participation of the community to perform primary collection.
- Manual street sweeping will be contracted to micro-enterprises (payment per km swept).
- Sanitary landfill will be serviced by a contractor that will make use of machinery belonging to AMDC; this will take place between 4 to 5 years (remaining lifespan for machinery; payment will be made per ton disposed).

The rehabilitation works will be executed through a contract, for a specified amount, depending on the design and technical specifications.

Table 12-12: Wok Schedule

	Activity	1999	2000	after 2001
A	Pre-conditions			
1	Establishment of an Executing Unit (SWEU)	Immediately done Strengthen its activities. Negotiations for a new institution	Establishment of an autonomous institution	Establishment of an autonomous institution
2	Design for collection and haulage	Terms of Reference Contracting and execution	Strengthening planning and development	Strengthening planning and development
3	Design for a street sweeping system	Terms of Reference Contracting and execution	Strengthening planning and development	Strengthening planning and development
4	Design for the rehabilitation and the operation of a sanitary landfill	Terms of Reference Contracting and Execution	Strengthening planning and development	Strengthening planning and development
5	Equipment and workshops strengthening	Request for technical assistance Training and equipment provision	Training and equipment provision	Preventive maintenance is done by the institution. Corrective maintenance is contracted out.
6	Revenue control system	Agreement with ENEE	Identify the total No. of clients and improve revenues.	Establishment of a fee system
7.	Monitoring and supervision system	Select personnel	Training and initiates functions	High professional level
B	Private Sector Participation			
1	Contract A: Collection and haulage for urban areas		Bidding Foundations. First bidding will be for 25%	Gradually expand the involvement of the private sector's scope
2	Contract B: Collection and haulage for marginal areas	Begin promotion of community organizations	Expand coverage for primary and secondary collection	Coverage expansion continues.
3	Contract C: Street sweeping operations	Training for micro-entrepreneurs	Contract out all manual sweeping operation	Micro-entrepreneurs should be successful
4	Contract D: Sanitary landfill operations			
	Existing landfill site	Operation improvement. Weighbridge installation.	Contract out operation services. Initiate rehabilitation	Correct operations. sanitary landfill is rehabilitated. Ecological park
	Future landfill site		Identify appropriate sites for a new sanitary landfill	New sanitary landfill constructed (2004)

Chapter 13

Project Evaluation

13 Project Evaluation

13.1 Technical Evaluation

The technical system proposed in the priority projects and the master plan is essentially the same as the present system consisting of waste collection, haulage, and disposal. It will not include any major processing or treatment system except on-site composting, that does not require complex technology. This technical system would be suitable because it is consistent with the institutional requirements for the area, identified in the main report, and also with the main SWM objectives, i.e., improvement of sanitary conditions and prevention of negative environmental impacts posed by the implementation of SWM works.

a. Collection and Haulage

All proposed collection and haulage systems, including the compactor truck system, the hoist truck and container system, the arm-roll truck and container system, and the dump truck system, have been used in the Central District for over four years. Their previous exemplary performance records have proved that they are appropriate for the Central District in terms of the waste quality, the topographical features, the climate, the existing skills, etc. As of August 1998, all collection vehicles granted by the Japanese Government in 1993, i.e., 12 compactors, 10 dump trucks, 1 hoist truck, 1 arm-roll truck, are still operable except one compactor, which was written off in a traffic accident. This implies that there are no technical problems predicted in the proposed collection and haulage system.

A collection system using large communal containers is currently used as collection points for street sweeping waste. The master plan proposes to apply this system for marginal areas so that residents living in inaccessible areas can carry their waste to containers. Whether the operation of this proposal will be a success depends on the neighborhood's cooperation and the accessibility of container trucks. The applicability of this system has been demonstrated through the implementation of this system in the pilot project, as a part of this study, in Colonia San Martin, Tres de Mar and Ayestas. The pilot project demonstrated that a hoist truck for a 5.5 m³ container can access relatively broad areas in marginal districts where road conditions are very poor. Therefore, in order to minimize the costs, the master plan proposes a combination of hoist trucks (for 5.5 m³ containers) and arm-roll trucks (for 10 m³ containers) as the collection and transportation system for marginal areas in order to minimize the cost.

The container system requires special attention because its improper use would affect the entire SWM system. If containers are used in residential or commercial areas, people may discharge their waste generated through business activities into them. This not only will increase the discharge amount of residential waste, but will also introduce industrial waste, such as construction waste, into the residential waste flow. Also this will lead to the loss of opportunity to earn special waste fees for large amount dischargers and for direct haulage. The container system will also encourage people to discharge more waste because it is very convenient for them to use these containers. Because it is essential to control the possible negative impacts of this

system, the master plan proposes the container system only for marginal areas, where residents can supervise the containers, and for collection points for street sweeping wastes, carefully supervised by the authority responsible for SWM.

b. Final Disposal

The master plan proposes immediate soil coverage and re-circulation of leachate in the existing disposal site as main technical improvements. The reasons why immediate soil coverage is not carried out at present, in spite of soil and equipment availability, are: 1) scavengers disturb the soil coverage works; 2) lack of funds to purchase enough diesel for landfill equipment; 3) lack of awareness on final disposal methods; and 4) lack of technical knowledge.

The institutional master plan proposes a solution for the second cause in detail. For the first, the third, and the fourth causes, possible solutions were, as a part of pilot projects in this study, demonstrated in the on-the-job training programs, the raising awareness campaign, and the improvement of scavenger management. The AMDC and the MCC is required to expand these experiences and to develop an appropriate system in line with the institutional master plan, carrying on the learning process to solve these problems over executing the final disposal operation.

c. Maintenance Workshop

The repairing capacity of the Cleansing Department's workshop has improved through repairing machinery granted in 1993 by the Japanese Government. The fact that all collection vehicles granted in 1993, except one compactor, are still operable as of August 1998 – after four years and eight months – has proved that its repairing capacity is sufficiently adequate.

The existing problems of repair works (long repair period) is attributed to the inappropriate administrative system. The institutional master plan proposes to solve these problems in detail.

d. Human Resources

The total number of people required for SWM works in 2010 will be more than double the current number. The master plan, therefore, proposes to extend the involvement of the private sector to control the number of employees required by the MCC; the aim is to maintain the Cleansing Department's present level of SWM employees.

The master plan proposes to shift the public sector's role in SWM works from actual physical engagement to control and supervision. The institutional master plan, therefore, proposes an education plan to train the required staff.

13.2 Social Evaluation

Since the master plan would pose various social impacts, it was evaluated in terms of intangible social impacts as listed below.

Negative Impacts:

- Loss of livelihood for scavengers.
- Loss of employment for staff currently employed at the Cleansing Department initiated by the expansion of the private sector's involvement.
- Rise in the waste collection fee rates.
- Uneven wealth distribution caused by the expansion of the private sector's involvement.

Positive Impacts:

- Improvements in public health and sanitary conditions.
- Prevention of flooding.
- Promotion of foreign investment and tourism.
- Increase in land value.

a. Mitigation Measures to Predicted Negative Impacts

a.1 Loss of Livelihood for Scavengers

The master plan proposes to prohibit the entry of unauthorized persons into a disposal site in 2008 to improve the sanitary and environmental conditions of disposal sites. If this is enforced suddenly, this will abruptly deprive the scavengers, who work in a disposal site, of their livelihood. The master plan proposes to take a few measures to minimize this kind of social impact prior to the entry restrictions. The first step is to introduce a recycling system at generation sources, which aims at diverting the current predominantly informal recycling activities to the formal recycling activities. The second step is to establish a manual sorting plant to be placed near a disposal site; this will create job opportunities for scavengers who will be employed as sorting workers.

a.2 Loss of Employment for Staff Currently Employed at the Cleansing Department initiated by the Expansion of the Private Sector's Involvement

The expansion of private sector's participation into the SWM works would reduce the role of the public sector and its work load. It would result in unemployment for some of the current Cleansing Department employees if the private sector's participation is expanded without a proper program.

The master plan proposes the MCC to retain the capacities to conduct some SWM operations directly. For collection and haulage, the master plan proposes the MCC to retain the capacity to do at least 25% of the entire collection and haulage works. The proposed required collection and haulage capacity for the MCC until 2010 is around 250 ton/day, almost same as the present capacity of the Cleansing Department. Therefore, the expansion of the private sector's participation will not result in layoffs for the present employees.

For street sweeping, the private sector has already become involved in street sweeping work since March 1998. As of August 1998, there were about 100 workers, employed

by the Cleansing Department, and about 300 workers, employed by micro-enterprises that are contractors to the Cleansing Department. The master plan proposes the MCC to retain the capacity to undertake 20% of the entire street sweeping. The required number of street sweepers employed by the MCC will then be 95 persons in 1999. Therefore, the impact will be negligible.

a.3 Rise in the Waste Collection Fee Rates

The master plan proposes to raise the present waste collection fee rate because the increase of the revenue for SWM works is the top priority issue in the master plan. Although this would increase the financial burden on citizens, the master plan, to minimize negative impacts, has taken the following considerations into account.

- a) To introduce the cross-subsidy mechanism (i.e., the affluent pay for the less well off).
- b) To keep the proposed rate below the amount that people are willing to pay (WTP).
- c) To keep the proposed rate below 1.0% of the resident's income.

Table 13-1 compares these amounts.

Table 13-1: Proposed Waste Collection Fee Rate for Residential Waste

Income Level Group	unit: Lps/month/household		
	Proposed Rate	Willingness to Pay	1.0% of Income
High Income Residents	70	40	69
Middle Income Residents	33	30	32
Low Income Residents	18	20	20

The master plan proposes the rate for high income residents to be higher than the amount they are willing to pay because it was deemed that they can afford to pay more as the WTP is far below 1% of the average income.

a.4 Uneven Wealth Distribution caused by the Expansion of the Private Sector's Involvement

Without careful consideration, further participation of the private sector would affect the distribution of wealth by creating a monopoly. For instance, because of previous experiences in SWM works and exemplary performance records, one company could be awarded more than one contract by the MCC. Also, if the contract requirements are stringent or demand that the contractor has a large amount of resources to enter the bid, it could become increasingly difficult for small and medium operators to enter the competition fairly. The outcome of both these hypothetical cases is a monopoly and a wealth distribution biased toward only a few companies that are rich and successful.

Therefore, the master plan proposes to restrict the size of each collection and haulage contract to 50 ton/day to give micro-enterprises more opportunities to enter the competition.

b. Predicted Positive Impacts

b.1 Improvements in Public Health and Sanitary Conditions

The implementation of the project will bring various benefits. Poor collection or disposal practices encourage the breeding of insects, rodents, and pathogens that can cause and transmit diseases, particularly several diseases found in the tropical cluster: viral encephalitis; trypanosomiasis; and Bancroftian filariasis. Since the master plan intends to mitigate the effect of such diseases by the elimination of waste heaps and the introduction of sanitary landfills with proper facilities, considerable improvements in public health and in disposal sites can be anticipated; conditions in nearby illegal dumping sites are also assumed to improve considerably.

The number of people who will benefit from refuse collection services by the implementation of the project is approximately 600,000.

b.2 Prevention of Flooding

Inadequate collection and transport of wastes may also clog open drains, creating breeding grounds for malaria and dengue-transmitting mosquitoes, or causing floods in rainy seasons, which may increase the chance of human contact with pathogen-infected feces contained in the waste. The master plan will significantly mitigate the dangers these situations may bring about through the promotion of regular road sweeping services.

b.3 Promotion of Investment and Tourism

In addition to the above-mentioned health effects, proper collection, transport and disposal of wastes shall provide the Central District with a favorable environment for the promotion of foreign investment and tourism. Since the Central District is the capital of Honduras, the improvement of its environment will enhance its image and eventually contribute to attracting more investors and tourists to the area.

b.4 Increase in Land Value

Well-managed waste disposal services also improve the living environment which result in increased land values. A study on the relationship between the living environment and land value suggests that, other factors held constant, housing values with distance from a landfill rise at an average rate of 6.2 % a mile within a two-mile radius of the landfill, presumably because the environmental and aesthetic problems associated with living near a landfill diminish as distance from it increases¹. Thus, the master plan, with the proper sanitary landfilling measures, increases the land value around the present illegal dumping sites and the disposal site.

¹ Beede, D.N. and Bloom, D.E. 1995, *The Economics of Municipal Solid Waste*, The World Bank

13.3 Environmental Evaluation

Table 13-2 summarizes the impacts that are predicted to occur with the implementation of the SWM master plan.

Table 13-2: Summary of the SWM Master Plan Environmental Evaluation

Project	Components	Positive Impacts	Negative Impacts
Increase in Waste Collection Rate	Waste Collection	<ul style="list-style-type: none"> • Improvement of sanitation and cleanliness <ul style="list-style-type: none"> ⇒ Mortality and morbidity ⇒ Promotion of tourism ⇒ Promotion of business • Improvement in air quality • Improvement in water quality • Removal of offensive odor • Improvement in aesthetic conditions • Reduction of public nuisance • Less contributors to global warming • Creation of job opportunities 	<ul style="list-style-type: none"> • Air pollution • Noise pollution
	Haulage	<ul style="list-style-type: none"> • Creation of job opportunities 	<ul style="list-style-type: none"> • Increase of traffic <ul style="list-style-type: none"> ⇒ Air pollution ⇒ Global warming ⇒ Traffic accidents ⇒ Congestion of traffic ⇒ Consumption of fossil fuel
Improvement of the Disposal Site	Landfilling	<ul style="list-style-type: none"> • Improvement of sanitation • Reduction of landfill gas <ul style="list-style-type: none"> ⇒ Less air pollution ⇒ Less contributors to global warming • Reduction of leachate <ul style="list-style-type: none"> ⇒ Less water pollution • Improvement in aesthetic conditions • Increase of land price • Reduction of public nuisance • Creation of job opportunities 	<ul style="list-style-type: none"> • Increase of equipment <ul style="list-style-type: none"> ⇒ Air pollution ⇒ Noise ⇒ Vibration ⇒ Consumption of fossil fuel

a. Waste collection work

a.1 Positive Impacts

Improvement of Sanitation and Cleanliness

Waste collection services improve sanitation and cleanliness in the waste catchment area, because waste is closely related to public health. The public health problems associated with solid waste fall into two categories: disease carried by vermin; and the physical and chemical hazards resulting from certain components in solid waste. Discharged solid waste provides food and habitat for rats, flies, and mosquitoes. Food wastes attract these insects and rodents, and the debris associated with the refuse provides shelter as well as breeding environments. Therefore, the population of vermin can be expected to increase if waste is not managed. Broken glass, rusty metals, household pesticides, solvents, etc., are the source of chemical and physical hazards associated with solid waste. Primary effects are therefore improvement of

sanitation and cleanliness. An improvement in morbidity and mortality rates is a secondary benefit.

Promotion of tourism and business

Improvement of sanitation and cleanliness would attract visitors to the area such as tourists and shoppers (consumers).

Improvement of air quality

Methane (CH₄) and carbon dioxide (CO₂) are generated mainly through the decomposition of organic solid wastes. The gravity of this impact may not be recognized because only a small volume of gas is dispersed in a wide area. When these gasses are emitted at the generation sources or at the landfill, however, the total pollutant load of the emission gas will be the same, i.e., they would still affect air quality.

Improvement of water quality

Where waste collection services are absent, wastes are often disposed of at small open spaces or at rivers and drain near the generation points. Wastes disposed of at small open spaces will produce leachate and pollute surface and ground water. Wastes disposed of into rivers will pollute river water.

Removal of offensive odor

Removing wastes from the waste catchment area will remove the causes of offensive odor.

Improvement of view

Wastes scattered will be removed from the waste catchment area, so the scenery will improve.

Less contributors to global warming

Waste that emit methane and carbon dioxide (major green house gases) through biodegradation will be removed from the waste catchment area.

Creation of job opportunities

Expansion of the waste collection service area creates job opportunities for collection workers, drivers, mechanics, etc.

a.2 Negative Impacts

Air pollution

Air quality would be affected by emissions from vehicles, such as carbon dioxide, carbon monoxide (CO), oxides of nitrogen (NO_x), and total suspended particulates (TSP).

Noise pollution

Heavy equipment and waste collection vehicles would generate noise.

b. Transport of waste from the catchment area to the landfill

b.1 Positive Impacts

Creation of job opportunities

Waste transport work creates job opportunities for drivers, mechanics, etc.

b.2 Negative Impacts

The aggregate impact of vehicle movements associated with transport includes air pollution, global warming, damaging of roads and underground utilities, traffic accidents, congestion of traffic, and consumption of fossil fuel. They are all negative impacts.

Air pollution

Air quality would be affected by emissions from vehicles, such as carbon dioxide, carbon monoxide (CO), oxides of nitrogen (NOx) and total suspended particulates (TSP).

Global warming

Carbon dioxide emitted by vehicles would contribute to global warming.

Traffic accident

Operation of vehicles may cause traffic accidents and may cause casualties, traffic congestion, etc., as a secondary impact.

Traffic congestion

Operation of vehicles would increase traffic volume and it would cause traffic congestion. It would cause the loss of travel time for other road users and possibly affect the flow of goods that are transported by road.

Consumption of fossil fuel

Transport vehicles will consume fuel which is a nonrenewable resource.

c. Sanitary landfill

c.1 Positive Impacts

Improvement of sanitation

Since this landfill site is equipped with best environmental protection technologies, such as landfill gas control, it will provide workers with better working conditions. It would decrease both health and occupational hazards for landfill workers.

Reduction of landfill gas release

Landfill gas control systems reduce emission of landfill gases that would cause an impact on air quality and would contribute to global warming. Landfill gas control systems will create the following secondary effects.

- Less air pollution
- Diminish the progression of global warming

Reduction of leachate

Leachate control systems control leachate, that would pollute surface and ground water in the surroundings, generated from landfills. Thus, it will reduce water pollution.

Improvement in aesthetic conditions

By providing litter prevention nets, planting trees, and providing turf on the slope to prevent waste from scattering, the aesthetic conditions will improve.

Creation of job opportunities

A sanitary landfill creates job opportunities for construction workers, equipment operators, etc.

c.2 Negative Impacts

Increase of equipment use

The increased use of equipment would cause air pollution, noise, vibration, and consumption of fossil fuel.

d. Conclusion

The improvement of collection rate will generate various significant positive impacts on the waste catchment area. These impacts will outnumber the negative impacts that will result from an increase in the use of waste collection vehicles.

As for the improvement of the final disposal, it will significantly mitigate the existing negative impacts. This benefit will outnumber the negative impacts that will result from an increase in the use of heavy landfill equipment.