D.5 Institutional, Legislative, Financial and Management System

D.5.1 Institutional System for SWM

a. Organization of the Public Sector in the Republic of Panama

The sovereign power emanates only from the people, pursuant to the political constitution, by means of three state powers: the legislative branch, the executive branch and the judiciary branch, each one of which act independently from each other, yet maintain a harmonious cooperation.

It also has six additional independent bodies with the following duties: The *Contraloría General de la República* [Comptrollership General's Office of the Republic; auditing of public funds], *Ministerio Público* [Prosecutor's Office; defense of the state's, municipalities and citizens' interests], *Ente Regulador de los Servicios Públicos* [Regulating Entity of Public Services; proper rendering of public services] and the *Tribunal Electoral* [Electoral Court] and the *Fiscalía Electoral* [Electoral Auditors' Office] (oversee the liberty, integrity and efficacy of the people's suffrage).

Two additional independent stand out as well: the *Comisión de Libre Competencia y Asuntos del Consumidor* [Free Competition and Consumer Affairs Commission; allows free competition, battles monopoly and orientates the consumer] and the *Superintendencia de Bancos* [Bank's Superintendence Office; regulates the nation's banking system].

b. Legislative Body

The legislative branch is constituted by an association known as the Legislative Assembly, a professionalized body formed by seventy two (72) legislators, elected by popular voting for a five (5) year period that represent the electoral circuits outlined by law; and the Permanent Commissions established by the Organic Regulation of the Internal System.

The main activity of this body is the issuance of the required laws for the compliance of the aims and the exercise of the State's functions as laid out in the Political Constitution. In addition to the legislative functions, it also has judicial duties, such as getting acquaintance of accusations or claims against the President of the Republic, judges from the Supreme Court or members of the Legislative Assembly, who can be judged by this entity.

Legal Framework

Political Constitution reformed by the 1978 Reformatory Acts, the 1983 Constitutional Act and the Legislative Act 1 of 1993 and Act 2 of 1994.

c. Executive Body

It is constituted by the President of the Republic and the State Ministers. The main functions of the Executive power are the planning, guidance, programming, directing, execution, control and evaluation of a set of activities encompassing economic, social, infrastructure (garbage and waste treatment, among others), politics and sovereignty.

To carry out its duties, the Executive branch has two main structures: the Central Government and Decentralized Institutions.

The Central Government area is constituted by the Presidency of the Republic, the Cabinet Council, the Advisory Commissions of the Executive Power, and the eleven (11) ministries. National public policies are dictated in this area.

The area of Decentralized Institutions is formed by all the autonomous and decentralized public institutions, public companies and financial mediators, which are responsible for the execution of governmental functions in accordance with the policies outlined.

Both areas develop programs, projects and also render public services.

d. Judiciary Body

It has the purpose of testifying, applying and enforcing the law through the independent and impartial proceeding of all its officials. Its principal task is the exclusive authority to judge and promote the execution of what is being judged, by means of the Supreme Court of Justice and the remaining ordinary and special courts.

Legal Framework

Political Constitution of the Republic, 1972. Reformed by the 1978 Reformatory Act and the 1983 Constitutional Act and the Legislative Acts 1º, 1993 and 2, 1994.

e. Independent Bodies

There exist nine (9) independent bodies: the Free Competition and Consumer Affairs Commission, the Comptrollership General's Office of the Republic, the *Defensoría del Pueblo* [People's Legal Aid Office], Regulating Entity of Public Services, the Electoral Auditors' Office, the Prosecutor's Office, the *Procuraduría de la Administración* [Administration Attorney's Office], the Banks' Superintendence Office and the Electoral Court.

f. Province System

Government

Provinces are political divisions constituted by the territory allocated to them by the laws and are the limitation areas for the governments. The governor is the representative from the Executive Power at his/her respective province, and has the responsibility of inspecting and coordinating the duties of public entities; likewise, he/she is the maximum authority within the province and head of police matters. The legal background of governments is outlined by the 1972 Political Constitution of the Republic and its reforms.

Provincial Council

A consultation body for the governor of the province, the provincial authorities and national authorities in general. Once the recommendations from provincial councils are approved by the Executive Body, their compliance will become compulsory. The provincial council has the power to forward bills.

The *Corregimiento* representatives (being the *corregimiento* the smallest political territorial unit) for the respective province (with opinion and voting), the governor, the district Mayor and the councilmen (opinion only) are members of the provincial council. The legal background for the provincial council is outlined by the 1972 Political Constitution of the Republic and its reformations.

g. Municipal System

The municipality is the community's autonomous and political organization within a district. The municipal organization will be democratic and will function in accordance with the administrative nature of the local government. Its main duty is to foster the development of the community and the achievement of social well-being.

Municipal Council

Each district has an assembly known as the Municipal Council, which is formed by all the *Corregimiento* representatives and, such being the case, by the councilmen at those districts with less than five *corregimientos*. The municipal council regulates the juridical life of municipalities by means of enforceable agreements and resolutions within the respective district.

Exclusive Jurisdictional Functions

To formulate, together with the Mayor and the participation and advise from the Ministry of Economy and Finance, the development policies for the districts and *corregimientos*, among

others, that can be related to the current study: to create municipal or mixed enterprises to exploit goods and services; to foster the formalization of contracts with public or private entities to create municipal or mixed enterprises, with the aim of exploiting goods and services; to set taxes, contributions, duties, fees and rates; to authorize and approve the formalization of contracts on concessions and other means to render municipal public services; to establish and regulate the urban and domestic cleansing service of the villages, and provide the means to utilize the waste and residues; to pronounce measures to protect and preserve the environment.

District's City Hall

Its main functions related to the current study: to lead and coordinate the waste collection works in the district; to oversee the maintenance and improvement of the physical working conditions with respect to infrastructure, equipment and working materials; to establish, coordinate and guide municipal public services; to collaborate in the protection of the environment.

***Corregiduría* (Police Station)**

It is the minor police entity for the local government and headquarters for the *Corregidor* (police commissioner). Its purpose is to preserve the public order by supporting civil and police duties undertaken by the district's Mayor.

It oversees the compliance with the sanity and ornament in the *corregimiento*.

The police commissioner is the police chief, member of the communal board and representative of the Executive branch in the *corregimiento*. One of his main attributions is to support the communal board to preserve the environment.

h. Communal Boards and Local Boards

Communal Boards

Each corregimiento will have a communal board, which will foster the organization and actions of the community to promote their social, economic, political and cultural development, and it will oversee for the solution of its problems as well. These organizations represent the people living in the *corregimientos*. They have a legal status conferred by the Mayor through a resolution.

Within its functions, this board actively participates in programs and works related to the development of the community; it fosters the sense of community and solidarity among the neighbors; it obtains the services, counseling, equipping and other means required for the

development of its activities; it promotes the development of the *corregimientos* by means of communal backup; and it coordinates the activities of local boards.

The *corregimiento* representative acts as chairman, the police commissioner and five representative citizens living within the *corregimiento*, who will be assigned by the *corregimiento* representative, are all members of the communal board.

Each *corregimiento* will choose a representative and a substitute through a direct public vote for a five-year period, these representatives stand for the people's expression from the *corregimiento* and the authorities will treat them with the proper respect and deference.

Powers of the *Corregimiento* Representative

The following are the representative's powers: to chair the communal board and represent it in legal terms; to appoint the five members of the communal board, pursuant to Art. 248 of the Political Constitution; to take part in the provincial and municipal council with opinion and vote; to represent the communal board before national and municipal authorities; to outline the *corregimiento* needs for their assessment and solution.

Local Boards

They cooperate with the communal boards to study neighborhoods, police stations or areas and conduct the required public works to solve them. They do not have a legal status.

Among its functions are the following: to spot problems in the community and motivate its dwellers to express their needs, ambitions, and resources so that they can cooperate to their own development; to raise, and maintain, the required attitude among the members of the community to allow them to work together in the solution of their problems; to prepare programs for the conduction of the communal and cooperation works among neighbors.

The local boards will have a directive board whose members will be elected by means of lists by the community. Each local board will appoint a spokesman to perform before the corresponding communal board. People beyond the age of 16 that live in the community can participate in local boards.

i. Institutions with Jurisdiction in SWM

The following are state institutions with competency in Solid Waste Management.

i.1 Central Government

i.1.1 Ministry of Health

Legal Background

Cabinet Decree No. 1, dated January 15th, 1969, which creates the Ministry and determines its structure and functions; Decree No. 75 dated February 27th, 1969, which establishes the Organic Law; Resolution No. 276 dated July 9th, 1998, which institutes the new Organic Structure; Resolution No. 334 dated August 13th, 1998, which institutes the Organic Structure of the Existing Regional Health Systems.

Purpose

To develop the health guidelines by means of the outlining and execution of health policies and strategies, and to carry out the actions for the rendering of services to the population and the environment; to prevent, remedy, repair and rehabilitate the people's and environmental health, as well as their promotion surveillance and regulation.

Principal Functions Associated with SWM

To formulate, coordinate, lead and execute the policies and activities from the Health Sector at a national level; to constantly update the set of laws that regulate the activities of the health sector and oversee its inter and intra-institutional relations.

Functions of the Administrative Units Entailed to SWM

International Affairs

To act as a means for the development of health policies for the Ministry of Health and the health sector; to serve as a link between the relations or communications with international organizations and countries, in order to channel resources and information for the benefit of the country.

National Policies Office of the Health Sector

To ensure the formulation and evaluation of public policies and health strategies for the people and the environment, with the participation of all the levels within the organization, of public, private, inter-sector and external sector institutions, the community and NGOs that shape the National Health System.

General Health Office

To elaborate the regulations and juridical and technical procedures for the development of programs from the National Health System for the population and the environment; to supervise and assess the compliance of population and environmental sanitary regulations.

It has the following administrative units to develop its duties: General Assistant Offices of Population's Health and Environmental Health.

General Assistant Office of Environmental Health

To direct and elaborate all the juridical and technical regulations and procedures for the development of integral environmental health programs through the entire National Health System; to review, update and permanently validate the technical and juridical regulations and procedures for the development of environmental health activities and programs, based on scientific evidence; to oversee and assess the compliance with the existing environmental health regulations; to establish the surveillance systems of protection factors and physical, chemical, biological, psychosocial and cultural risks to achieve effective sanitary interventions in the natural and social environment in which population dwells.

To fulfill its functions, it has the following administrative units: Vector and Animal-transmitted Disease (*Zoonosis*) Control Departments; Quality of Water; and Sanitary Quality of Environment.

i.1.2 Ministry of Economy and Finance

Legal Background

Law No. 97 dated December 21st, 1998, which creates the Ministry of Economy and Finance; Law No. 6 dated February 3rd, 1997, which dictates the Regulatory and Institutional Framework to Render the Public Electricity Service; Executive Decree No. 1 dated January 18th, 1999, which adopts the organic structure of the Ministry of Economy and Finance (MEF) for temporary purposes.

Purpose

To integrate and develop the duties related to public investing, budget, public revenues and national treasury, public credit and modernization of the state, which will ease the formulation and adoption of economic, financial and social policies, as per the reality of the country, that drive the country's social and economic development to the maximum extent.

Principal Functions Associated with SWM

To formulate initiatives in regards to economic policies; to schedule public investments and social strategies; to modernize the state.

Functions of the Administrative Units Entailed to SWM

Department of Technical International Cooperation

To identify, pursuant to public institution requirements, the need for external technical cooperation; to set up a multi-annual technical cooperation program, according to the priorities set forth by national and sector development plans; to arrange the provision of technical cooperation and recommend top priorities in agreement with the National Development Plan and/or governmental programs.

Technical Unit of Public Policies

To work as a liaison among the Ministry, the international financial institutions and international cooperation organizations for the follow-up of targets and actions of the country's Economic Program.

Coordinating Unit for the Privatization Process

To coordinate and follow up the different stages of the privatization process and make recommendations to top levels on interesting issues of the process; to coordinate the diverse national and international public acts that convey the transferal of goods or services to the private sector, in accordance with the regulations set forth by the Fiscal Code and the respective set of laws.

Office of Social Policies

To prepare and promote surveys, analysis and research that prepare the grounds for the formulation of governmental policies linked with social development and arrangement; to propose managing modalities and strategies that render the implementation of social policies feasible.

To conduct its functions, it has the following administrative units: Assistant Office of Social Policies, Research and Social Studies Departments; Social Policies and Coordination; Social Information and Evaluation; and Strategic Social Administration.

General Cadastre Office

To conduct the cadastre study of the entire territory of the Republic and oversee its maintenance and updating; to make an inventory and appraisal of all the real estate,

regardless of its nature and definition. Among its administrative units, it has an Appraisal and Cartography Department.

i.1.3 Ministry of Public Works

Legal Background

Law No. 68 dated June 7th, 1904, which modifies the name of the Secretariat of Public Works to the Secretariat of Fomentation; Executive Decree No. 656 dated July 18th, 1990, which establishes the new administrative framework of the Ministry of Public Works.

Purpose

To develop the programs and implement the construction and maintenance policies of the nation's public works and ground transportation.

Principal Functions Associated with SWM

To exercise the administration, coordination, supervision and execution of policies, plans, programs and budgets aimed at the construction and housekeeping of public works and the Ground Transportation Plan at a national level.

Functions of the Administrative Units Entailed to SWM

Tommy Guardia National Geography Institute

To carry out the cartographic and geophysical surveys and national geographic research. It has an administrative unit called Geographic Information Systems, among others.

National Maintenance Office

To implement the construction and maintenance policies and programs.

National Office of Ground Transportation

To implement the policies and the Ground Transportation Plan at a national level. Among its administrative functions we have the Traffic Measures and Freight and Traffic Flow Control and the Executive Office of Road and Traffic.

i.1.4 Housing Ministry

Legal Background

Law No. 9 dated January 25th, 1973, which creates the Housing Ministry; Resolution No. 26 dated February 21st, 1994, which rearranges its administrative structure.

Purpose

To establish, coordinate and ensure the execution of the housing and urban development policies at a national level, with the purpose of providing this right to the entire population, especially low-income sectors.

Principal Functions Associated with SWM

To lay out develop policies, plans, regulations and actions that foster and/or ease the development of housing projects and to regulate urban development.

Functions of the Administrative Units Entailed to SWM

General Office of Urban Development

To propose laws and regulations on urban development and housing; to recommend the approval of housing and urban development plans in the country, both private and public; to prepare the plans for the harmonious and methodical development of the country's urban centers.

Among its administrative units we have the following: Assistance Office of Urbanism; Metropolitan Area Department; Human Settlements and Environment Department.

i.1.5 Ministry of Education

Legal Background

Law No. 84 dated July 1st, 1941, which sets the number and designation of the Ministers of State; Law No. 47 dated September 24th, 1946, the Education Organic Law; Law No. 34 dated July 6th, 1946, which annuls, modifies, adds and subrogates the articles of Law No. 47 dated 1946, the Education Organic Law.

Purpose

To lead the country's educational policies as from an updating process that guarantees the articulation of the educational system; to achieve increasingly quality and fairness levels, with the objective of driving the harmonious and integral development level of the pupil within the society and in a physical, intellectual, moral, aesthetical and civil aspect, so that the student receives the appropriate training and a finds a useful job for his/her own interest and for the benefit of all.

Principal Functions Associated with SWM

To establish, organize, execute and oversee the activities related to the different educational levels by means of plans outlined in tandem with the institutions related to this field.

To drive an education modernizing process with a participative, coordinated, integral, progressive approach and with a vision into the future, so that the articulation between education and the society can happen in multiple ways.

Functions of the Administrative Units Entailed to SWM

National Office of Community Education and Parents

To promote the participation of the community, governmental institutions and NGOs in the educational duties; to coordinate social-economic, educative and communal activities of parents' associations, federations and confederations.

Office of Student Affairs

To achieve the development of cultural, sport, leisure and social activities that allow for a greater participation of the pupil.

National Office of Environmental Education

To provide guidance by means of seminars-workshops to the teachers, environmental and regional coordinators and provincial and national supervisors, on the importance of educational development; to advise, coordinate and supervise the compliance with Law No. 10 of Environmental Education; to participate in the decision-making process on the environmental issues that takes place at the Directive Boards with the participation of state institutions representatives, which aim at the protection, evaluation and conservation of environmental patrimony and actions.

Televisora Educativa Canal 11 (Channel 11 Educational Television)

To plan, produce and broadcast TV programs with an educational, cultural and scientific approach; to develop long-distance educational projects, along with the corresponding teaching and curricular units from the Ministry of Education, University of Panama, private and international organizations.

i.1.6 Ministry of Commerce and Industries

Legal Background

Law No. 84 dated July 1st, 1941, which sets the number and designation of the Ministers of State; Cabinet Decree No. 145 dated June 3rd, 1969, which creates the Ministry of Commerce

and Industries; Cabinet Decree No. 225 dated July 16th, 1969, which organizes the Ministry allocates its functions; Law No. 53 dated July 21st, 1998, which creates the Internal Vice-Ministry of Commerce and Industries and the Vice-Ministry of Foreign Trade.

Purpose

To promote, coordinate, develop and execute the policies outlined for the industry, trade, insurance, securities, finance, resource exploitation, hydrocarbons and foreign trade subjects.

Principal Functions Associated with SWM

To plan, organize, coordinate, lead and control the activities related to the formulation and execution of government policies for the creation, development and expansion of industries in the country.

Functions of the Administrative Units Entailed to SWM

National Office of Entrepreneurial Development

To advise, coordinate, plan, assess and oversee the activities of this office; to develop and regulate the industry and small enterprise activities, with the purpose of fulfilling its scheduled objectives.

It has some of the following administrative units to perform its duties: General Office of Industries, the Department of Industrial Auditing; the general Office of Industrial Regulations and Technology, and the Department of Technical Regularization.

i.1.7 Ministry of Work and Labor Development

Legal Background

Cabinet Decree No. 2 dated January 15th, 1969, which creates the Ministry of Work and Social Welfare and designates its functions; Cabinet Decree No. 249 dated July 16th, 1970, which dictates the ministry's Organic Law.

Purpose

To set the guidelines of labor policies and serve the social issues in the Republic; to foster harmonious relations between capital and work; to provide guidance, so that the employer-employee relations are solved pursuant to the most appropriate legal procedures and to promote the creation of productive and well-paid employment.

Principal Functions Associated with SWM

To plan, lead and control the development of the state's labor and social policies; to study and resolve the issues related to the work and labor security fields; to establish regulations for the strengthening and coordination of labor union policies, and to oversee the enforcement of constitutional laws and legal provisions that rule this subject.

Functions of the Administrative Units Entailed to SWM

General Office of Decision and Conciliation Boards

To propose policy guidelines for the administrative and technical functioning of Decision and Conciliation Boards; to expedite the enforcement of labor justice within its scope of jurisdiction.

General Labor Office

To develop the jurisdictional function as per the law; to organize and lead the functioning of individual or collective working relations; to get acquaintance and approve the companies' internal regulations.

National Office of Work Inspection

To organize, lead and execute the activities related to the compliance with working regulations; to propose policy guidelines for work inspection, occupational safety and working environment, as well as to investigate on the existing working conditions and to promote the compliance with labor agreements and regulations.

i.2 Decentralized Institutions

i.2.1 Panama's Inter-Oceanic Region Authority

Legal Background

Law No. 5 dated February 5th, 1993, which creates Panama's Inter-Oceanic Region Authority and in which measures are adopted for Reverted Property; Law No. 7 dated March 7th, 1995, which modifies and annexes some articles to Law No. 5 of 1993.

Purpose

That Reverted Property be gradually incorporated back to the nation's integral development; to exclusively exercise the custody, exploitation and administration of Reverted Property within the national guidelines and policies set forth by the State, in accordance with the General Plan and partial development plans approved in the future for their improved utilization, and in coordination with the State's competent bodies.

Principal Functions Associated with SWM

To outline the General Plan and adopt it as the fundamental guide for its administrative functions; to plan, coordinate and decide on the execution of specific strategies, programs and projects for the use, conservation and development of Reverted Property; to oversee that the appropriate policies for the conservation, protection and improvement of Panama Canal's hydrographical basin be adopted and executed, in such a way that potable water supply is guaranteed for the metropolitan region and for the Canal's efficient operation.

Functions of the Administrative Units Entailed to SWM

Office of Technical Planning

To identify alternatives for the maximization of Reverted Property; to guard and follow up the general and sector plans; to organize, supervise and carry out the land use projections in reverted areas.

i.2.2 Panama's Maritime Authority

Legal Background

Executive Order and Law No. 7 dated February 10th, 1998, which creates Panama's Maritime Authority and unifies the diverse maritime competencies of public administration.

Purpose

To manage, promote, regulate, project and execute the policies, strategies, regulations, plans and programs directly or indirectly related or linked with the functioning and development of the Maritime sector; to perform as the Republic's supreme maritime authority to exercise the rights and enforce the responsibilities of the Panamanian State within the framework of the United Nations' Convention on Maritime Law, 1982, (MARPOL), and other laws and regulations in force.

Principal Functions Associated with SWM

To manage, conserve, retrieve and exploit marine and coastal resources; to coordinate, along with the National Maritime Service, the compliance with national legislation regarding maritime space and domestic waters of the country.

Functions of the Administrative Units Entailed to SWM

General Office of Merchant Navy

To enforce the national regulations and international treaties on Panamanian vessels related to maritime security and navigation, prevention and control of sea pollution.

General Office of Harbors and Auxiliary Maritime Industries

To exploit and operate port services; to control, coordinate and audit those harbors and facilities not directly operated by this office.

i.2.3 National Environment Authority

Legal Background

Law No. 41 dated July 1st, 1998, General Environment Law of the Republic of Panama.

Purpose

To ensure the compliance and enforcement of environmental laws, regulations and national policies

Principal Functions Associated with SWM

To formulate and implement governmental policies, strategies and programs for the environment and the use of natural resources; to dictate regulations for emissions, absorption, procedures and products, along with the respective authorities for each case; to evaluate environmental impact studies.

Functions of the Administrative Units Entailed to SWM

National Environment Council

It is formed by three Ministers of State, appointed by the President of the Republic.

To recommend the national environment policy and the sustainable use of natural resources; to foster and support the National Environment Authority in the coordination of the Environment's Inter-institutional System for the execution of the nation's environment policy and sustainable development; to collaborate in the incorporation of the environmental issue within the context of public policies, in coordination with the National Council of Sustainable Development.

National Consultative Commission of the Environment

It will be integrated by no more than fifteen members representing the government, the civil society and the provinces.

A consultative body for the National Environment Authority for decision making with national and inter-sector importance; it will also be able to issue recommendations to the National Environment Council.

Environment Regional and District Consultative Commissions, with participation from the Civil Society

These commissions are integrated as follows:

- Provincial: By the governor, who chairs it; by the Technical Council, representatives of the Provincial Coordination Council and by civil society representatives in the area.
- Regional: By the representative of the General Indigenous Congress, the representative from the Regional Coordination Council, the Technical Council and by civil society representatives in the area.
- District: By the Mayor, who chairs it; by representatives of the Municipal Council and by civil society representatives in the area.

To analyze the environmental topics and make remarks, recommendations and proposals from the Regional Environment Administrator.

i.2.4 Institute of National Aqueducts and Sewerages

Legal Background

Law No. 98 dated December 29th, 1961, which creates the Institute of National Aqueducts and Sewerages; Law No. 29 dated December 14th, 1993, which modifies Law No. 98 dated December 29th, 1961, and which creates the Institute of National Aqueducts and Sewerages (*IDAAN* in Spanish) as an autonomous entity of the State.

Purpose

To trim down morbidity and mortality rates of water-related diseases, thus improving the health, well-being and progress levels in the country, through the rendering of potable water services and the innocuous collection and disposal of wastewaters.

Principal Functions Associated with SWM

To plan, investigate, lay out, lead, build, inspect, operate and provide maintenance to all the items related to potable water and sewerage in the Republic; to advise the remaining bodies of the State and control all the activities related to the potable water services and collection and treatment of wastewaters.

Functions of the Administrative Units Entailed to SWM

Office of Financial Services

To regulate, lead, coordinate, control and supervise the financial activities in accordance with the guidelines arising from plans.

It has the Assistant Office of Commercialization Services to perform its functions.

i.2.5 National Institute of Professional Formation

Legal Background

Law No. 18 dated September 29th, 1983, which creates the National Institute of Professional Formation; Resolution No. 2 dated February 3rd, 1994, which creates its administrative framework currently in force; Resolution No. 155 dated October 14th, 1994, which executes the institute's new organizational structure.

Purpose

To propitiate the worker's technical development without disregarding economic, social, cultural and human aspects, according to his/her skills and to the employment possibilities and productive occupations required by the national development process.

Principal Functions Associated with SWM

To contribute to the technical and human improvement of the workers, in a way that the quality of human resources can be improved and their life quality can also be increased; to propitiate and reach agreements, in tandem with the diverse enterprises, the formative actions being carried out through the use and mobilization of the existing installed capacity.

Functions of the Administrative Units Entailed to SWM

Department of Technical Cooperation

To foster and arrange technical cooperation resources, both domestic and foreign ones, and to evaluate offerings and provide guidance in respect to their utilization.

Assistant Office of Technical Operations

To organize, program, oversee and evaluate the professional formation actions at a national level. Its supportive offices are the Department of Technical Assistance to the Enterprise and the Department of Occupational Certification, Formation and Training.

i.3 Independent Bodies

i.3.1 Regulating Entity of Public Services

Legal Background

Law No. 26 dated January 29th, 1996, which creates the Regulating Entity of Public Services

Purpose

To regulate, control and audit the rendering of potable water, sanitary sewerage, telecommunications and electricity services; to enforce the regulations that guarantee the rendering of such services at reasonable rates and prices.

Principal Functions that could be Associated with SWM

To comply with and enforce the laws and regulations from regulated public service enterprises; to grant concessions, licenses and authorizations for the provision of those public services that are of its competency, on behalf of the State; to verify the compliance with the quality levels of the services in regards to technical, commercial, legal and environmental issues; to foster competition and efficiency in the activities of public services and investigate possible monopoly, anti-competitive or discriminatory behaviors of enterprises and entities operating such public services, when they are considered to go against public interests; to oversee and verify the enforcement of the rate system and its values, according to the mechanisms foreseen in sector laws; to impose sanctions to transgressors, within its regulation and jurisdictional field, based on the powers entitled in the Law, the corresponding sector laws or concessions, licenses, or authorizations; to arbitrate in conflicts between the service-rendering enterprises and other State bodies, municipalities or customers, within its jurisdictional field; to mediate, as the ultimate administrative entity, after accusation from customers on the inefficient rendering of services or lack of attention to the claims.

Functions of the Administrative Units Entailed to SWM

Water and Cleaning Service

To regulate, control, oversee and audit the rendering of public potable water and sanitary sewerage services; to dictate regulations for the formulation of efficient investment programs for the maintenance, rehabilitation and expansion of service-rendering systems; to mediate as the top administrative entity in accusations of customers on the inefficient rendering of services or lack of attention to their claims.

D.5.2 SWM Legislative System

a. LEGAL AND REGULATORY FRAMEWORK IN THE MUNICIPAL SOLID WASTE MANAGEMENT

Hierarchy	Executor	General scope and specific regulation	Evaluation Associated with the Study
Constitution of the Republic		Articles 105 and 106, which establish that the State is primarily responsible to oversee for the population's health and to fight transmittable diseases through environmental cleansing. Article 114.It is the fundamental duty of the State to guarantee that people live in a healthy and pollution-free environment, and air, water and food meet the appropriate development requirements for human life. Article 115.The state and all the inhabitants of the national territory have the duty of encouraging a social and economic environment that prevents pollution of the environment, maintaining the ecological balance and avoiding the destruction of ecosystems. Article 117. The law will regulate the utilization of non-renewable natural resources, in order to avoid social, economic and environmental damages arising from those resources.	It is the State's function to oversee for the population's health. The State, through its competent authorities, will combat transmittable diseases through environmental cleansing. The text of the 1972 Political Constitution, which was reformed in 1978, 1983 and in the 1994 legislative acts, already establishes the importance of environmental cleansing to prevent diseases.
Ratified International Treaties		Ratified international treaties constitute laws of the Republic, with a higher hierarchy than secondary laws approved by the Legislative Assembly	
Basle Agreement	ANAM/MRREE	It regulates the trans-border mobilization of hazardous wastes It is a Republic law The regional agreement has been additionally ratified	Treaty currently in force by the State. There exists a ratified Regional Agreement of Trans-border mobilization. The ANAM and **MRREE** are responsible of overseeing its compliance and paying attention to the notifications. The agreement classifies as hazardous waste the medical residue resulting from medical attention provided at hospitals, health centers and clinics; as well as medication and pharmaceutical wastes and other toxics related to the activities taking place in health facilities.
Secondary Laws and its regulations			
General Environmental Law (LEGA)	ANAM	Law No. 41 issued on July 1st, 1998 **5 Aims and Objectives** Article 1. Environmental administration is an obligation of the State; therefore, the present law sets the principles and basic regulations for the protection, conservation and retrieval of the environment, through the promotion of sustainable use of the natural resources. In addition, it arranges the environmental duties to be managed and integrates them into the social and economic objectives, in order to achieve the sustainable human development in the country. **6. Strategies, Principles and Guidelines** Article 3. The national environment policy constitutes the set of measures, strategies and actions established by the State to orientate, limit and determine the behavior of the public and private sector, the economic agents and the population in general for the conservation, use, management and utilization of natural resources and the environment. The Executive Body, with the counseling by the National Environment Council, will approve,	<u>Organic Structure of the Sector</u> The current body of laws for environmental management is based on the General Environmental Law, which creates a national system (Environment's Inter.-institutional System) shaped by those public institutions with environmental jurisdiction, as well as a system formed by local entities (Provincial, Regional and District Consultative Commissions); all of the above with a great participation from the civil society and coordinated by the ANAM. The highest rank in ANAM's organization chart belongs to the National Environment Council (three ministers), who advises the Cabinet Council and recommends the national environmental policy. The National Consultative Commission of the Environment in turn advises this Council and the General Administration. It is by means of this organic structure that the civil society, organized in diverse levels, can express its opinion and participate in the decision-making

Hierarchy	Executor	General scope and specific regulation	Evaluation Associated with the Study
		promote and oversee the national environmental policy as part of the public policies for the country's economic and social development. About the Administrative Organization of the State for Environmental management Articles 5, 14, 16, 18 and 21, establish the administrative organization of the State for the environmental management: the **National Environment Authority (ANAM)** as the regulating entity of the State for natural resources and the environment; the **National Environment Council** (integrated by three Ministers of State) recommends the Cabinet Council on the national environment policy and the sustainable use of natural resources; and the **Environment's Inter-institutional System**, which is formed by those public institutions with environmental competency, in order to harmonize their policies, prevent conflicts or competency voids and meet the LEGA objectives and aims and the national environment policy with coherence and efficiency; for such purpose, they are obligated to setting up coordination, consultation and execution mechanisms after following the ANAM parameters. Likewise, the **National Consultative Commission of the Environment** is created (integrated by no more than fifteen members representing the government, the civil society and provinces) as a consultation body of ANAM for making decisions with national and inter-sector transcendence; it will also be able of issuing recommendations to the National Environment Council; in territorial terms, the civil society will be integrated into **Environment Consultative, Provincial, Regional and District Commissions** to analyze environmental topics and make remarks, recommendations and proposals to the Regional Environment Administrator The public or private activities, works or projects that might pose an environmental risk will require an environmental impact study, prior to their execution and will be subject to the environmental impact assessment process (Art. 23) The ANAM will lead the process for the elaboration of regulation proposals on environmental quality (Art. 32); the competent authority will enforce these regulations, in a gradual and stepwise manner (Art. 33). The municipal authorities will be able to dictate environmental quality regulations within the framework of this law, which will respect the Political Constitution and the contracts entered with the nation and will be authenticated by the National Environmental Authority (Art. 36) The Ministry of Health (MINSA) is the authority in charge of regulating, overseeing, controlling and sanctioning all the topics related to the assurance of human health (Art. 56). It is the State's duty, by means of the competent authority, to regulate and control the differentiated management of household, industrial and hazardous wastes, throughout its stages: generation, collection, haulage, recycling	process. The ANAM acts in coordination with the competent national authority to regulate, supervise and oversee any activity that might harm the environment. The ANAM coordinates its activities with the following bodies: a) with MINSA in regards to environmental health; international agreements linked with hazardous substances and wastes; wastewaters and air quality; b) with the Ministry of Education with respect to environmental education; and c) with the *Secretaría Nacional de Ciencia y Tecnología* (National Secretariat of Science and Technology) for scientific and technological research. The ANAM is the competent authority in the following topics: a) To issue the resolutions and technical and administrative regulations for the execution of the National Environmental Policy b) To enforce the General Environmental Law (*LEGA*), its regulations, the environmental quality standards and the technical and administrative provisions assigned by law c) To dictate the scope, guides and reference terms for the environmental impact assessments and studies, as well as to evaluate and approve the sworn statements and issue the environmental resolutions that allow the beginning of projects. d) To impose sanctions and fines The General Environmental Law confirms MINSA's competency in - **regulating, overseeing and sanctioning** all the topics related to the assurance of human health. Likewise, it can be understood that the Ministry of Health is the competent authority to **regulate** and **control** the differentiated management of household, industrial and hazardous wastes in all its stages: generation, collection, haulage, recycling and final disposal (Art. 58). Within this article (Art. 58), it is determined that the State will set the rates for these services. The environmental responsibility is very clear as outlined in Articles 106 through 119 (Title VIII). *Responsibility* is an extremely important environmental, social and economic subject. Its economic effects are very polemical, which in turn renders the enforcement of the law difficult. It can be affirmed that the basis for every regulation on the management of solid wastes and air, soil and water protection arise from LEGA's Title VIII; the rest of the regulation define competencies, structure the powers and provide guidance with technical regulations. The following concepts are introduced as follows: *objective responsibility* for damages; *solidary responsibility* of the generator for the management of its wastes; and *independence* from civil liability in regards to the administrative and criminal liabilities. As a factor to render the responsibilities set forth in

Hierarchy	Executor	General scope and specific regulation	Evaluation Associated with the Study
		and final disposal. The state will establish the rates for such services (Art. 58) Title VI deals with natural resources; in Chapter IV, it is established that the use of soil will be compatible with its purpose and ecological aptitude, according to the environmental arrangement programs for the national territory (Art. 75). It is also established that the conduction of public or private activities that, given their nature, provoke or might cause the severe degradation of soils, will be subject to sanctions (Art. 76). Chapter V deals with air quality. It is stated that air is public property. The ANAM, along with the competent entities, will be in charge of regulating all the topics related to air quality. Hydric resources are mentioned in Chapter VI. It is established that activities that modify the nature system or water quality or alteration of riverbeds can be carried out, with the authorization in advance from the ANAM (Art. 80). Those who utilize hydric resources have the obligation of conducting the required works for their conservation (Art. 82). Water is public property in all of its forms (Art. 81) By means of Resolution No. 49 dated February 2nd, 2000, the Ministry of Commerce and Industries approved and enforced the Regulations on Wastewaters. Any natural or artificial person that emits, pours, disposes of or discharges substances or wastes that affect or may affect human health; that put the environment into risk or damage it; that affect or may modify the essential ecological processes or the population's quality of life, will be liable of **objective responsibility** for those damages that might cause serious damage, pursuant to the provisions of the special environmental laws (Art. 109)	Article 113 as feasible, the insurance companies are endowed to establish *civil environmental liability insurance*, and to allow legal actions to be more effective for the protection of the environment. Article 117 outlines the formalities to be followed as per the *procedimiento sumario* (summary procedure) and the prescription in ten years, from the moment the damage is acknowledged.
Environmental Impact Assessment Process	ANAM	Executive Decree No 59, dated March 16th, 2000, which regulates Chapter II of Title IV of Law No. 41, dated July 1st, 1998, General Environment Law of the Republic of Panama. **Matters and scopes of this Code** Article 1. This regulation sets forth the provisions to which the Environmental Impact Assessment process will abide by.	By means of the regulations of Title IV, Chapter II, the procedure for the Environmental Impact Assessment is defined and becomes effective, with technical and administrative operatibility. The taxation list of projects associated with the solid waste management to be put into the Environmental Impact Assessment process is as follows: • Construction and operation of management, treatment and final disposal systems for solid wastes and industrial, household and hazardous residues. • Sanitary landfills • Facilities for the treatment or final disposal of toxic or hazardous wastes • Facilities for the final treatment of common wastes • Safety store places for hazardous wastes The MINSA is the competent authority that received the projects mentioned above; the Institute of National Aqueducts and Sewerages (*IDAAN* in Spanish) will receive the projects for purification plants and systems.

Hierarchy	Executor	General scope and specific regulation	Evaluation Associated with the Study
			The Environmental Impact Assessment process has three categories for Environmental Impact Studies (EIS), and Chapter III of Title III establishes the contents for each one of these categories. This fact guarantees an appropriate and grounded forecast, identification and interpretation arising from the project. Projects can only begin after the sworn statement (Category I) has been presented and approved or after obtaining the **Environmental Resolution** (Categories II and III). Unlike the Sanitary Code (1947), the LEGA is a modern set of laws. Its organic structure is shaped with all the public institutions with environmental jurisdiction, and civil society is represented down to a district level. There exists an organic communication between the civil society and the Cabinet Council, through the National Environment Council
Panama's Sanitary Code	MINSA	Law No. 46 dated November 10th, 1947 Article 1. It regulates all the topics related with public healthiness and hygiene, the sanitary policies and preventive and curative medicine. Article 5. To study and solve any political, social or economic national problem that might affect health; and first of all, to provide orientation and general guidelines of the Government's official actions against such problems. Article 15.The technical sections will develop the following fundamental activities: - Environmental and housing sanitation Article 85.The National Public Health Department has the following powers and duties: 2ºTo control all the aspects related to the execution of preventive medicine and sanitation. 12º To solve any situation not foreseen in the Code, when it is directly related to public health. Article 88.The following are local sanitary activities regarding environmental control: 6º To collect and provide treatment to garbage, wastes and residues. 9º To control the propagation of bugs and other harmful fauna or disease-carrying vectors. Article 91.The following are local activities in regards to the protection and maintenance of health and collective individual safety: 8º Control of every local unsanitary factor. Article 201. Public health engineering and city, hamlet and village sanitation will be subject to the regulations proposed by the Public Health Office to the Executive Body …- Article 207. The following are accepted as sanitation regulations, including potable and wastewater chemical and bacteriologic pattern tests, are those officially recommended by the Pan-American Sanitary Office.	Unfortunately, the 1947 Sanitary Code has not been modified to update the health sector's legal and institutional framework, and adapt it to the requirements and needs of our time. Fifty-five years ago, there was no distinction between hazardous and non-hazardous wastes; these concepts were unfamiliar or not even important in Panama. The Sanitary Code has only one article that deals directly with solid wastes; it is number 6 from article 88, which establishes that one of the local sanitation activities is the collecting and treatment of garbage, wastes and residues.
Cabinet Decree No. 1 dated January 15th, 1969	MINSA	Decree that resulted in the creation of the Ministry of Health (MINSA). Article 1º: Health sector is constituted by autonomous and semi-autonomous bodies and entities that conduct the promotion, protection,	With this decree, it is established that the MINSA is the competent authority on national health. It has to prepare (keep updated) and execute the National Health Plan, as well as to supervise and evaluate all the activities within the health sector.

Hierarchy	Executor	General scope and specific regulation	Evaluation Associated with the Study
		repairing and rehabilitation of health activities; by research and teaching institutions of such sector; by institutions that directly or indirectly contribute to the improvement of community health and housing conditions and the ones financing programs.	The health sector is constituted by all the entities pointed out in Art. 1 of the decree and among them, the municipalities, which responsibility is urban and residential cleaning service provision.
Regulation for the Arrangement and Management of Solid Wastes from Health Facilities.	MINSA	Executive Decree No 111 dated June 29, 1999. Article 1. It regulates everything related to the arrangement and management of solid wastes generated by private or public health facilities, with the aim of protecting the people's health and environment. Article 63. it declares that the MINSA, at a national level, is the authority in charged of ruling, promoting and evaluating the management of solid wastes from health facilities.	The MINSA took part in the ALA Project 91/33 and part of its staff received training on hospital's solid waste management. Wastes are classified in common (they will be managed as household waste), anatomic-pathologic, radioactive, chemical, infectious, sharp objects, pharmaceutical and special. Articles 15 and 16 consider infectious, pathologic, sharp objects, inflammable, corrosive, radioactive, toxic, cito-toxic and explosives *products* and waste. This regulation sets detailed technical and management regulations for the preparation, collection, internal transportation, temporary storage, treatment, collection, external transportation and final disposal of the wastes. The following should be pointed out: - The treatment can be carried out at the generation site or outside the health premises, at a treatment plant that provides services to several health facilities (art 44) (disinfect or sterilize infectious wastes through a chemical or thermal process, irradiation, incineration, and so on). - Haulage of common wastes will be conducted through the household collection service, whereas the rest of the residues will be transported in vehicles with special features (art 46). - Art. 47 establishes some of the special characteristics for the vehicles with the exclusive purpose of collecting hazardous wastes. - Infectious wastes generated by the attention to patients with infectious-contagious diseases must be treated within the generating facility (art 33); the latter wastes and anatomic-pathological ones can be disposed of at a special sanitary landfill or, after being treated, at a common sanitary landfill. - The carriers of hazardous medical wastes are subject to administrative commitments before the MINSA (art 48) (waste discharge-haulage-receiving reports; civil liability insurance; contingency plan; training to its personnel) - The enterprises or entities that provide the medical solid waste and medical sanitation services must have the proper authorization from the MINSA
National Manual to manage international non-hazardous solid wastes in ground, air and maritime harbors within the Republic.	MINSA	Executive Decree No. 116 dated May 18, 2001. It establishes the procedure to be followed by natural or artificial persons and State entity that undertakes the international non-hazardous solid waste management in ground, air and maritime harbors within the Republic.	The inherent functions to the sanitary ambit will be the MINSA's responsibility; authorization to classify and discharge the wastes will be the responsibility of **MIDA**'s agro-farming quarantine inspectors, as well as the custody of solid wastes from their discharge and haulage to their final disposal site. The municipalities will be in charge of the final disposal of the wastes and will ensure their proper functioning, as per the regulations in the manual.
Labor Code	Ministry of Work and Social Welfare	Law No. Article 282.All employers are obliged to enforce all the necessary measures to efficiently defend the worker's health and life, conditioning facilities, providing working equipment and adapting methods to prevent, reduce and	Safety and hygiene at work are regulated by the Working Code (*Codigo del Trabajo*) regulations. Art. 288 defines as unhealthy works those carried out at facilities or industries that, given their nature, might create conditions that harm or provoke the damage to the workers' health, as a result of the

Hierarchy	Executor	General scope and specific regulation	Evaluation Associated with the Study
		minimize professional hazards at working places, as per the regulations dictated by the Ministry of Work and Social welfare, *Caja de Seguro Social* (Social Security Savings bank) and any competent body.	materials employed, elaborated or emitted or to slid, liquid or gaseous wastes. It also defines the following as hazardous works: - Those conducted at the facilities or industries that immediately and severely harm or might harm the life of the workers, be it solid, liquid or gaseous; or the storage of toxic, corrosive, inflammable, radioactive, inflammable substances, regardless of the way they are stored. Art. 288 also outlines that the technical services from the Ministry of Work will determine what places, facilities or industries are unhealthy or hazardous, as well as those substances whose elaboration is prohibited, restricted or has to submit to certain requirements. Art. 104 prohibits women to work in hazardous or unhealthy activities. Art. 104 outlines the elaboration and compliance with an Internal Working Regulation, which establishes the required norms for hygiene, first aids and safety in work, as well as the time and way in which workers must undergo previous or periodical medical examinations, as well as prophylactic measures dictated by the authorities.
Municipal System	Municipalities	Law 106 dated October 8th 1973, modified by law No. 52 dated December 12 1984 Article 1.The Municipality is the community autonomous politic organization established within a district. The municipal organization will be democratic and will essentially respond to local government administrative issues. (Article 229 the Political Constitution) Article 5.Municipalities will be able to challenge any legislative or administrative action emanated from the national authorities when such action is considered to be violating the municipal autonomy. **First Section. Board Competency** Article 17. The Municipal Councils will have exclusively competent to enforce the following functions: 3. To create municipal or mixed companies to work on good or services (…) 4. To promote the formalization of contracts with public or private entities, for the creation of municipal or mixed companies, with the aim of exploiting good and services. 10. To create and keep public utilities companies, mainly water, power (…) ***14. To establish and regulate urban and household cleaning service for towns, and finds ways to make use of such waste and residues.*** ***Capítulo IV. Rates and Fees*** ***Article 76.The Municipalities will set and collect fees and rates on the following provided services:*** ***9. Waste collection on private residences and septic tanks cleaning*** Paragraph: The Nation, the inter-municipal association to which the Municipality is part of and which is the one that impose such obligation and paupers will be exempt of paying fees and rates.	This law is almost 30 years old of being promulgated and, as in the Sanitary Code, the lack of a wider set of regulations related to the municipal solid waste management is remarkable. However, in the book - *Legislación Municipal Comentada*-(Comments on Municipal Legislation) from Mr. Héctor Pinilla and Ms. Ada Vergara, there is a comment on Article 1 of this law that reads: the following are constitutive elements of the municipality, among others: a) Population: it is constituted by the group of people dwelling the municipality; yet, the most significant element of its inhabitants is the *necessary neighboring relationships*. b) Financial and economic autonomy: it consists of the municipality's power to provide its own resources in order to *attend the public services it is supposed to render.* The municipalities' economic capacity relies on the forms of financing, and especially on the tributary power to levy taxes, rates, fees and municipal contributions. We can also add that the municipalities are also empowered to establish and regulate the urban and household cleansing service they render to their population. Law No. 106 date October 8th, 1973 and Law No. 52 dated December 12th, 1984 that modifies the former, grants the municipal entities a series of juridical instruments that allow them to provide goods and services. Therefore, there exist juridical powers for the solid waste management service to become strengthened with novel organization forms, and to achieve the necessary participation from the users.

Hierarchy	Executor	General scope and specific regulation	Evaluation Associated with the Study
		Article 136. The Municipalities will be able to provide with useful public utilities by means of departments, municipal or private companies Article 138. The municipal public service concession will be decreed by the Council by means of an agreement adopted by the absolute majority voting of its members, and the contracting will have to fulfill the following rules (among others) 2.That such service is impossible or difficult to provide by the Municipality.	
That promotes the cleaning of public places dictates otherprovisions	Municipalities	Law No. 30 dated July 12, 2000 Article 1. The police commissioner (*corregidor*), Mayors and Province Governors will be empowered to administratively sanction, with fines form 5 balboas (B./5.00) to five hundred balboas (B./500.00), to anyone that litters garbage or wastes, at any public location that should be placed in bags, baskets or any other container for that purpose; to anyone that scratches public or private building walls; as well as those depositing human or animal excrements on public places. In all the cases the infringer is obliged to clean the affected place In case the violator is an under aged person, the parents or guardians will be responsible for the fine imposed. In case of domestic pets, the responsible will be the owner and the person in charge of the animal. Article 7. The municipalities will open a special account denominated Municipal Cleaning Fund, which will be constituted by the payment of imposed fines by this law. Fifty percent (50%) of the generated fund by fines will be used by the enforcing authority on ornament, painting, gardening and similar activities. Like wise, all the contributions made by companies, people, government, national or international organizations, NGOs, funds granted by municipalities, legacy, inheritance and donations will be part of the Urban Cleaning fund. Contributions to the Municipality Cleaning Fund will be used to hire personnel, buy materials and cleaning equipment, community awareness campaigns on cleaning issues, as well as any other concept on municipal cleaning issues. Article 8. Municipalities and schools will be able to create and regulate voluntary inspection bodies to enforce this law.	This law is not regulated to date. In the mentioned regulation, the procedures will adjust to the population's juridical culture; i.e., a police officer might consider the issuance of a summons for a person in custody of an animal and for the owner, due to the excrement of the animal, or issuing such summons to a person littering paper on the street as complicated formalities. In this regard, there exists the need to have an urban and household cleaning regulation that outlines the responsibilities and duties of all the attendees in the district's cleaning and ornate; also, there is the need for education programs and urban facilities and furniture (pedestrian paper baskets), so that the purpose of the law to maintain cleanliness is achieved. On the other hand, this law limits the amount of the fines to only B/. 500.00 per infraction, and although the transgressor is obligated to clean the spot affected, the latter generates a conflict with Decree No. 1144 dated April 4th, 2000, which sanctions natural or artificial persons that violate the provision of Decree No. 2025 dated December 1st, 1995, with fines ranging between B/. 10.00 up to B/.5,000.00.
By means of which the services related to urban and household cleaning in the metropolitan region are transferred to Panama, San Miguelito and Colón Municipalities.	Panama, San Miguelito and Colón Municipalities.	Law No 41 dated August 27 1999 Article 1. Transferal of the management, operation and exploitation of the services related to urban and household cleaning and to sanitary landfills in the metropolitan region will abide by the provisions of the law herein. Article 2.Such transfer form the Metropolitan Cleaning Office (DIMA) to the municipalities of Panama, San Miguelito and Colón, means the management, planning, research, inspection, operation and development of the services related to urban and household cleaning within the metropolitan region. For the purposes of this Law, the metropolitan region refers to Panama, Colón and San Miguelito districts.	This law derogates Law No. 41 dated July 27th, 1973, which created the *Dirección Metropolitana de Aseo* (Metropolitan Cleaning Office, or DIMA); it took charge of the services being rendered by the Cleaning Department that was part of the IDAAN. The DIMA attended the solid waste management services in the districts of Panama, San Miguelito and Colón. Law No. 41 dated August 27th, 1999, transfers the administration, operation and exploitation of the services being provided by the DIMA to the municipalities of Panama, San Miguelito and Colón. With the enforcement of this law, the Urban and Domiciliary Cleansing Office (DIMAUD) was created in each of the municipalities of Panama, San

Hierarchy	Executor	General scope and specific regulation	Evaluation Associated with the Study
		Article 4.To enforce the objectives established on article 2 of this Law, the municipalities are empowered to set and collect fair rates and fees for ordinary and especial services provided, so that they can be able to cover its running cost. These rates and fees will be periodically set and reviewed by each municipality, by means of a mathematical formula considering current fee factors, whole sale price index and an amount established for fines if users delay in the payment, in order to have enough funds all the time to keep the community serviced. Likewise, each municipality will be able to enter agreements related to administrative support services for achieving objectives and functions, such as fee collection and any other necessary function. Article 6.The Panama Municipality will be responsible for the Cerro Patacón sanitary landfill. Article 10.Each municipality will recognize DIMA's employee's service years when the transfer is conducted and will respect the working stability as per the performance of functions and responsibility fulfillment. Article 16.All issues related to the protection of public health and the environment, the Ministry of Health or the competent body as per the law, will withhold and execute the legal power conferred by the Sanitary Code and environmental laws, and they will be, therefore, the maximum authority to express its opinion, determine and decide on health and environmental protection requirements. Article 18. The municipal director of Urban and household Cleaning will be empower to set fines, as per the regulations provided by the Municipality Mayor. Without prejudice of the established herein in the previous paragraph, the competent authorities will be able to impose the violators the corresponding sanctions on theirs law and regulations. Article 21. Solid waste collection and disposal services are compulsory for all household, commercial stalls and industrial building, as well as for all public and official facilities within the corresponding district. *Article 23. Panama, San Miguelito y Colón district Mayors, will be empowered to regulate services pointed out in article 2 of this Law by means of decrees..*	Miguelito and Colón. For purposes of compliance with the law, the municipalities mentioned above have the following powers, responsibilities and functions: a) **DIMAUD's responsibilities and functions:** direction, planning, research, inspection, operation and exploitation of urban and household cleansing services. b) **To set rates and fees** that are reasonable for the ordinary and special services they render, so that they allow to cover the costs of functioning. c) **Administrative backup agreements,** which could be entered to meet (DIMAUD's) objectives and functions d) **Cerro Patacón sanitary landfill,** whose administrative responsibility falls on the municipality of Panama. The Mayor administering a sanitary landfill can subcontract its operation to third parties. e) **Regulation of the service by means of decrees:** the Mayors for the districts of Panama, San Miguelito and Colón have the power to regulate the services foreseen in Article No. 2 of the law by means of decrees. f) **Compulsoriness of the services** for the collection and disposal of solid wastes for all inhabitable properties, commercial stalls and industries, public and official facilities. The competent authority to provide such services is the DIMAUD, pursuant to Article 2 of this law, which explains the operation and exploitation of the services. The law acknowledges the Ministry of Health or the competent body as per the law, to execute the legal powers conferred to it by the Sanitary Code and the environmental laws.
Decrees of Panama Municipality City Hall.	Panama Municipality	Decree No 1144 dated April 4 2000 It modifies Art. 3 of Decree No 130 dated February 11, 2000, which modified Article 8th of Decree No. 2025 dated December 1st, 1995, on cleaning and ornament: Article eighth:Natural or artificial people breaking the provisions of this Decree will be sanctioned by the corresponding authorities with fines from ten Balboas 00/100 to five thousand Balboas	To date, there is no regulation for the management services of solid wastes in the metropolitan area. Neither the Cleansing Department nor the DIMA or the DIMAUD have had a set of regulations that control the rendering of the service. The municipality of Panama has provided a series of decrees to protect the district's cleansing and ornate through the enforcement of fines as a penalty for the infractions.

Hierarchy	Executor	General scope and specific regulation	Evaluation Associated with the Study
		00/100, according to the severity of the fault Decree No 2025 dated December 1st, 1995 By means of which articles are added to Decree No. 670 dated September 10th 1991. Decree No. 670 dated September 10th 1991. By means of which cleaning and ornate measures are dictated in Panama District. Decree No. 203 dated February 7th, 1990 By means of which cleaning measures related to land lots and the possible mosquito reproduction are taken. Decree No. 19 dated July 16th, 1981 By means of which some articles of Decree No. 6 dated May 4th, 1970 are modified and added; the former decree establishes the use of canvas or lids to cover loads, as well as the preventive cleaning measures for the trucks or vehicles devoted to the transportation of certain materials.	On general provisions: Every owner has the obligation to cooperate with the city's cleaning, by reducing the generation of wastes to the minimum level possible; to keep the front of his/her property clean and painted, including the section of street that corresponds to his/her front and sideways of the construction. Wastes must be placed at accessible spots and within the hours scheduled for their collection. State or private institutions that carry out weed cleaning operations or constructions that generate wastes, debris or disposable materials are obligated to discharge them in appropriate containers, to facilitate their final disposal. On prohibitions: To litter waste; the inappropriate disposal of wastes that hinder their collection; burning of wastes; to leave vehicles and others on sidewalks, streets or vacant property; to post propaganda or painting of walls, trees or posts. On supervision and sanctions: Authorized or *ad honorem* inspectors appointed by means of decrees will conduct supervision and surveillance duties, and will bring transgressors of the provisions of the decree before the police authorities.

b. LEGAL INSTRUMENTS OF THE STUDY

LEGAL INSTRUMENTS OF THE STUDY	
Crimes against the environment (Bill)	By means of which Title XIII regarding crimes against the environment is added to the Penal Code. It contains severe penalties according to the degradation of the environment. This bill regards the precepts included in the General Environmental Law (*LEGA*) with respect to the objective responsibility for damages; the solidary responsibility from the generator and independence from civil liability regarding the administrative and criminal responsibilities. The stepwise execution of LEGA's mandates, outlined in articles 32 through 35, should be considered in this project.
Institutional and regulatory Framework for the Solid Waste Management (Draft of Bill)	The body of this bill has three parts: the **Institutional framework,** which establishes the jurisdiction from the competent institutions; MINSA, in the formulation and coordination of the sector's policies and long-term planning; the municipalities as responsible for the rendering the services; the Regulating Entity of Public Services for the regulation, control, supervision and auditing of the services; and the customers of the services. The **Juridical framework** that regulates the rights, powers, duties and obligations from the providers of the services and the customers'; the rate system and payment of the services. **Participation from the private sector,** which regulates participation of the private sector in the provision of services. The MINSA has prepared an alternative bill that is being discussed, taking the original draft as a basis.
Regulatory Framework for the Management of Hazardous Wastes (Draft of Bill)	It introduces the mandates established by the LEGA: objective responsibility for evaluating the environmental damages (a damage is assumed unless proved otherwise); solidary liability, which involves all the actors in an operation. With the latter, the competent authority becomes strengthened by defining and providing strength to its actions. The Operational permit for the management of hazardous wastes (HW) is created (RP), which allows the follow-up to the operations; the Manifest and Tracking system, in order to know the HW being moved and handled; Residue inventory, Generators and Providers of Services, through a database that eases the administration. It proposes the creation of a Remediation Fund for the operations of a HW sanitary landfill (after closure); and the civil liability insurance for environmental damages (during the operation) It establishes the basis for a national policy on this issue and the responsibilities and relations among the State, the generators and the providers of the service. It appoints the Ministry of Health as the competent authority to exercise the powers and competences set forth in the bill herein. The draft bill is complemented with 23 regulations and technical resolutions and delivery< apart from several technical-economic study profiles.
Technical Regulations of Sanitary Landfills for non-hazardous solid wastes (Regulation draft)	A technical regulation bill prepared by the MINSA, and enforceable to any natural or artificial, public or private that selects the site, the design, construction, operation, closing and post-closure of sanitary landfills, be it manual or mechanized landfills, for non-hazardous wastes, in order to protect the people's and the environment's health.
The installation, functioning and surveillance of incineration and co-incineration systems for hazardous and non-hazardous wastes is regulated.	It regulates everything related to the use of incinerators and co-incinerators for the treatment of the wastes generated at public, private and mixed facilities,. The purpose is to prevent or, whenever feasible, to downsize the negative effects of the pollutants emitted towards the atmosphere that come from the incineration and co-incineration of hazardous and non-hazardous wastes.

c. SUMMARY OF MAIN COMPETENCIES AS PER THE CURRENT LEGAL FRAMEWORK

SUMMARY OF MAIN COMPETENCIES AS PER THE CURRENT LEGAL FRAMEWORK	
Ministry of Health	• In health matters, the State has to oversee for the population's health and fight transmittable diseases through environmental sanitation (Political Constitution Art. 105 and 106) • Public health engineering and cleansing of cities. (Sanitary Code Art. 201) • Sanitary activities regarding environment control are the following: collection and treatment of garbage, wastes and residues. • To study, formulate and execute the National Health Plan and supervise and assess all the activities conducted within the health sector. (Cabinet Decree No. 1 dated January 15th, 1969) • It is the authority in charge of regulating, overseeing, controlling and sanctioning everything linked with the assurance of human health (LEGA's Art. 56) • To regulate and control the differentiated management of household, industrial and hazardous wastes throughout its stages: generation, collection, haulage, recycling and final disposal. The State will outline the fees for such services. (LEGA's Art. 58) (the law does not establish who is the competent authority) • It is the sector's ruling body, and it has the responsibility and authority to opine, determine and make a decision onthe healthiness requirement) Art. 16 of Law No. 41 dated August 27th, 1999) • The authority in charge of regulating, promoting, evaluating and overseeing the management of solid wastes from health facilities (Executive Decree No. 111 dated June 29th, 1999)
National Environment Authority	All the regulations correspond to Law No. 41 dated July 1st, 1998 • The State's ruling entity in natural resources and environmental issues • Public institutions with environmental jurisdiction are obligated to coordinate, advise and execute their actions by sticking to the parameters outlined by the ANAM, by means of the Environment's Inter-institutional System. • To issue the resolutions and technical and administrative regulations for the execution of the environmental policy • To enforce the LEGA • To dictate the scope, guidelines and terms of reference for the environmental impact assessment and studies. To evaluate and approve the Sworn statements and issue the environmental resolutions that allow the beginning of projects. • To impose sanctions and fines
Municipal system	All the articles mentioned herein correspond to Law No. 106 dated October 8th, 1973, and modified by Law No. 52 dated December 12th, 1984 • To create municipal or mixed enterprises for the exploitation of goods and services. Art. 17 • To promote the formalization of contracts for the exploitation of goods and services. Art. 17 • To establish and regulate the cleaning and household service for their population. Art. 17 • To set and collect fees and rates over the rendering of the waste collection service. Art. 76
Municipality of Panama	All the articles mentioned herein correspond to Law No. 41 dated August 27th, 1999 • It is responsible for the direction, planning, researching, inspection, operation and exploitation of the services. Art. 2 • To set and collect reasonable rates and fees. Art. 4 • To formalize contracts regarding the urban cleansing and household services. Art. 6 • Management of Cerro Patacon sanitary landfill. Art. 6; it empowers the Mayor that manages a sanitary landfill to enter operation contracts of such landfills. Art. 8 • The collection and final disposal services are of a compulsory nature (Art. 21) and the DIMAUD is the competent authority to operate and exploit them (Art. 2). • To impose fines • To regulate the rendering of the urban cleansing and household services by means of decrees

d. SUMMARY OF THE MAIN COMPETENCIES LINKED WITH THE MUNICIPAL SOLID WASTE MANAGEMENT AND HAZARDOUS WASTES

SUMMARY OF THE MAIN COMPETENCIES LINKED WITH THE MUNICIPAL SOLID WASTE MANAGEMENT AND HAZARDOUS WASTES			
ACTIVITY	MINSA	ANAM	MUNICIPALITY OF PANAMA
Outlining of policies	●	●	
Hazardous wastes	●	●	
Surveillance and controls	●	●	
Technical regulations	●	●	
Sanctions and fines	●	●	●
Operation and exploitation of the services			●
Fees and rates fixing			●
Regulation of the service			●

D.5.3 Financial and Accounting System

a. Accounting System

The present accounting system used by DIMAUD is mandatory for all government offices, and complies with the Government Accounting Manual (Manual General de Contabilidad Gubernamental) of 1993. The Comptroller of the Republic closely supervises and controls the accounting of government offices, deciding the account under which a given cost or expenditure is to be registered. The process may distort the real cost structure of DIMAUD. The government accounting system is a rigid system that does not permit adaptation according to the operating characteristic of each government office.

It can be seen that the present accounting system of DIMAUD is designed for budget control, and it is not well suited for cost accounting. If the DIMAUD accountant wishes to calculate total cost per ton, he is forced to compute the relevant component costs by adding up accounts according to the assigned accounting code number. However, the assignment of these accounting code numbers may not respond precisely to the operating characteristic of DIMAUD. Rather, it is rigidly determined in the Government Accounting Manual so as to facilitate the budget control job of the Comptroller of the Republic.

In the process of choosing cost components according to the code numbers assigned to each account, there arise many chances for making mistakes. For instance, an estimation of the unit cost of solid waste disposal by DIMAUD in 2001 resulted in B/59.60 per ton, but it had a wide monthly variation, ranging from B/33.64 per ton in April to B/107.32 per ton in December. This kind of wide variation in estimated unit cost makes one suspect of some kind of error. The cost estimate could be more accurate if precise waste collection records were

available, but the unit cost estimation was based on assumed tonnage of collected solid waste.A more worrisome point was the fact that the unit cost of landfill activity in May gave a negative figure, which obviously contained errors in the input of component costs.

b. Financial System

b.1 DIMAUD Tariff

The present tariff or user charges of DIMAUD were set by Executive Decree 165 of August 26th 1999, which can be summarized as follows.

Table D-27: DIMAUD Tariff Structure

User Category	User Sub-category	Tariff Type	Tariff (Balboa)
High Income Residence (over B/2,500)	Detached house	Fixed	B/.11.50/mo.
	Apartment	Fixed	B/.10.30/mo.
	Condominium	Fixed	B/.10.30/mo.
Middle Income Residence (B/600-B/2,500)	Detached house	Fixed	B/.7.50/mo.
	Apartment	Fixed	B/.7.20/mo.
	Condominium	Fixed	B/.7.20/mo.
Low Income Residence (B/100-B/600)	Detached house	Fixed	B/.5.60/mo.
	Apartment	Fixed	B/.5.00/mo.
	Condominium	Fixed	B/.5.60/mo.
	Rented room	Fixed	B/2.50/mo.
	Marginal house	Fixed	B/.1.75/mo.
Service, up to 5 employees	By type of activity	Fixed	B/.15.00/mo. to B/.67.76/mo.
Retailers, under 5 employees	By type of activity	Fixed	B/.20.00/mo. to B/.68.21/mo.
Commerce, over 5 employees	By type of activity	Fixed	B/.20.00/mo. to B/.140.57/mo.
Wholesaler	By type of activity	Fixed	B/.55.00/mo. to B/.140.00/mo.
Hotels and Restaurants	By type of activity	Fixed	B/.30.00/mo. to B/.655.76/mo.
Industry		Unit based	B/.14.30/cubic yard
Special Service	Rental back-loading container	Unit based	B/.70.00/mo.
	Rental front-loading container	Unit based	B/.90.00/mo.
	Disposal of trees	Unit based	B/.8.00/ton
	Disposal of debris	Unit based	B/.8.00/ton
	Disposal of scrap	Unit based	B/.5.00/ton
Landfill	Own waste	Unit based	B/.17.00/ton
	Private waste collection service	Unit based	B/.30.00/ton
	Scrap	Unit based	B/.5.00/ton

Source: Executive Decree 165, August 26th 1999

The present residential tariff structure charges fixed monthly tariff, classifying residential customers into three groups according to the income level. And within each income group, the tariff varies according to the housing type, even though the difference between apartment and condominium is not clear. The residential tariff structure is fairly simple and appears to have been accepted by users of DIMAUD service.

The tariff structure is quite different for non-residential customers, which are classified by type of economic activity with great detail. The breakdown can be summarized as follows: wholesaler: 11 activity types and 4 tariffs; hotels and restaurants: 8 activity types and 7 tariffs; commerce with more than 5 employees: 41 activity types and 7 tariffs; retailers with less than 5 employees: 13 activity types and 6 tariffs; and service with up to 5 employees: 40 activity types and 5 tariffs.

b.2 Billing and Collection

DIMAUD inherited from DIMA the joint billing/collection system with IDAAN, the water supply company. Customers receive in one bill the amounts corresponding to water and solid waste disposal, but they have the option to pay both bills or either bill. As the bill is included in the water bill, users of solid waste disposal service may not feel compelled to pay the service charges. Billing and collection service provided by IDAAN to DIMAUD in 2001 can be summarized as follows.

Table D-28:: Billing and Collection by IDAAN for DIMAUD in 2001

Month	Number of Bills	Amount of Bills (Balboa)	Collected Amount (Balboa)
January	111,385	1,293,123.51	947,097.06
February	112,279	1,304,888.25	762,981.11
March	113,401	1,341,984.88	1,123,566.60
April	113,699	1,389,118.91	919,210.54
May	114,744	1,425,740.51	1,139,503.11
June	115,111	1,432,036.25	1,053,989.59
July	116,020	1,423,232.29	1,025,582.28
August	116,024	1,423,317.14	1,161,723.13
September	116,369	1,436,288.39	929,673.14
October	117,253	1,423,276.65	881,505.82
November	118,041	1,445,163.82	944,825.65
December	118,667	1,468,018.96	1,130,834.73
Total	1,382,993	15,410,204.68	12,020,492.76

Source: DIMAUD Accounting and Commercial Departments

According to the table above, collection by IDAAN in 2001 amounted to B/.12,020,492.76 out of B/.15,410,204.68 billing, giving a 78% collection rate.DIMAUD paid B/120,830.94 to IDAAN for this service. However, DIMAUD income from service charges is more than the amount billed by IDAAN. This is because DIMAUD collects directly from the government, and DIMAUD is trying to get the government to increase every year the budgeted solid waste disposal charges corresponding to different government offices. Also, DIMAUD undertakes own collection on billing made by IDAAN.

On the other hand, the Census of 2000 reported 180,474 dwellings in Panama District, of which 1,296 without water supply service. Then, IDAAN billing to 118,667 customers amounts to 66.2% of 179,178 dwellings with water supply service in Panama District, which implies a low billing rate. However, this is explained by the existence of multi-family buildings covered by a single contract. If DIMAUD estimate of 2,000 such contracts with an average of 15 dwellings are added, the resulting billing rate is 83%, thereby indicating that DIMAUD estimate of 85% coverage is correct.

b.3 DIMAUD Income and Expenditures

According to DIMAUD Financial Statement, Annex-7 Income Report, total income in 2001 amounted to B/24,278,558, of which B/21,807,977 from service charges, B/2,000,580 subsidy from the Central Government, and B/460,251 from other sources. Revenue from households amounted to B/17,179,475, equivalent to 78.8% of total service charges, while user charges from sanitary landfill amounted to B/1,246,847. Revenue from juridic person, central government, autonomous entities and government corporations all added up to around 12% of total income.

The jump of 52.8% in income from “Households” between 2000 and 2001 can be explained by the fact that the 2000 figure was an estimate. It was necessary to make an estimate because when the service was transferred to DIMAUD in 1999, DIMA did not have the customers classified into different types, in addition to having Colon and San Miguelito included in the service.

Table D-29: DIMAUD Income Report

Income Description	2001	2000
Service Charges		
Household	17,179,475	11,241,750
Juridic person	353,967	247,084
Central government	1,303,039	1,261,307
Autonomous entities	670,691	625,133
Financial intermediary	340,286	392,690
Special service	16,305	26,386
Government corporations	697,367	792,929
Cerro Patacon Landfill	1,246,847	1,391,514
Total Service Charges	**21,807,977**	**15,978,794**
Government Subsidy	2,000,580	2,283,349
Other Incomes	460,251	484,909
Income from Previous Years	9,750	0
Total Income	**24,278,558**	**18,747,051**

Source: Informes Financieros DIMAUD 2001-2000, Anexo 7

According to Income Statement (Table B of Financial Statement), total expenditures amounted to B/21,754,547, of which B/10,531,322, equivalent to 48.4% as "Personnel Expenses". Other important expense items were "Service Provided by Third Party" amounting to B/5,154,376, or 23.7%, and "Operation Expenses" amounting to B/3,393,176, or 15.6%. Also included as an expense item was "Reserve Funds" amounting to B/2,046,390, equivalent to 9.4%. "Management Expenses" included a variety of expenses, among them the payment made by DIMAUD to IDAAN for billing services.

Table D-30: DIMAUD Income Statement

Income and Expenditures	2001	2000
Income		
Income from service	21,808,977	15,978,794
Other operational income	460,251	484,908
Total Income	22,269,228	16,463,702
Expenditures		
Personnel expenses	10,531,322	9,127,348
Operation expenses	3,393,176	2,100,771
Service by third party (Sub-contractor)	5,154,376	2,609,720
Management expenses	552,706	556,596
Reserve funds	2,046,390	1,465,628
Expenses of past years	76,577	51,557
Total Expenditures	21,754,547	15,911,620
Operating Income	514,681	552,083
Other expenses	9,750	393,463
Surplus before Subsidy	524,431	945,546
Subsidy	2,000,580	2,283,349
Surplus or Deficit	**2,525,011**	**3,228,895**

Source: Informes Financieros DIMAUD 2001-2000, Cuadro B

D.5.4 Financial System

As DIMAUD came into being when the service provided by DIMA was transferred to the Municipalities of Panama, San Miguelito and Colon by virtue of Law 41 of August 27th 1999, Financial Statements are available only for the years 2000 and 2001. The Balance Sheet is shown below.

Table D-31: DIMAUD Balance Sheet

ASSETS and LIABILITIES	2001	2000
ASSETS		
Current Assets		
Cash and Bank	1,252,103	1,882,994
Commercial Accounts Receivable	10,475,774	5,625,819
Other Accounts Receivable	3,097,277	2,142,743
Inventory	1,933,455	1,959,367
Total Current Assets	16,758,608	11,610,922
Fixed Assets		
Land	3,549,435	3,549,435
Machinery and Equipment	4,176,204	4,886,024
Other Assets	11,269,828	0
Total Assets	**35,754,075**	**20,046,381**
LIABILITIES and EQUITY		
Current Liabilities		
Commercial Accounts Payable	3,639,348	1,295,892
Other Accounts Payable	221,218	217,123
Total Current Liabilities	3,860,566	1,513,015
Equity		
Public Equity (Capital)	26,574,299	15,304,471
Additional Public Equity	6,201	0
Accumulated Results	5,313,009	3,228,895
Total Equity	31,893,510	18,533,366
Total Liabilities and Equity	**35,754,075**	**20,046,381**

Source: Informes Financieros DIMAUD 2001-2000, Cuadro A

Analyses of DIMAUD Financial Statements 2000 and 2001 permit the following remarks.

a. Fixed Assets

Fixed Assets include "Other Assets" for B/11,269,828, which is equivalent to "Provision for Bad/Doubtful Accounts" shown in Accounts Receivable.

b. Accounts Receivable

Accounts receivable showed a large increase (B/5.6Million in 2000 to B/10.5Million in 2001), one reason being the delayed transfers from IDAAN to DIMAUD. This is caused by the requirement that the transfer of large amounts must have the advance approval of the Comptroller of the Republic, a quite time-consuming bureaucratic procedure. The delayed transfer of funds can reach as much as B/1,000.000. Also, large provisions were made for bad or doubtful accounts (B/11,269,828 in both 2000 and 2001), as shown in the following table.

Table D-32: DIMAUD Accounts Receivable

Accounts Receivable	2001	2000
Accounts Receivable – Private Sector		
Households	18,084,858	13,545,808
Juridic person	2,058,153	2,048,859
User fee Cerro Patacon landfill	690,763	555,755
Total Receivables from Private Sector	**20,833,773**	**16,150,422**
Accounts Receivable – Public Sector		
Central government	382,479	355,975
Autonomous entities	142,392	129,456
Financial intermediary	227,761	149,231
Government corporations	108,604	93,209
Municipalities	50,593	17,354
Total Receivables from Public Sector	**911,829**	**745,225**
Total Accounts Receivable	**21,745,602**	**16,895,647**
Provision for Bad/Doubtful Accounts	11,269,828	11,269,828
Total Effective Accounts Receivable	**10,475,774**	**5,625,819**
Other Accounts Receivable		
Employees	12,036	6,470
Returned checks	4,211	3,324
Discounts	23,925	48,303
IDAAN	436,000	0
Municipality of Panama	2,603,232	0
Municipality of Colon	17,775	0
National Bank	98	0
Others	0	2,084,647
Total Other Accounts Receivable	**3,097,277**	**2,142,743**
Grand Total Accounts Receivable	13,573,051	7,768,562

Source: Informes Financieros Comparativos 2001-2000, Anexo-1, DIMAUD

Accounts Receivable from Employees refer to amounts owed by some employees who were found guilty of having caused damage to DIMAUD assets, and have the obligation to repair the damage. Accounts Receivable from Municipality of Panama refer to water consumed by the Municipality, which IDAAN deducts from bill collection done on behalf of DIMAUD, whereby DIMAUD has to recover the same amount from the Municipality. Accounts Receivable from Municipality of Colon refer to fuel borrowed by Municipality of Colon from DIMAUD in 2000.

c. Accounts Payable

Accounts Payable also showed a large increase (B/1.5Million in 2000 to B/3.9Million in 2001), which was caused mostly by the rental of machinery and equipment for the operation of the landfill.

d. Liquidity Ratios

Current Ratio showed a large decrease but it is still adequate (7.7 in 2000 to 4.3 in 2001), and the same remark can be made about the Quick Ratio (6.4 in 2000 to 3.8 in 2001).

e. Support Documents

Inconsistent numbers were observed concerning income in 2001 between Income Statement (Table B) and Supporting Documents (Table F and Annex 7).

f. Cost of Service

Cost of service by "activity" (Administrative, Collection, Maintenance, Landfill, Street Sweeping, and Landscaping) was already available in DIMAUD. Unit cost per ton for 2001 was calculated by distributing administrative expenses to other activities proportionately with the corresponding labor costs, as shown in the table below.

Table D-33: Unit Cost of DIMAUD Service

Activity	DIMAUD Cost (Balboa/year)	Distributed Cost (Balboa/yer)	Assumed Solid Waste (ton/year)	Unit Cost (B/ton)
Administrative	3,935,387.98			
Collection	10,090,778.29	12,295,080.06	300,000	40.98
Maintenance	1,488,635.78	1,919,017.65		
Landfill	2,612,096.64	2,821,384.70	365,000	7.73
			411,000	6.86
Sweeping	3,047,337.99	4,138,754.27		
Landscaping	580,310.37	580,310.37		
Total	21,754,547.05	21,754,547.05	365,000	59.60
			411,000	52.93

Source: Informes Financieros Comparativos 2001-2000, Anexo 8, DIMAUD

- Total Cost: B/59.60/ton, assuming 1,000ton/day generation (365,000ton/year), but B/52.93/ton if the assumption is the total disposal amount of 411,000ton/year in Cerro Patacon landfill
- Collection Cost: B/40.98/ton, assuming 300,000ton/year collection
- Landfill Cost: B/7.73/ton, assuming 365,000ton/year final disposal, but B/6.86/ton if 411,000ton/year is assumed

Collection cost and total cost are high compared to referential parameters.

Administrative Expenses included most of clothing (pants, T-shirts, caps, shoes), which at least conceptually, should go to Collection Service and Street Sweeping. This remark is valid even after recognizing that "sweaters" (T-shirts) and caps included in Administrative Expenses were gifts to school children who were required to do community work in order to graduate, and many of them chose to get involved in solid waste management.

g. Commercial Aspects

- IDAAN sends daily report to DIMAUD on the amount collected during the day, but the actual transfer of funds is not daily. The larger the amount to be transferred, the larger is the delay in fund transfer because it requires the prior approval of the Comptroller of the Republic. This means that the transfer does not follow the consecutive order of daily collection. One large collection (B/274,000) of early January 2002 was still not transferred on February 20th.

- The delayed transfer from IDAAN is included in Accounts Receivable, despite being a revenue that only a technicality prevents it from being registered in accounting as income. The delayed transfer can sometimes reach B/1,000,000.
- The delayed transfer from IDAAN caused large ups and downs in monthly income (B/0.9Million to B/2.7Million in 2000, B/1.2Million to B/1.9Million in 2001).
- Subsidy from the Central Government (B/2Million in 2001) is earmarked B/91,715 per month for street sweeping and B/75,000 per month for Returned Area (Areas Revertidas).
- IDAAN charges DIMAUD for printing and delivery of bills, and for bill collected, depending on the geographic area and the type of bills (B/120,830 in 2001)
- IDAAN issues nearly 120,000 bills per month on behalf of DIMAUD, even in areas where IDAAN does not provide water service, which necessarily places DIMAUD in charge of collection.
- IDAAN normally collects from 70,000 service users, and DIMAUD collects from the remaining 50,000, of which 25,000 are hardly-paying customers in marginal areas.
- DIMAUD estimates the coverage of IDAAN to be around 85%, and the cost of billing/collection is considered low.
- A new water supply client is automatically added as DIMAUD client.
- Water supply is perceived as a social service that the government should provide because it is a vital need, and this perception makes it difficult to use service cut-off as a coercion instrument, despite provisions made in this regard by Decree Law 2 of January 7, 1997.
- DIMAUD expects to clear billing mistakes and fictitious accounts receivable in 2002, and from then on strive to keep accounts receivable proportionate with the billing growth.
- DIMAUD is in the process of differentiating between residential customers and business customers in the same building, who are currently being billed with the same tariff.

- DIMAUD is interested in directly controlling income from clear-cut commercial and industrial customers (independently located, without being combined with dwellings), as one source of stable monthly income. The other income sources under direct DIMAUD control would be the public sector (institutional) and Cerro Patacon sanitary landfill.

- Letters sent to late-paying service users, warning them that DIMAUD would proceed to collect through judicial means, are effective with middle income and commercial customers, who come to the office to pay before actually starting the judicial procedure. However, the same method would not be effective with hardly-paying residents of marginal areas.

- Adding waste collection fee on the property tax would not help to improve collection rate from hardly-paying customers in marginal areas. The reason is that dwellings costing less than B/20,000 are exempt from property tax by virtue of Law 100 of October 4th 1973, and most hardly-paying customers live in this type of houses in marginal areas.

D.5.5 Management System

(Lic. Gladys Díaz y Pascual Leguías – consultar)

TYPE OF UNIT	UNIT	OBJECTIVE	MAIN FUNCTIONS AND JURISDICTION	Intra-institutional coordination relations			Inter-institutional coordination.	REPORTS
				Vertical	Horizontal	Diagonal		
Directive Office	General Office	To lead the DIMAUD, as per the duties and powers endowed by Law No. 41 dated 27/09/99	To formulate the financial policy and the budget; to approve organization; impose fines; to arrange operations; to order collecting; to guarantee the coverage of the service and audit its performance.	The Mayor's office; and downwards with the departments and units	Different offices in the Mayor's office, in both ways	Municipal Council, Communal Boards; *Secretaría General* (General Secretary Office), Treasury, Legal Counseling of the municipality.	Ministry of Health, according to the Sanitary Code and the ANAM. Other public entities Private enterprise and NGOs; contractors; international bodies	
	Assistance Office	Delegated functions and replacement of the General Office during temporary absences.	Works with the General Office; coordinates and controls the activities according to the General Office's instructions; to preside over the technical commissions.					

TYPE OF UNIT	UNIT	OBJECTIVE	MAIN FUNCTIONS AND JURISDICTION	Intra-institutional coordination relations			Inter-institutional coordination.	REPORTS
				Vertical	Horizontal	Diagonal		
Counseling	Unit of Legal Counseling	Advising the General and Assistant Offices in juridical matters and other administrative units in the correct interpretation of legal provisions.	To elaborate Mayor Decree projects; to represent and defend the entity; to review documents and issue juridical concepts; legal advising; guidance in tenders; to counsel in working conflict matters. Technical Advisory Authority (ATA) with the *Despacho Superior* (Superior Office) and guidance and advising with the units that shape the DIMAUD	General Office and Assistant Office.	Public Relations with regards to advertising.	General Secretary Office, Legal Counseling and the Purchasing Department of the municipality. In the DIMAUD, with the administrative and commercial services units.	Relations per delegated authority with the MINSA, MEF, *Contraloría General de la Republica* (Comptrollership General's Office of the Republic, CGR) in regulations, norms, contracting and legal procedures.	
	Unit of Public Relations	To strengthen the institutional image	To create a positive image; to have presence in the mass media and assess news; to organize activities; gazettes; guidance to the user. Technical authority (ATA) with legal, administrative and operational counseling to project the institutional image	General Office and Assistant Office for promotional events.	Legal counseling provides support in advertising operations.	IT, Public Property, Purchasing, Warehousing, providing logistic support.	Relations per delegated authority with the Panamanian Institute of Tourism (IPAT), MINSA, IDAAN and other public institutions. Coordination relations with press media.	
	Information Technology (IT) Unit	To provide technical support and oversee the safety and functioning of automated information.	To plan the needs; to provide counseling; to monitor the functioning of the collection and sweeping routes; to inform and provide training. Technical authority (ATA) with Payment roll, Accounting, Public Property, Vehicle Monitoring, Warehouse, Attention to the Customer.	General Office and Assistant Office	For the management and operation of databases with: Security, Administrative Services, Relations with the Community, Human Resources and Coercive Jurisdiction.	Execution of IT works: Commercialization, sweeping, collection, Public Relations, Legal Counseling Related to the IT Department of the municipality.	Regarding the updating of payment rolls, it coordinates with the CGR.	
	Security Section	Permanent surveillance of goods and property, and protection of the personnel.	Security of the facilities and equipment; protection to the staff; lineal hierarchical authority at the following areas: Carrasquilla, Cerro Patacón, Pacífico and Brigada Amarilla	General Office and Assistant Office	In administrative actions with Administrative Services, Human Resources, Relations with the Community, Coercive Jurisdiction and IT (Information Technology).	In safety regulations and procedures with the *Dirección de Vigilancia Municipal* (Office of Municipal Surveillance). In damages caused to vehicles with Maintenance. It controls and checks the movement of vehicles.	Regarding the social prophylaxis operations and crimes committed within the entity with the *Policía Nacional* (National Police)	
Support	Department of Administrative Services	To provide the material and financial resources; to provide control on the use of property; to conserve physical infrastructure.	Registry, management and control of financial operations; purchasing, storage and dispatch; list of charges; payments; insurance; maintenance and repairing of physical facilities.	General Office and Assistant Office Downwards with the Accounting, General Services, Public Property, Purchasing and Warehousing units	Regarding the support services with: IT units, Relations with the Community, Human Resources, Security and Coercive Jurisdiction.	Formalities for purchase orders, checks, account statements, controls and registration before the following: Gral. Secretary, Treasury, Purchasing, Administration and Legal Counseling of the municipality. In the DIMAUD Technical Services,	For purchase order arrangements and issuance of checks with the CGR. With providers of goods and services.	

TYPE OF UNIT	UNIT	OBJECTIVE	MAIN FUNCTIONS AND JURISDICTION	Intra-institutional coordination relations			Inter-institutional coordination.	REPORTS
				Vertical	Horizontal	Diagonal		
						Commercialization, Maintenance and Shops, Sweeping, Collection, Public Relations, Legal Counseling, Archives and Mailing, Budget, Maintenance, Receivership and Formalities.		
	Accounting Section	To prepare, register and control the entity's accounting and financial activities.	To gather, classify and arrange the information for accounting and financial statements. Reports on financial statements. Banking settlements. To receive payments, post deposits, update the petty cash flow, to prepare collecting arrangements to the government (subway, yellow brigade), to settle obligations, support to the social assistance fund, posting of the operations fund, rotary fund and payment roll. Budget control and expenditure and investment draft. Lineal hierarchical authority in the following administrative areas: accounting, budget, receivership and formalities. Technical authority (ATA) in the accounting records, use of funds and financial reports.	Department of Administrative Services	Administrative accounting formalities with: General Services, Public Property, Purchasing and Warehousing	Regulations and procedures for financial and accounting arrangements with the Accounting and Budget units of the municipality.		Monthly depreciation report to the accounting section, and a monthly and quarterly report on fixed assets.
	General Services Section Archive/mail area Infrastructure maintenance area.	Housekeeping of physical infrastructure and management of documents, archives and mail.	Preventive maintenance and repairing in all the facilities, cleaning, furniture. To receive, record, distribute and deliver mail, reproduction of documents	With the Department of Administrative Services and downwards with the Archives and Mail and Infrastructure Maintenance areas	Relations with the Accounting, Public Property, Purchasing and Warehousing units, within the boundaries of the Department of Administrative Services and in regards to general maintenance and mailing and courier service	With the entity's administrative units in regards to the courier service, mail distribution and general maintenance With the Mailing and Archives unit of the municipality.	With the CGR and other governmental entities.	
	Public property section	Updated inventory of the entity's property	Control and updating of property; reappraisal and depreciation of assets; discarded goods applications before the Ministry of Economy and Finance (MEF); movement of incoming and outcoming goods in coordination with the warehouse.	With the Department of Administrative Services.	With the Accounting, General Services, Purchasing and Warehousing units, regarding the administrative activities.	With the Public Property department of the municipality in administrative activities.	With the MEF and the CGR, regarding the inventories, appraisals and information on the entity's fixed assets.	
	Purchasing section	Timely acquisition of goods and services	Quotations, requests, specifications, purchase order control, programming and	With the Department of Administrative Services	With the Accounting, General Services,	With all the entity's administrative units regarding	With the MEF and the CGR in regards to the enforcement of	

TYPE OF UNIT	UNIT	OBJECTIVE	MAIN FUNCTIONS AND JURISDICTION	Intra-institutional coordination relations			Inter-institutional coordination.	REPORTS
				Vertical	Horizontal	Diagonal		
			arrangement of public acts, delivery and receiving and proposal of criteria for the acquisition of goods and services. Coordinate the availability of line items with the Budget Unit.		Public Property and Warehousing units, in the arrangements for the purchase process.	their purchase of goods and services. With the Purchasing unit of the municipality, related to the compliance with the purchasing regulations and procedures.	the Fiscal Code and the legal purchasing procedures.	
	Warehousing section	To receive, store and provide materials, tools, spare parts and others.	Receiving and storage, control of stocks, supplying of materials, tools, spare parts and others. To prepare the annual needs program; to collaborate with internal auditing; to keep stock levels appropriate in order toprovide a satisfactory response; to keep an updated record of the goods.	With the Department of Administrative Services	In the requisitions with the purchasing unit; in the financial records with the Accounting area; recording of inventories with Public Property; in the maintenance of offices and cleaning with General Services.	In the supplying of materials with: Legal Counseling, Commercial Relations, Maintenance and Shops; Public Relations and Operations.		
	Community Relations Unit Community Cleaning Promotion Area Communal Training Area (Cleaning Inspection Area ¿? Recycling	To raise awareness and citizen organization mechanisms to attend, process and suggest solutions for the cleaning problems, using children and youngsters as the driving axis.	Develop organization and awareness programs in schools; and training, conferences and lectures with local governments. Incorporate communities in the cleaning programs. To organize, lead and control the inspectorates activities.	With the General Office and Assistant Office Hierarchical authority in line with the Community Cleaning Promotion Area, Communal Training and Cleaning Inspection areas. Technical authority (ATA) in the sweeping and collection units	With the administrative units of Security, Administrative Services, Human Resources, Coercive Jurisdiction and IT, regarding the support required for their administrative activities.	With the Public Relations, Collection and Sweeping units, in the promotion of communal cleaning and sanitation actions.	With the ANAM. With different junior high schools	
	Coercive Jurisdiction Unit	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	
	Human Resources Section	Management of the human resource	To advise and enforce the regulations and norms of human resources, classification of positions, salary scales, performance, recruiting, actions and history, training, updating, social and labor welfare	General Office and Assistant Office	On administrative activities with: IT, Community Relations, Security, Coercive Jurisdiction.	With all the administrative units	With the CGR in the management of human resources and payment rolls. With the CSS in diseases, pensions and retirements. With the private activity in credits for the workers.	Presents periodical reports. ¿?
	Occupational Health Unit	To provide integral attention in preventive and curative health, a hygienic and safe labor environment	To develop occupational health programs; to guard medical attention; prevention programs; attention to laboratories and medications; control and elimination of work hazards; psycho-social risk control and prevention	With the Human Resources Section	Coordination with the Payment rolls, Personnel Actions and Social Work units	For logistic and financial support with the General Office, Administrative Services and other units.	Development of health activities, clinical services, medications, training, with the *Caja de Seguro Social* (Social Security Savings system, CSS),	

TYPE OF UNIT	UNIT	OBJECTIVE	MAIN FUNCTIONS AND JURISDICTION	Intra-institutional coordination relations			Inter-institutional coordination.	REPORTS
				Vertical	Horizontal	Diagonal		
		to protect the worker.	programs. Technical authority (ATA) with the sweeping, collection and maintenance and Shop departments, in the orientation of health and labor environment conservation programs. Technical functional authority (ATF) delegated by the Human Resources Chieftainship as regards to the occupational safety regulations and conservation of health			Coordination of the programs being offered to the workers with Public Relations and the municipality's Social Development Office.	MINSA, IDAAN, *Instituto Nacional para Formacion y Aprovechamiento de Recursos Humanos* (National Institute for Human Resources Formation, INAFORH), and the *Asociacion Nacional contra el Cancer* (National Association against Cancer, ANSEC).	
	Personnel Actions Unit	To carry through the actions of Human Resources and keep registries updated.	Formalities for appointments, vacations, licenses, layoffs, assistance, permits, punctuality, contracts, absences, professional risks, sickness, work recommendation letters, compensation time, dismissal from the position.	With the Human Resources Section	In the arrangement of personnel actions with the Occupational Health, Payment rolls and Social Service units	In the arrangement of personnel actions with all the entity's administrative units.		
	Payment Roll Unit	To prepare payment rolls	Payment rolls, posting of checks to the National Treasury, control of salary payments, claims, rebates fro unjustified absences and delays, sworn statements of the number of dependents	Human Resources Section	In the arrangement of payment rolls and payments with the Occupational Health, Personnel Actions and Social Health units	In the arrangement of payment rolls and payments of officials with all the entity's administrative units It coordinates with the municipality's Payment rolls unit the procedures and regulations that must be followed.		
	Social Work Unit	To contribute to the workers' social and labor well-being by paying attention to their problems and needs.	To plan, supervise and evaluate the social assistance programs and cases on social and economic needs at an individual, group, family and therapeutic level; preventive, educational and entertaining programs with a psycho-social approach; guidance with alimony, family planning and suspension of labors; to drive changes in the mentality, behaviors and	With the Human Resources Section.	Of an administrative and social service type with the Occupational Health, Payment rolls and Personnel Action units	Regarding the social work regulations and procedures with the Social Development Office and the municipality's Social Work Department. With the development of social development programs and labor problems with: Training units, *Corregidurías* and Community Relations, Administrative Services and Public	With the CSS in occupational health programs; with the MOP clinic for the sweeping workers; for the workers' sons with the *Dirección de la Juventud* (Office for Youngsters); Ministry of Education for lectures to the students of 5th and 6th grade On family planning with the *Asociacion Panameña para el*	
			attitudes; to elaborate diagnostics and strengthen social programs.			Relations of the entity.	*Planeamiento de la Familia* (Panamanian Association for Family Planning, APLAFA); in drugs with the	

TYPE OF UNIT	UNIT	OBJECTIVE	MAIN FUNCTIONS AND JURISDICTION	Intra-institutional coordination relations			Inter-institutional coordination.	REPORTS
				Vertical	Horizontal	Diagonal		
							REMAR Foundation; in family maltreatment with the *Hogar Nueva Vida* (New Life Home) and the ANCEC for ccancer prevention.	
Operative duties	Commercialization Department	To guarantee that the revenues for the services rendered are collected and facilitate the best conditions for the customers' commercial formalities with the entity.	To define the sales and collecting policies. Analyze delays and recovery actions. To establish working methods. To evaluate and control the activities of the subordinated units. To coordinate with the Coercive Jurisdiction Unit. To coordinate the transactions of returned checks and forged bills.	With the General Office and Assistant Office, and downwards with the Collecting and Attention to the Customer units	With the Technical Services, Maintenance and Shops, Sweeping and Collection Departments	Not available.	With household and commercial users.	To present reports
	Collecting Section	To charge the customers for the services rendered	To prepare statements for the corresponding credits. To conduct the collecting duties, to follow them up and control the recovery. To keep the delay registries updated. To verify the checks and bills received.	Upwards with the Commercialization Department	With the Attention to the Customer section	Not available.	Coordination with state institutions linked with the presentation of bills for the services rendered. With the private sector in regards to bills for credits granted.	
	Customer Attention Section Billing Area Claims Area Cadastre Area	To inform the customer on their claims, bills and cadastre surveys.	To bill the cleaning fee every month To attend the claims, conduct the research and inform on the results obtained to the customer To keep the customers' database updated.	Upwards with the Commercialization Department	With the Collecting and Cadastre sections	With the IT (prepares customer reports), Collection (indicates the area serviced), Accounting (processes information on credit adjustments) and Public Property units with regards to the cadastre, billing and claims.	Coordination with public and private entities regarding their billings and claims.	
	Maintenance and Shops Department	To ensure the daily availability of the equipment	To program and oversee the activities of subordinated units. To approve the requests for purchasing pieces and spare parts. To attend the collisions, annual technical inspection of vehicles (*revisados*), policies. Inventory and status of the fleet.	With the General Office and Assistant Office. Lineal hierarchical authority over its dependent units. Technical authority (ATA) in the General Office and Assistant Office,	With the Technical Services and Commercialization departments in activities programmed by the entity. With the Sweeping and	With the Human Resources, Public Relations, Warehousing and Purchasing units in several activities linked with the area of service.	Suppliers of materials, tools, pieces and spare parts to repair the fleet.	

TYPE OF UNIT	UNIT	OBJECTIVE	MAIN FUNCTIONS AND JURISDICTION	Intra-institutional coordination relations			Inter-institutional coordination.	REPORTS
				Vertical	Horizontal	Diagonal		
				and in the Purchasing, Warehousing, Administrative Services, as regards to the acquisition of new pieces of equipment and spare parts.	Collection departments related to the use of the fleet.			
	Automotive Mechanics Section Heavy Equipment Area Light Equipment Area "A" Zone of Automotive Maintenance	To conduct the repairing of mechanical failures	To check for failures and breakdowns. To request spare parts and accessories To make simple and complicated repairs. To conduct evaluations and prepare specifications for the acquisition of spare parts. To evaluate damaged vehicles that must be retired from circulation.	Upwards with the Maintenance and Shops Department	With the Preventive Mechanics and Other Maintenance Services units regarding the repairing and maintenance operations to be conducted.	With the Purchasing and Warehousing units related to the acquisition of materials and spare parts.	Not available	
	Preventive Maintenance Section	To provide preventive maintenance to the entity's vehicles, avoiding major damages	To keep vehicles in good physical and mechanical conditions. Updated control of the status. To check part of the vehicles everyday (motor, electrical parts, crashes, oil, greasing and others)	With the Maintenance and Shops Department.	With the Automotive Mechanics and Other Maintenance Services units	With the Purchasing and warehousing administrative units, regarding the acquisition of pieces, materials and spare parts.		
	Other Maintenance Services Section Welding, milling, greasing, mending, sheet-metal working and electro mechanics Area	To keep the equipment in optimal functioning conditions	To manufacture pieces in the mill; rectifications; to repair trailer boxes; welding; electricity; facilities; tires and have a daily control; greasing; straightening.	With the Maintenance and Shops Department.	With the Preventive Maintenance and Automotive Mechanics units, regarding the support that they provide.	Purchasing and Warehousing units, in the acquisition of pieces and spare parts.		
	Collection Department	To keep public thoroughfare and areas of the district clean	To program and coordinate the collection activities To control and meet the established collection programs. To participate in the collection operations programmed. To coordinate with the different areas the regular and special operations. To arrange the required material resources.	With the General Office and Assistant Office Downwards with A, B and C collection areas. Downwards with the welding, milling, greasing, mending, sheet-metal working and electro mechanics areas.	With the Sweeping, Maintenance and Shops, Technical Services and Commercialization departments regarding the mutual support to carry out the operations.	With the administrative units of Community Relations, Public Relations and with Communal Boards and *Corregidurías* in the cleaning operations carried out at the communities. Coordination with the Human Resources and	With the CSS, MEF, National Police, *Centro de Rehabilitación Femenino* (Feminine Rehab Center) to the support provided in the collection of the solid wastes. With the *Asociacion Nacional para la Conservacion de*	To present monthly reports

TYPE OF UNIT	UNIT	OBJECTIVE	MAIN FUNCTIONS AND JURISDICTION	Intra-institutional coordination relations			Inter-institutional coordination.	REPORTS
				Vertical	Horizontal	Diagonal		
	Collection Section, Area A, B and C	To collect solid wastes in the *corregimientos* of the district of Panama	To pick up, carry and dispose solid wastes in Cerro Patacon sanitary landfill. To install containers on streets. To coordinate, oversee and assess the collection duties. To participate and provide support in special operations. To assign the programmed collection works	With the Collection Department.	With the Area B and C collection units	Social Work units regarding the administrative actions that they carry out with the staff. With Community Relations and Public Relations units, Communal Boards and *Corregidurías* in the cleaning operations. With the Human Resources and Social Work units.	*la Naturaleza* (National Association for Nature Conservation, ANCON), *Patronato del Estadio Nacional* (National State Trusteeship) in the collection of the solid wastes.	
	Sweeping Department	To keep public thoroughfare and areas of the district clean	To program and coordinate the sweeping and cleaning activities To control the compliance with cleaning and sweeping programs. To coordinate with the heads of diurnal and nocturnal shifts the normal and special operations. To arrange the provision of resources. To participate in the cleaning operations programmed by the *corregimientos*.	With the General Office and Assistant Office and downwards with the diurnal and nocturnal sweeping sections.	With the Collection, Maintenance and Shops, Technical Services and Commercialization departments regarding the support of the operations.	With the administrative units of Community Relations, Public Relations, Social Work, Human Resources, Communal Boards and *Corregidurías*.	With the Ministry of Education, CSS, MEF, National Police, to the support provided for the cleaning inside and outside their operations areas. With entities of the private sector, ANCON group, *Patronato del Estadio Nacional*	
	Diurnal Sweeping Section	To keep public thoroughfare and areas in the 19 *corregimientos* of the district clean	To conduct the cleaning, sweeping of streets, avenues and public areas during the diurnal shift. To coordinate, supervise and evaluate the cleaning duties. To participate in the cleaning operations programmed. To assign el the sweeping duties as per a program.	With the Sweeping Department.	With the Nocturnal Sweeping unit	With the Community Relations, Public Relations, Human Resources and Social Work units.	With Communal Boards.	
	Nocturnal Sweeping Section	To keep public thoroughfare and areas in the 19 *corregimientos* of the district clean	To conduct the cleaning, sweeping of streets, avenues and public areas during the night shift. To coordinate, supervise and evaluate the cleaning duties. To participate in the cleaning operations programmed. To assign el the sweeping duties as per a program.	With the Sweeping Department.	With the Diurnal Sweeping unit	With the Community Relations, Public Relations, Human Resources and Social Work units.	With Communal Boards	
	Department of Technical Services	To program, execute and control the operations related to projects and sanitary landfills	Calculation and engineering design and sanitary works; research, counseling, guidance, inspection and control of engineering projects. Execution, updating and maintenance of topographical maps and maintenance of sanitary landfill areas. Technical training and	With the General Office and Assistant Office	In administrative activities with the Commercialization, Sweeping, Collection and Maintenance and Shops departments.	In the survey and design of engineering drawings and sanitary works with the Municipal Office of Works and Constructions and in training actions on solid wastes with the	In the treatment of solid wastes disposed of at the sanitary landfill with: San Miguelito and Arraiján municipalities, CSS, MINSA, the Canal authority.	To present reports

TYPE OF UNIT	UNIT	OBJECTIVE	MAIN FUNCTIONS AND JURISDICTION	Intra-institutional coordination relations			Inter-institutional coordination.	REPORTS
				Vertical	Horizontal	Diagonal		
			technology transfer.			Social Development Office and Protocol of the municipality. Technical support with the Legal Counseling, Public Relations and Community Relations units.	With the private enterprise that uses the sanitary landfill.	
			Statistical registry and control of operations and negotiation of contractors' accounts Hierarchical authority in the project units and sanitary landfill units. (ATA) with the general Office and Assistant Office.					
	Projects Section Engineering Area	To program, execute, lead, specify, supervise and control projects.	Elaboration of designs, drawings and specifications. Terms of reference for the contracts with third parties. Supervision and control of execution.	Lineal hierarchical authority in the engineering, statistical, and technical training areas	With the Technical Services department	With the Sanitary Landfill section	Coordination with governmental, municipal and private entities that use the sanitary landfill	
	Statistics and Technical Training Area	To generate data and provide training for the appropriate management of solid wastes.	Data recording of disposed solid wastes. Control and verification of contractors' accounts of the sanitary landfill To train officials, educational institutions and private enterprises on the SWM.				Coordination with other bodies in training and technology transfer activities	
	Sanitary Landfill Section Weighting and Washing Section Sanitary Landfill Operations Area	Entrance and weighting control Washing of DIMAUD's collection vehicles Topography	Weighting and registry of all the vehicles and the solid wastes entering, and collecting to particulars. Washing of vehicles after the working day. Surveys, leveling, calculation and design required for the operations.	With the Department of Technical Services and downwards with the Weighting and Washing and Sanitary Landfill Operations areas.	With the Projects section regarding Cerro Patacon operations	With the Commercialization Department in regards to the information on the entrance of solid wastes, to be used for the collecting	Public, municipal and private entities regarding the weighting of solid wastes and the guide for discharging the solid wastes.	
		Maintenance of the facilities Organization and commanding of transit and unloading	Preventive maintenance of green areas, physical facilities and equipment and the stabilization pond To attend, guide and organize transit and unloading of vehicles					

D.5.6 Private Sector

The private sector participates in collection, recycling, and final disposal areas.

a. Collection

During January 2002, private vehicles transported to Cerro Patacon sanitary landfill the following solid waste amounts.

The vehicles owned by a private company that services San Miguelito Municipality are also classified as private vehicles.

Table D-34: Admission of private vehicles into Cerro Patacon sanitary landfill, January 2002

Source	Weight in tons	% of the total amount of waste transportedto Cerro Patacon	No. of trips	% of the total number of vehicles allowed into Cerro Patacon
Total amount of waste transported to Cerro Patacon	86,111.51	100	9,902	100
Private with credit	3,494.54	4.06	1,309	13.22
Private paying in cash	2,067.17	2.40	1,817	18.35
Sub total	5,565.71	6.46	3,126	31.57
San Miguelito	7,144.89	8.30	1,446	14.60
Total	12,710.60	14.76	4,572	46.17

The private company that services San Miguelito District deposits 8.3% of the total solid waste allowed into Cerro Patacon.DIMAUD does not bill for this final disposal service neither to San Miguelito nor the private company that collects in San Miguelito.

Private vehicles that pay in cash, as they are given access into the facility, transport 2.4% of the total amount of waste allowed into Cerro Patacon.Private vehicles with credit (they are billed subsequently) transport 4.06% of the total.The combined weight of both sources added up to 5,565.71 tons (6.46% of the total).

These numbers suggest that solid waste amount from these private sector sources, taking into account those generators that use their own vehicle as well as those who hire private collectors, is less than the amount of waste transported by the private company that collects in San Miguelito.

Similarly, DIMAUD´s fee for companies that transport their own wastes is less than the fee for private companies that collect for a third party.

These private collection companies believe that this practice to have a final disposal service for free and the differentiated tariffs is discriminatory and affects negatively their interests because they can not compete under these circumstances.

They point out that under these conditions, some unscrupulous persons offer their collection services at a low price and discharge the waste collected in non-authorized locations.This situation violates existing regulations, affects the public health, and degrades the environment.

DIMAUD has to assume the cost for special operations dedicated to collect solid waste disposed illegally and keep clean the district.

Private entrepreneurs suggest that a register of collection operators should be initiated and the responsible authorities should investigate and punish, as it is established in the law, those who irresponsibly are harming the society as a whole.

These entrepreneurs are convinced that an effective regulation of collections services directed to the private sector would be convenient for the residents in the district, private sector, and DIMAUD.

b. Final Disposal

The contract of operation by a private company of Cerro Patacon sanitary landfill still needs to be countersigned by the office of the Republic´s Controller.DIMAUD conducted a public bidding for that purpose.

Currently, DIMAUD has a machinery rental contract for the operations at Cerro Patacon.

c. Recycling

There is a marketing structure, partly formal and partly informal, consisting of street workers, collection workers, public and private employees, residents, scavengers in Cerro Patacon, purchaser points (in the city and Cerro Patacon), recycling shops, purchaser companies, processing and transforming companies, and exporters.

The recycling sector has grown in the last ten years.Recycling materials have acquired added value in some cases; for example, there is a producer and exporter of packages for eggs that uses recycled material as raw material.Similarly, plastic has begun to be used as raw material to make new products.

Entrepreneurs in this sector are also initiating an association as a first important step directed to obtain the support of the state and the international cooperation.They estimate that they can

achieve stability in the market and improve the working conditions and income of the primary recyclers.

They are convinced that the sector can achieve sustainable growth, based on statistics that reflect the tendency to include recycled materials in the national production, and the volume and value of the exportations.

D.6 Social Aspects

Waste-pickers working under poor conditions in Cerro Patacon landfill count over 400. Improvement of waste-pickers' current situation is inevitable both for themselves and landfill operation. Previously various studies on waste-pickers were attempted at the landfill and a couple of studies help us establish some points of comparison with the present situation. For example, one is elaborated by DIMA in 1984, compiled by National Environment Commission in 1987 and the other is a survey executed by Patsy Arcia from DIMA within the scope of an international consulting job.

In this study, an investigation on the present conditions of waste-pickers was implemented in February 2002. The results are mentioned below.

D.6.1 History of waste-pickers in Panama

a. Before Cerro Patacon

The previous study shows that there were recycling activities in the final disposal site used in 1945 in Panama. It is important to mention that at that time the recollection service was under the rule of U.S.A. Afterwards, the site was relocated at Parque Lefevre, which was named Panama Viejo Crematory. The presence of people who dedicate to pick solid waste came to be known after the Crematory started its operation. In 1955, recollection, sweeping and final disposal services were transferred to the Republic of Panama.

By 1956, the waste-pickers were no more than 20 people and the majority was workers of the Aqueduct, Streets and Sewage System Department ("D.A.C.A") that belongs to the Public Work Ministry (MOP). There was no woman in this labor. There is information that by 1969 the waste-picker population oscillated daily between 100 and 150 but now not only to pick solid wastes but also to collect food to bring to their homes. Women were also involved in this activity at this time.

By 1971, the National Institute of Aqueduct and Sewage Systems (IDAAN) hired 14 labors to work in the Crematory to recover materials from the wastes. The sale of those materials created an important income for the operation of the department. However, this section was closed because of the increase of waste-pickers and some other reasons.

By 1984 it is recorded that waste-picker population went as high as 250 to 300, including men and women whose ages vary from 14 to 36. Since then, involvement of children under the age of 15 became remarkable.

Due to high pressure made by some communities surrounding the Panama Viejo Crematory, the final disposal site was finally moved to the present Patacon area in 1985.

b. After Cerro Patacon

An interview survey was conducted by DIMAUD at Cerro Patacon in April 1995. At this time the number of waste-pickers was estimated approximately 300 from which 50 were children under 15 years old. Some of the population came from the previous disposal site, Panama Viejo Crematory.

After the investigation conducted in February this year, the population of waste-pickers is estimated between 450 to 500. The personnel of a private company that manage the landfill operation estimates that it reaches as high as 600 to 700 especially during specific periods such as those before school begins, Christmas and carnivals. Since there is not any kind of control or restriction policies to limit the access to the landfill, it is impossible to determine the exact number of west-pickers.

It is worth mentioning that many waste-pickers had been hired by DIMA, now called DIMAUD through years and vice versa, many ex-DIMAUD workers have now joined in the waste-picking activity.

D.6.2 General information

a. Sex and age

The data obtained during the investigation on west-pickers show that the proportion of men to the entire population is 83% (Figure D-35). The majority of waste-pickers are concentrated in the age between 31-50 (61%) (Figure D-36).

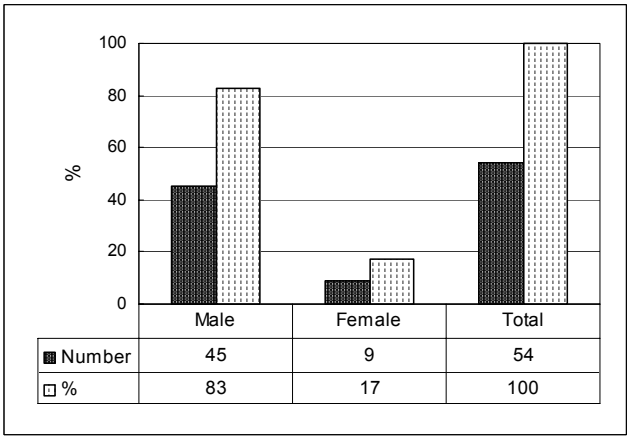


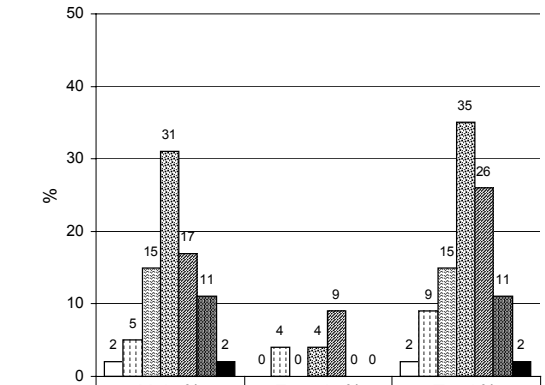
Figure D-35: Percentage of waste-pickers by sex in the Cello Patacon Final Disposal Site

b. Place of birth

Most waste-pickers were born in Panama district (37%), followed by Darien (31%) and Veraguas (13%).

c. Previous occupation

The following occupations were identified within the waste-pickers; building workers (11%), domestic work (11%), ex-DIMAUD recollectors (11%), sailors (5%), waking sellers (5%), masonry worker (4%), heavy truck driver (4%), welding worker (4%), security police (2%), driver (2%), baker (2%) and fumigator (2%).



	Male %	Female %	Total %
10 - 15	2	0	2
16 - 20	5	4	9
21 - 30	15	0	15
31 - 40	31	4	35
41- 50	17	9	26
51 - 60	11	0	11
61 - 70	2	0	2

Source: FAS PANAMA, February 2002

Figure D-36: Percentage of waste-pickers by age in the landfill

d. Living condition

A high percentage of houses do not have electricity (44%), drinking water (46%) and sanitary (72%). In the same way, 50% has soil floor as shown in Figure D-37. Regarding the living period on their actual residence, most of the waste-pickers have between 5 to 10 years.

However, most waste-pickers buy water from the particular seller or other group go down to the stadium to fill some 5 gallon tanks.

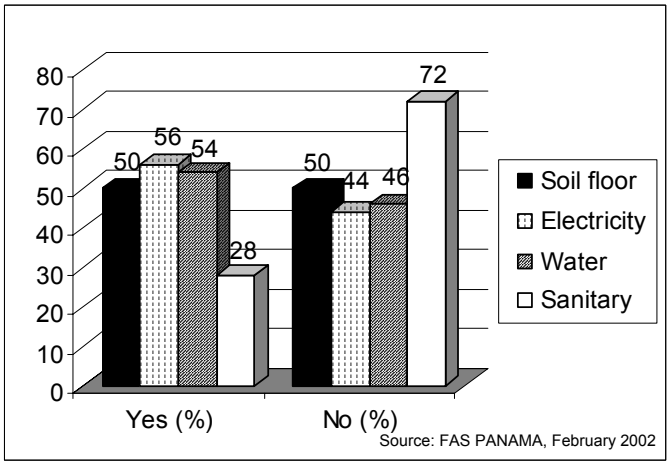


Figure D-37: Living condition of waste-pickers

Figure D-38: View of "ranchitos" located in Cerro Patacon Landfill

The waste-pickers' houses in the landfill, called "ranchito", are mostly temporary buildings because they remove and relocate them as the landfill advances. However, there are permanent houses of some waste-pickers, too. These ranchitos are made from woods, pallets and plastic bags and so on (See Figure D-38). During the investigation we could count 85 ranchitos. In the later visits to the same areas we found that many ranchitos had been removed and relocated to other places in the landfill. The conditions of these ranchitos are totally unhealthy.

e. Education

In general most waste-pickers complete elementary school. And there is a case of an ex-law student that was identified in the 1995 survey. 28% have incomplete elementary school (20% in 1984) against 39% with complete elementary school (26% in 1984), 11% have incomplete first half of secondary school (36% in 1984) against 9% with complete first half (2% en 1984), 2% with incomplete second half of secondary school (2% en 1984), 2% with incomplete university (1% en 1984) and 9% with no education (1% in 1984) (Figure D-39).

Comparing 1984 and 2002 surveys, the population in 1984 (38%) had more high school years than in year 2002 (22%).

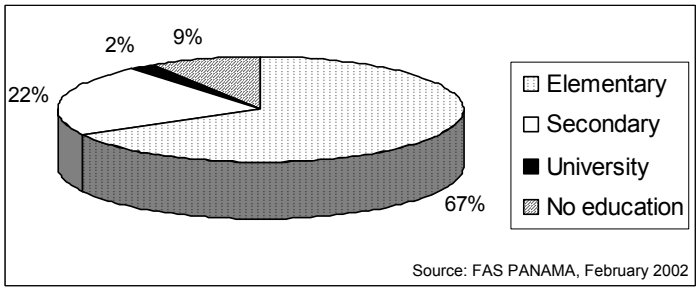


Figure D-39: Education level of waste-pickers

D.6.3 Basic infrastructure within the landfill and close communities

a. Condition of the surrounding areas

There are two main routes to the landfill: one is Ricardo J. Alfaro Avenue, which is the main route and intersects with North Highway. The other is the route which intersects with a road to the lakes on the way to Paraiso Town in Ancon. Besides, by walking they can use a land route of Villa Cardenas that communicates with Las Cumbres, San Miguelito, Kunanega and Valle de San Francisco. Also there are routes through Mocambo Arriba and Chivo Chivo. Villages closer to the landfill are: Kunanega, Valle de San Francisco, Villa Cardenas, Mocambo Arriba and Mocambo Abajo. Waste-pickers and buyeres in the landfill come from these four villages. The general basic conditions in these villages are summarized in Table D-35.

Table D-35: Basic Conditions of the Communities located around the Cerro Patacon Lanfill

Community	*Houses*[4]	*Habitants*	*School*	*Health Center*	*Electricity*	*Drinking water*	*Sewage systems*
Mocambo Arriba[5]	123	559	Yes	Yes	No	Yes[6]	No
Kunanega	97	851	Yes	Yes	Yes	Yes[7]	No
El Valle de San Francisco	86	86	No	No	No[8]	Yes, partial	No
Villa Cárdenas	13	27	Yes	No	Yes	No	No
Mocambo Abajo	174	660	No	No	No	No	No
Relleno sanitario	84 ranchitos	168	NA	NA	No	No	No
Total	407	1664	----	------	------	----	------

Source: FAS PANAMA, February 2002

[4] Data from the Houses and Population National Survey of May 2000.
[5] Mocambo Arriba is located within Las Cumbres, but there are 6 houses in Ancon.
[6] One of the residents commented that they have drinking water availability problems and that the aqueduct does not cover the whole community. The National Survey indicated that 42.73% have no drinking water.
[7] Provision Tank.
[8] The community had commonalty electricity but now cut off because of arrearage of electric fee. Now they are making new efforts to connect the electricity to houses.

The survey indicated, as shown on Figure D-37, that the houses of waste-pickers reflect a lack of basic services.

b. Transportation

The transportation to the landfill depends on the buses or "chivas" that travel to Kunanega and Mocambo Arriba, which have a frequency of every 3 hours. However, large numbers of waste-pickers walk through the road close to the pre-cooperative or through Kunanega, which seems that they walk until the Transistmica Avenue to take a bus to Las Cumbres and San Miguelito.

Going to the final disposal site is a daily activity for many truck and lorry drivers from DIMAUD or others. And they are often pressed by some waste-pickers to take them in and out the landfill. Even the DIMAUD workers, especially those who cover the night turn have to take this way of transportation.

D.6.4 Working condition

a. Working section

Figure D-40 shows the percentage of working sections of waste-pickers. Majority of waste-pickers work only in the organic site (74%).

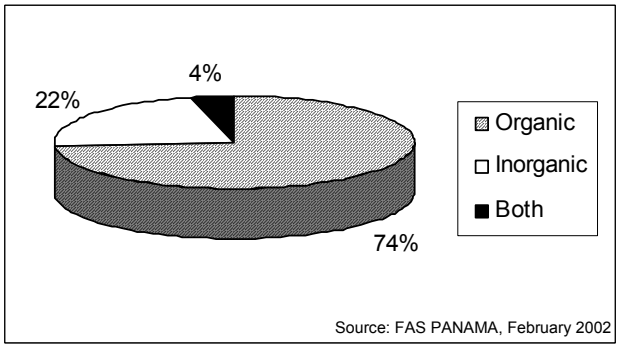


Figure D-40: Working section of waste-pickers

b. Working days

According to the investigation, 73% of waste-pickers work more than 6 days per week (Figure D-41). It is important to mention that the majority of the waste-pickers that lives in "ranchitos" in the landfill have continuous working periods that oscillate from 1 to 4 weeks. After that they go back to their permanent residences to have a rest, and then again come back to the landfill. On Sundays, most waste-pickers have rests.

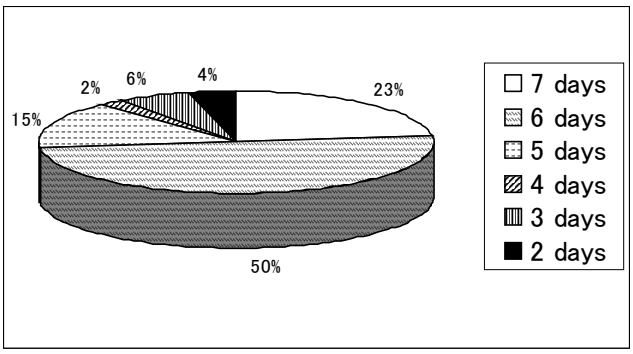


Figure D-41: Working days in a week

c. Safety

Majority of waste-pickers use gloves made from hard cloths. The use of masks is very low with only 11% of waste-pickers. In the organic section, usage of tools is very low or null. On the other hand, 63% uses tools in the inorganic section due to the type of materials they picks. The tools which are frequently used are: chisels, mallets, screw drivers, monkey wrenches, pressure wrenches, knives, pincers, machetes and bags. Source: FAS PANAMA, February 2002

Regarding the problems waste-pickers face in the landfill, waste-pickers regard the work accidents most critical (44%), followed by fights and disputes (24%), illness (20%) and security (17%). Only 6% recognized drug as a problem. 30% answered no problem.

The awareness of safety among waste-pickers seems to be high. The most waste-pickers have their own personal protection and safety measures during the labor time. The internal security problems such as thefts and attacks within the landfill are indicative of the low police vigilance and ineffective access control.

D.6.5 Recovered material

a. Material type

Recovered materials in the landfill are enumerated below.

Aluminum cans, aluminum, bronze, cupper, lead, batteries, glass bottles, soft iron, white and color paper, newspaper, 5 galloon plastic tanks, bags, used cloth, food, wood, tires, car parts and electric appliances (used and damaged iron machines, microwave, and so on).

The data obtained both from organic and inorganic sites show similar type of materials to be recovered. Most waste-pickers collect metals (68% and 100% of waste-pickers in organic and inorganic sites, respectively), followed by paper (55% and 69%) and newspaper (23% and 22%).

b. Treatment of picked materials

Organic and inorganic materials

After accumulating a certain amount, they sell the materials to companies, intermediaries or classifiers-intermediaries in the landfill. Paper will also be sold to the classifier-intermediaries from Mocambo Arriba or the Pre-cooperative.

Clothes

Cloths are picked and classified in the ranchitos. They take the classified cloths to their homes to wash and sell to neighboring communities. This is mainly women's work.

Fabrics

Materials will be brought to ranchitos to clean (take out the zippers, knobs, and so on). Then, they wash in the river and dry the classified materials. After this procedure they use the materials in their houses making hammocks, mosquito nets, bed sheets and clothes. This activity is mainly performed by women and is for their own use or for their relatives. In this case there is not any direct income. They do this work every two months.

96% of waste-pickers clean materials in the ranchitos, while 4% brought them to their residences.

c. Solid waste carriage

87% of waste-pickers does not transfer the materials to other places but sell in the landfill and leave residual materials around ranchitos. 6% takes out the materials manually from the landfill. 6% uses transportation hired within the landfill. Those who transfer the materials burn or burry the residual materials at their residences.

d. Amount and price of materials

Survey results show that a significant amount of solid wastes are recovered by waste-pickers. For example, the average amounts of paper, metal and carton a waste-picker collects in a day are 86-100 lbs, 45-50 lbs and 200-1000 lbs, respectively.

The prices of materials recovered by waste-pickers have a direct relationship with the local and international market, which affects waste-pickers' daily income. For example, paper price has a cycle of 4 or 5 years and metal price changes constantly. The present prices of each material recovered by waste-pickers are shown in Table D-36.

Table D-36: Price of materials recovered

Material	Balboa/lb	Balboa/unit	Balboa/ton
Paper (white)	0.04 - 0.05		
Metal(mix)	0.15		
Copper	0.25		
Aluminum	0.15		
Bronze	0.15		
Newspaper	0.01		
Sack		0.05	
Glass bottle		0.05	
Plastic tanks (55 gl.)		2.00 - 5.00	
Plastic backet (5 gl.)		0.01	
Battery		0.75	
Textiles (a piece of clothes)		0.50 - 1.00	
Carton			40.00

Source: FAS PANAMA, February 2002

e. Income

According to the investigation conducted, 57% (44% in 1984, 63.3% in 1995) of picker-pickers earns B/. 10.00 or less per day, 26% (53% in 1984, 18.3% in 1995) between B/. 10 and 20 and 11% (3% in 1984, 7% in 1995) more than B/. 20.00. 6% (11.4% in 1995) does not receive any direct income. These figures indicate that after 18 years the average income of waste-pickers has decreased while their living standard has increased. This might be caused by various reasons: on the one hand there is much more competition, and on the other hand, they spend less time to pick up solid wastes in comparison with the time they did in the previous Crematory. Finally, the sale price of paper has decreased by 72% (B/. 0.05 at present against B/. 0.18 in 1984).

80% of waste-pickers think that they have the same daily income in the rainy season as well as in the dry season, while 20% think more in dry season.

D.6.6 Possibility to change the present situation

Following questions were given to both waste-pickers and buyers.

A. Why are you doing this activity?

B. To improve your actual working conditions what would you prefer to do? (with options to choose)

C. What could you suggest to improve you current situation? (open question)

In the case of question A, 80% of waste-pickers referred to lack of employment, while many buyers had different answers "it is a good business". For question B, 75% of waste-pickers answered "to get other job", 16% "to improve current condition", and 9% "working cooperatively". In the case of buyers, 44% answered "to get other job"; 44% "to improve current working conditions" and; 12% "to join a cooperative". Finally, the following answers were obtained from waste-pickers for question C.

- To be helped to get other permanent job
- To dress in uniforms
- To divide the working areas
- to have ID card
- to be supported by organizations
- to control the trading system

On the other hand, buyers suggestions were "improvement of vigilance and security" due to the frequent fights, attacks and thefts, followed by avoiding company's monopoly (on paper), to have an special place outside the working area, to control buying hours and standardize the prices.

D.6.7 Recommendations by various groups

There have been many recommendations and suggestions from different groups and organizations that are involved in the waste management of the Cerro Patacon landfill (waste-pickers, DIMAUD personnel, classifiers, intermediaries, enterprises, interested institutions). The important thing is a dialogue and planning process with all involved groups such that a plan can be designed at a short, medium and long term to reconvert the waste picking activities in the landfill into feasible and agreed alternatives. Summary of recommendations are mentioned below.

a. For a short term plan

- To make a general survey to all waste-pickers and buyers, companies, "chicheros" and carriers to obtain data that help identify people and prohibit the access of unidentified persons. After this procedure there will be the first filter for children under 15 years old and fugitives. The access of drug sellers will also be limited and controlled.
- To request health assistants from the Public Health Center to conduct a periodical health check for waste-pickers.

- Workers in the landfill will wear uniforms. Each group has a specific color, so that waste-pickers, buyers and other traders can be easily identified.
- To establish weight control system to obtain statistic data of recovered solid waste by companies. It will help identify unauthorized buyers. This will also help to establish monthly fees accordingly to the profit made by each company and direct intermediary.
- To establish a security control plan within the landfill to avoid the access of unauthorized persons.
- To study the possibility of dividing the discharge area in two zones, such that waste-pickers and landfill operators can work in an alternate way.
- To provide containers to waste-pickers to make the collection activity effective.
- To establish time schedule for buying process.
- To remove the "ranchitos" built in the discharge and working area in each section and prohibit its construction. There are considerable waste-pickers who permanently live in the landfill. For the waste-pickers living permanently in the landfill, it will be necessary to find a solution probably with the help of ARI (for the land), MIVI (for the materials) and other institutions.

b. Middle and long term plan

- To improve the price control. It should be analyzed by the involved groups because some might feel unprotected while others trust.
- The problem of drug within the waste-pickers and buyers should be treated by a professional team.

D.7 Environmental Education

D.7.1 Environmental Education System

The Ministry of Health (MINSA) is the authority in charge of standards, to watch over, to control and to sanction all relative aspects in order to guarantee the human health. Likewise, from the perspective of the environmental health it coordinates with the National Environmental Authority (ANAM), technical and administrative measures, so that the environmental alterations do not affect directly the human health.

MINSA has Integral Health Promoters that are volunteers elected by communities. Curriculum of Environmental Health responds to all programs that MINSA executes contains topics regarding water, control measures and surveillance of water, construction and uses of sanitary latrine and waste disposal.

MINSA will grant, in meritorious cases, environmental recognition for natural or juridical people who make efforts on environmental education.

The environmental law of ANAM, regarding environmental education (Law 41, Article 48) said: are duties of the State, to diffuse information or programs on environmental conservation and the sustainable uses of natural resources, as well as to promote educational and cultural activities of environmental nature, to contribute and supplement the civic and moral value with the Panamanian society. The communication media can offer cooperation to execute the projection of the present article. According to Article 49, ANAM will coordinates with the Ministry of Education (MEDUC), and will support, to fulfill the act of law 10 of 1992, specifically in the incorporation of Environmental Education in communities.

ANAM, through Law 41, recognizes the Environmental Education as one of the most important instruments for environmental management. Therefore, MEDUC and ANAM have united efforts for the production of Didactic Guides for Environmental Education, taking as target groups initial stage and primary level.

The National Office for Culture Development is in charge to diffuse these guides to coordinate and organize training for use and management of those guides. For training were hired highly qualified professors, who imparted seminars and conferences at national level.

The National Office coordinates the realization of diverse competitions at national level such as:

- Ecological competitions for secondary students.
- National competition on ecological stories for fourth, fifth and sixth grade students.
- National competition on ecological paintings for secondary students.

Some printing materials prepared by ANAM are:

- Ecological calendar,
- Story booklet "Water for Life"
- Book knowing our environment from A-Z
- Pamphlets on various environmental topics

MEDUC, through Natural Sciencies and Social Studies subjects of the primary school, aspects related with natural resources are imparted, but in a very general way in 3rd and 5th school years. There are no specific environmental education programs.

Previously mentioned printed materials have been distributed in some schools through ANAM, and chats and conferences have been carried out, however these activities have lost pursuit due to lack of educational programs (on environmental aspects and solid waste) and material resources.

The General Environmental Law (Law 41 of 1 July 1998 of ANAM) includes the citizen's participation in the State Administrative Organization for environmental management, reserving its participation at national, "comarca", and district level Consultative Commissions. Regulation for civil society participation exists, that is part of the process of environmental impact assessment. There are educational policies in the environmental field, although their results did not seem to be appreciated.

D.7.2 Environmental Education Programs with Communities by Several Organizations

Many organizations provide the environmental education and encourage community participation related with solid waste management in Panama District and in the whole country, in such components as reduction of waste at generation source, recovery processes, and recycling. However, many lose continuity due to the lack of coordination among the main actors of the society (institutions, communities, NGOs, etc.), lack of human resources and economic or simply lack of enthusiasm or interest.

a. Ministry of Education (MEDUC)

The Environmental Education Office of the Ministry of Education presents a Didactic Guide of Environmental Education"Our life and waste" which contains methods of environmental conservation, especially through the appropriate waste management and reuse through recycling. The text was elaborated under the Program of Japanese Volunteers of Japan International Cooperation Agency.

b. Municipal Department for Urban and Household Cleansing (DIMUAD)

DIMAUD through Community Relations Unit with the support of other related offices has planned a serie of cleansing awareness activities and a recyclable material recovery activity in communities and schools of the capital district. It takes as beginning point the educational establishments (primary, secondary schools and at university level), Junta Communals, NOGs and others. Through the program it is expected a change of population's habits and attitudes on solid waste management, through training and orientation on the reduction of solid waste production and separation at generation source.

This activity program has a objective of validating a strategy for the promotion of an appropriate SWM, by means of waste separation at generation source and the environmental health based on the community health with a narrow relationship between DIMAUD and the community organizations.

The training and awareness program is focused to fulfill the main objective of the work program of the Municipality of Panama whose goal is to achieve "A Great City". The specific objectives are:

- To raise awareness and the organization mechanisms for cleansing in the community, taking as target group children and youths through the schools.
- To involve adults by means of the local government: Junta Communals, Junta Locals, Working Committees, and Health Committees.
- To involve "Corregidors" and Inspectors as supervisors of the Legal Disposition execution.

The Public Relations Unit of DIMAUD carries out functions like diffusion of the different activities done by this department, orientation campaigns on the adequate disposal of solid waste at school, institution and community level, promotion of cleansing activities, etc.

Regarding preparation of educational programs on MSWM formulated by DIMAUD, there is not any specific program, monitoring and evaluation, since it offers information in a general way related to works carries out by DIMAUD, waste management, recycling, etc.

c. Non Governmental Organizations (NGOs)

Among the non-governmental organizations dedicated to the promotion of the environmental sanitation and social development the following can be mentioned:

- APROSAC (Association for Promotion of Environmental Sanitation) impels the community and municipal participation, micro and small company participation in the tourism sector and environmental management. Their short term goals are focused in creating micro-enterprises for waste management, based on the conceptual frame of "integral solid waste" considering waste reduction at source, recycling and final disposal.
- The projects of FAS (Social Action Foundation for Panama) concentrate on youths and in materials to recycle waste service and promotion of integrated projects for waste management in the rural areas of Panama.
- APRONAD (Association for Promotion of New Alternatives of Development) contributes to generate employment and to improve the quality of existing employment in communities of low resources. They cooperate in the improvement of the environment through an effective management of the productive processes and in to the rendering of services. They promotes new development alternatives that foment employment, generation of revenues, participation and environmental protection.

D.8 Relevant Studies

During the last years, several national and international agencies have conducted studies related to the solid waste management in the study area.

The following table show some of those studies:

Study	Scope
Study on Solid Waste Problematic in Panama, San Miguelito, and Colon cities Department of Cleansing. National Institute of Aqueducts and Sewage, 1982	Diagnostic of the situation; technical/economic feasibility; administrative restructuring. It is analyzed and designed a new organization oriented as an autonomous entity. In 1984, DIMA is created.
Studies on Sanitary Landfill in Mocambo. Ministry of Planning and Economic Policy. National Commission of the Environment, 1987	Directed to replace the old dumping site in Panama viejo. Selection of the site; structural studies; design; operative procedures; development plan. The results of this work serve as framework for the development of Cerro Patacon sanitary landfill.
Plan for Urban Development of the Metropolitan Areas in the Pacific and the Atlantic. Housing Ministry, 1997	Planning context; urban development plan; local action plan; proposal for institutional development; analysis of the client´s needs and design of the geographic information system. Tend to strengthen in the MIVI, the planning and regulation capacity for the urban development; it also includes proposals presented in the Conservation Plan of the Natural Resources in the Canal Basin (Regional Plan) and the General Plan for the Use, Conservation and Development of the Canal Area (General Plan)
Diagnostic, Master Plan, Characterization of Actives and Evaluation of Alternatives for the Participation of the Private Sector of the Solid Wastes in the Metropolitan Area, Colon, Reverted Areas, and Western Panama. Ministry of Economy and Finances, 2000	The government begins a process which intends to regulate the provision of the service for the solid waste management in the Great Metropolitan Area of Panama. Analysis and conclusions regarding the current situation of the services provided by DIMA, the participant institutions, the organization, the cost of the services, the organization affectivity and operation efficiency, available actives, market. The opinion of the clients is gathered, their availability and capacity to pay; a subsidy policy is design. A draft is written for a law on the Institutional and Regulatory framework.

Annex E

Industrial Waste Management

Contents

Page :

List of Tables

Page :

E Industrial Waste Management

E.1 Current Situation of Industrial Waste Management

E.1.1 Definition of Industrial Waste

Definition of industrial waste: Material generated by or remaining from production process and is not usable. (LEGA: General Environmental Law)

Also, LEGA defines Hazardous Waste as waste or residue that affects human health, including those classified as hazardous in international conventions ratified by the Republic of Panama, or in special law or regulation.

E.1.2 Quantification of Hazardous Industrial Waste

Hazardous waste generated in the country was quantified in the study on Diagnosis, Master Plan and Evaluation of Alternatives for Private Sector Participation in Hazardous Waste Management, MEF, 1999 shows quantification results corresponding to Panama District, by type of manufacturing industry according to Uniform National Industrial Classification of all Economic Activities, CINUTA.

Inert waste comprises 48.75% of total, waste from food industry 14.55% and waste from textile industry (apparel) 9.57%. These types of waste are regarded as non-hazardous and amount to 72.86% of total industrial waste.

The remaining 27.14%, equivalent to 15,812.72 ton/year, are: oil, acid, alkaly, solvent, recipients, paint and others, pesticide and organic and inorganic chemicals. These types of industrial waste are considered as hazardous.

E.1.3 Large Generators of Industrial Waste

In Panama Metropolitan Area (Districts of Panama, San Miguelito and Colon) in 1999, 132 industries were identified as potential generators of hazardous waste and were given high priority. Of these, the following are considered as large generators in Panama District.

Table E-1: Quantification of Hazardous and Non-hazardous Industrial Waste by Group, Panama

Group	Non-Stable	Employ ments	Oils	Acids	Alkali	Solvents	Container	Paint/others	Plagic	Org. Chem.	Inorg.	Putrescibl e	Textile	Inert	Total
Food products	120	5,709	306.3		781.0							8,480.0		513.9	10,081.2
Beverage	11	1,101									4.6			110.1	114.7
Vehicle Chassis	4	122	73.1							3.7	7.3			36.6	120.7
Leather tannery	24	1,687	644.4								6.8			3,017.5	3,668.8
Edition and Printing	68	1,878	1,049.4			19.3		329.4		0.5	38.8			309.1	1,746.5
Manufacturing and Production of Paper	51	1,493			89.6			179.0						748.0	1,016.6
Optical Instr.	2	37	11.1								2.2			11.1	24.4
Games and toys	3	117				7.0		117.1						35.1	159.2
Wood and its products	47	1,852	72.1			22.6		223.5	0.6					370.4	689.2
Machines and Elect. Appliances.	9	196	16.9							0.8	68.4			354.1	440.2
Machines and Equipment	12	295	5.1			1.0		4.6			16.5			87.5	114.7
Metal products	97	2,393	1,134.6	915.8	415.7	1.5		48.2			597.6			3,388.1	6,501.5
Non-metallic Minerals	30	2,213									1,248.7			8,891.8	10,140.5
Other Manufacturing Industries	15	474				19.9		332.3		0.3				142.2	494.7
Parts and Vehicle pieces	13	140	42.0								8.4			42.0	92.4
Oil Refinery derived Products	5	489	392.2	233.4	932.8	32.6	93.5				372.9			980.9	3,038.3
Rubber and Leather Products	66	1,926	1,443.2			0.8								3,863.6	5,307.6
Chemical and pharmaceutical Products	61	1,978			2,200.6	30.0	99.3	57.1		5.0	720.5			3,967.9	7,080.3
Ship/Vessel Repairs	3	444				8.9		88.8						88.8	186.5
Tobacco	2	432	43.2			8.6								43.2	95.0
Garment and textile products	114	8,058	144.0		5.3			32.4					5,576.0	1,394.0	7,151.7
Total	757	33,034	5,377.7	1,149.3	4,424.9	152.2	192.8	1,412.4	0.6	10.2	3,092.7	8,480.0	5,576.0	28,396.0	58,264.7

Table E-2: Large Potential Generators of Hazardous Industrial Waste in Panama District

	Name of the Company	Description of Activity
1.	Baterías Nacionales S.A	Chemical
2.	Xerox de Panamá S.A	Services
3.	3M de Panamá S.A	Services
4.	Petroterminal de Panamá S.A	Services
5.	Reconstructora de Frenos y Discos S.A	Minerals
6.	Fibropan S.A	Minerals
7.	Texaco Panamá S.A	Chemical
8.	Pinturas Sur de Panamá S.A	Paint
9.	Frenos y Embragues de Panamá S.A	Minerals
10.	Procesos y Análisis Metalúrgico S.A	Metals
11.	Fundición Centroamericana S.A	Metals
12.	Acero de Panamá S.A	Metals
13.	Esso Standard Oil S.	Chemical
14.	Insecticidas Superiores de Panamá S.A	Chemical
15.	Tabacalera Istmeña S.A	Tobacco
16.	Tabacalera Nacional S.A	Tobacco
17.	Tenería El Progreso S.A	Leather
18.	Tenería Tauro S.A	Leather
19.	Grupo Editorial Universal S.A	Services
20.	Corporación La Prensa S.A	Services
21.	Impresora Panamá S.A	Services
22.	Imprenta Edicano S.A	Services
23.	T – Shirts Interamericana S.A	Textiles
24.	Webforma de Panamá S.A	Paper
25.	Derivados de Pertóleo S.A	Chemical
26.	Asfaltos Panameños S.A	Chemical
27.	Metal Química S.A	Chemical
28.	Industrias Panan S.A	Chemical
29.	Sherwin Williams de Panamá S.A	Paint
30.	Fábrica de Pinturas Gliden S.A	Paint
31.	Laboratorio Prieto S.A	Chemical
32.	LAFSA	Chemical
33.	Nacional Química S.A	Chemical
34.	Aditivos de Panamá ADIPAN	Metals
35.	Plásticos Modernos S.A	Plastics
36.	Polymer Extrusión S.	Plastics
37.	Laboratorios Opticos Chevalier S.A	Services
38.	Galvanizadora Mecánica S.A	Metals
39.	Radiadores de Panamá S.A	Metals

E.1.4 Present Treatment and Disposal of Industrial Waste

Description of the present day management of potentially hazardous industrial waste will be easier by considering five sectors: medicine, solvent, motor oil, chemical products and paint.

Quantification results show that around 16,000 ton per year of potentially hazarodous waste is generated in Panama District. According to the Safety Office of Firefighters of Panama, there are about 100 persons or small and medium size companies that provide collection and transportation service of this waste. No regulation exists for this type of transport, despite the latent risk to public health and safety, or to the environment.

As the market is not regulated, no registered data is available on waste generators, transport operators, or those working on material recovery from this waste. Likewise, places where the transport operators discharge this type of waste are unknown.

Also unknown are the companies that treat their waste before final disposal. There are only a handful of companies recovering material from this type of waste. Derivados de Petróleo S.A and Eco Klean S.A treat used motor oil to utilize it as alternative fuel. Procesos y Análisis Metalúrgicos S.A, recovers lead from car batteries, selling part to Panamanian battery manufacturers and exporting the rest.

It was found that waste liquid and sludge are discharged into the sewer system, as well as into the course of rivers crossing the District. As a result, environmental deterioration has worsened, especially affecting Panama Bay.

No strict control is conducted in Cerro Patacón sanitary landfill on the characteristics of waste brought in by private vehicles.

E.1.5 Control and Supervision System

a. Legal framework for the control and supervision of industrial waste

Legislation and competent authority are established in General Environmental Law No. 41 of July 1, 1998 (LEGA), which creates the National Environmental Authority as the State autonomous entity to direct matters concerning natural resources and the environment.

LEGA recognizes the Ministry of Health as the authority in charge to regulate, watch, control and sanction all matters related to guaranteeing human health. It establishes the duties of the State, through competent authorities, to regulate and control the differentiated management of waste, be it household, industrial or hazardous, in all stages. Likewise, it establishes duties to take measures to ensure management of potentially hazardous substance without endangering human health and the environment, which will require registration prior to commercial distribution or use.

The competent authority can grant the right or permit, through contract, for the management and disposal of potentially hazardous substance, duly justified by pertinent studies. The right or permit can be granted to municipalities, provincial governments, board of trustees, foundations and private companies.

The Ministry of Health (MINSA) is the competent authority to administer, regulate, enforce and sanction the management of hazardous waste, and its effective or latent risk to human health. On the other hand, the National Environmental Authority (ANAM) is the leading State agency on matters pertaining to natural resources and the environment, has the right to formulate concerned policies, and shares with MINSA the regulation, enforcement and application of penalties in cases of lack of compliance.

MINSA is the competent authority concerning regulation, sale and storage of agricultural chemicals. MINSA regulates production and sale of 98 chemicals, and also those that cannot be used or sold in the country.

b. Institutional structure for the control and supervision of industrial waste

Within MINSA, there is a Section on Hazardous Substance and Waste, which is a fifth level unit and depends from the Department of Sanitary Quality of the Environment. This administrative unit implements the policy of MINSA, and is responsible for hazardous waste, as accorded by law. This unit receives the studies on environmental impact of new projects, reviews them to make recommendations, in accordance with the taxative list for Environmental Impact Evaluation Process.

E.1.6 Key Issues

- To establish the regulatory framework to guide and regulate the hazardous waste management, in accordance with one of the main provisions of the Environmental General Law.
- To give more hierarchy and strength to the MINSA structure on hazardous waste

E.2 Suggestions for the Present Management of Industrial Waste

E.2.1 Regulatory Framework

Under MINSA coordination, preparation is underway on the final version of a draft law on regulatory framework for hazardous waste management. This will guide and regulate management of hazardous waste generated within the country, and the transit of hazardous waste generated elsewhere. Its preparation, discussion and presentation to the legislative body is a commendable effort that deserves the public support.

The approval of this law, its passage, and its effective compliance, could guarantee a drastic reduction of hazardous waste hidden in municipal solid waste. Hazardous waste mixed in municipal solid waste poses health and safety risks to DIMAUD collection workers, and contributes to environmental degradation in Cerro Patacon sanitary landfill.

Only one comment is made concerning the draft law. The objective of the law, as stated in the draft, is to establish regulations for hazardous waste management, with the goal to prevent, mitigate, and control contamination, which will result in protection and recovery of environmental quality, protection of public health, and sustainable use of natural resources of the country.

Consideration is given to a number of modern concepts, contained in General Environmental Law, seeking compatibility between sustainable environment and economic development. The concepts are OBJECTIVE RESPONSIBILITY to assess environmental damage (*damage is presumed until proven otherwise*) and SOLIDARY RESPONSIBILITY (*all parties involved in an operation are equally responsible*). Both concepts will define and strengthen the competent aurhority, as well as providing more clarity to legal cases.

A management tool is introduced as **Operation Permit for Hazardous Waste Management**, which will be a specific and temporal requirement. To obtain the permit, the would-be-operator should comply with all the requirements set by the competent authority, and he should submit in advance a **Civil Responsibility Insurance against Damage to Third Party and the Environment.**

Hazardous waste will be classified based on a list provided by MINSA. Hazardous waste, if mixed in whatever proportion with non-hazardous waste, will make the whole classified as hazardous for all legal and regulation purposes. These proposed rules have a special importance in this project with DIMAUD.

Likewise, other management tools are proposed: **Declaration and Tracking System for Hazardous Waste and Residue, Management Plan for Hazardous Waste and Residue,**

and Contingency and Emergency Plans. In addition, MINSA will organize and make available the technical information on hazardous waste management to the Environmental Information System and to all economic agents. Together with ANAM, MINSA will propose incentive programs in support of economic agents, with emphasis on waste minimization and economic use.

The draft law establishes responsibilities of economic agents such as Generators, Receivers and Transport Operators.

Responsibility is established for environmental contamination caused by disposal of hazardous waste in the soil. The concepts of objective responsibility and solidary responsibility are applied in this case.

To comply with the LEGA provision on Objective Responsibility, a special fund will be created as **Fund for Remediation of Soil Contaminated by Disposal in Landfill (FRSC).** This fund will be capitalized with the mandatory contributions from users of the landfill.

Importers and exporters of products and residue that might generate hazardous waste, should request MINSA the corresponding permit. For issuing the permit, MINSA in coordination with competent authorities will set the requirements. These activities include pesticides, waste from ship operation or air transport.

The draft law establishes enforcement and application of penalties for non-compliance, and the appeals procedure.

E.2.2 Strengthening the Structure of the Competent Authority

Enforcement and technical assistance activities are conducted by MINSA, through the Section on Hazardous Substance and Waste, which together with the Section on Non-Hazardous Waste are in the fifth level within the organization structure.

Negative externalities generated by deficiency in waste management, hazardous and non-hazardous, and affecting public health and safety, make it necessary to recommend a higher hierarchy for the administrative units responsible for prevention, control and mitigation of the said effects.

Annex F

Medical Waste Management

Contents

Page :

List of Tables

Page :

F Medical Waste Management

F.1 Current Situation of Medical Waste Management

F.1.1 Definition of Medical Waste (MW)

Medical waste is all those waste generated in the following health establishments:

a) Hospitals, Quantification of the DE clinics, medical centers, dental clinics, health centers, policlinics, and psychiatric clinics, psychiatric and geriatric houses, and other specialties of public and private sectors.

b) Autonomous institutes related with health.

c) Clinical laboratories, biochemical and biotechnology laboratories of public and private sectors.

d) Pathological anatomy departments, morgues and funeral and cremation houses.

e) Outpatient clinics, clinics, hospitals and veterinary laboratories.

f) Biomedical investigation centers, biotechnology and genetics

g) Any other establishment determined by the Ministry of Health.

The hospital waste are comprised by common waste (by nature is similar to the household waste) and medical hazardous waste.

F.1.2 Quantification of MW

From the study carried out under ALA program (Regional Program on Medical Solid Waste ALA 91/33, Agreement between European Union and Central American Governments) it can be determined that the rate of hazardous waste generation in health establishments in Panama District was of 0.8/kg/bed.

In order to quantify hazardous waste from health establishment without beds, it can be considered that each ten-outpatient consultation generate the value of a hospital bed.

F.1.3 Major MW generators

During 1998, the following occupation statistic of the main health establishments in Panama District was registered.

Table F-1: Major Generators in Panama District. 1998

Health Establishment	Nos. of Beds	Patients/day
PUBLIC		
Metropolitan Hospital Complex. CSS	931	300,174
Children Hospital	393	142,309
National Psychiatric Hospital.	546	163,925
Santo Tomás Hospital	667	182,684
National Cancer Institute	127	33,206
"Hogar de la Esperanza" Hospital	48	12,560
Sub total		834,918
PRIVATE		76,187
Total		911,045

F.1.4 Current in House Management, Treatment, Haulage and Final Disposal of MW

For the present study, a survey in three district hospitals was carries out: One public and two privates, with a total of 1,100 beds. The results are described as follows:

Activity	Yes	No	Remarks
Separation	X		There are written instructions for separation and handling. Waste is separated into three categories: materials, which have had, contact with infectious patients; organic fabrics coming from surgery and childbirth; sharp and piercing materials (needles, surgical knifes, shaving blades, etc).
Packing and storing	X		Plastic bags of red color are used for packing in the first two categories, and plastic bins with cover or cardboard boxes, which are sealed. These recipients are deposited in a returnable plastic container of red color.
In house collection	X		The containers are collected twice a day. The collection of waste of outpatient consultation is carried out two to three times a day and is disposed in plastic bags of red color.
In house haulage	X		The recipients with red bags are moved from each generation area, using a cart and hauling to central storage area.
Central storage	X		The place is fenced and closed. One of the hospitals has a refrigerated space for pathological waste. The places are disinfected every day. In two hospitals there is additional place to store hazardous waste. There is free access for the collection vehicles.
Haulage (outside)	X		DIMAUD provide daily collection service.
Treatment		X	A hospital declares that incinerates its waste. The ashes are discharged with common waste. Two hospitals discharge its waste without treatment.
Final disposal	X		At Cerro Patacon sanitary landfill, DIMAUD collection trucks discharge the waste in a hole that previously had been prepared and covers immediately with other waste.

Although waste separation procedures and in house handling are carried out, haulage is made by vehicles, which do not have the characteristics for such a purpose. Disinfecting is not carried out before disposal in the sanitary landfill. In this landfill MW disposal does not fulfill the minimum protection standards for the health and safety of DIMAUD workers.

F.1.5 Control and Supervision System

a. Control and supervision legal framework for MW.

By means of the Executive Decree No. 111 of 23 June of 1999, the regulation is decreed. A regulation for solid waste management coming from medical establishments is established.

This Decree has its juridical base in the Article 106 of Policy Constitution; the Sanitary Code, the General Law of Environment. The Decree norm in effective forms the integral medical waste management.

MW is classifies as common, anatomopatologics, radioactive, chemical,

infectious, sharp and piercing materials, pharmacists, and, special

It adopts the procedures recommended in the Project ALA 91/33, regarding the recipients and their identification; and management in collection and in house collection process, temporary storage, treatment, collection and external haulage, and final waste disposal.

It determines that the infectious and anatopathologic waste, if they are not disposed in a special sanitary landfill, they should be treated before disposing in the sanitary landfill. The waste coming from the isolation pavilions and piercing materials, although they have been disinfected, it should be considered as dangerous and their manipulation and final disposal should be carried out in a special sanitary landfill. The pharmaceutical citotoxics should be treated with the methods prepared by the manufacturer or producer, through their manager or representative. It is described these Decree dispositions, since being in effect for approximately three years, it is not completed, as for the final disposal that is carrying out in the sanitary landfill Cerro Patacon.

On the other side, the Decree determines the procedures for the external haulage. It points out the characteristics that should complete the vehicles to transport MW considered as dangerous. Equally, the collection vehicles of DIMAUD that provides services to several public and private health establishments are very far from the established characteristics.

Equally, it points out the responsibility that involves the Medical or Administrative Director of the health establishment, as for the execution of the regulation, from the generation to the final disposal.

b. Institutional structure of control and supervision for MW

The existing regulatory scheme considers hospital waste as dangerous waste, following the classification of the Agreement of Basel.

As such, the control and supervision relapses in MINSA where is executed through the Section of Substances and Hazardous Waste.

It has been pointed out previously that this administrative unit is of the fifth level inside the structure of MINSA, this is, with little hierarchy, and reduced capacity to assist the supervision that requires the application of the Decree No. 111.

There is weakness in programs for personnel training in health establishments with regard to the MW management.

Knowledge on occupational accident and nosocomials disease statistics and their associated costs, related MW management, will be important.

F.1.6 Key Issues

Weakness in the control capacity and supervision

- Low training of health establishment's personnel in the procedures and practice of MW management.
- Lack of information on labor accidents and nosocomial diseases.

F.2 Suggestions for Present MW Management

F.2.1 Institutional strengthening of the competent authority

To strengthen the institutional capacity of MINSA, to assist their supervision responsibility and control, according to Decree No. 111 of June 23rd, 1999.

It is suggested, to endow a bigger hierarchy and resources to the section of Substances and Hazardous Waste; program of personnel training to build capacity to carry out their supervision work and control, and also, to conduct programs of trainers in MW management.

It is suggested, to provide a bigger hierarchy and resources to the section of Substances and Hazardous Waste; a program of personnel training to build capacity to carry out their supervision work and control, and also, to conduct programs of trainers in MW management.

F.2.2 Formation

To sensitize, qualify and train personnel of all level of health establishments of MINSA and private, in the observation of the procedures and practice of MW management, to prevent labor accidents, nosocomial diseases, the risks to the community in general, the environmental damage, and the associated costs to these events.

Of great utility they will be the procedures settled down in the Program ALA 91/33 and the didactic material produced.

To sensitize, to qualify and to train the personnel of all health establishment levels of MINSA and private, to prevent the work accidents, the nosocomial diseases, the risks to the community in general, the environmental damage, and the costs associated to these events.

Of great utility they will be the procedures settled down in the Program WING 91/33 and the didactic material that was produced.

F.2.3 Registration

It is suggested, to supplement the health establishment statistics keeping data on costs with labor accidents and nosocomial diseases. This information will be of great importance to evaluate the cost related with a MW deficit management.

Annex G

Pilot Projects

Contents

Page :

List of Tables

Page :

List of Figures

Page :

G Pilot Projects

G.1 Collection Improvement

G.1.1 Outline

a. Background

Through the diagnostic of the collection service in the Panama District, it was established that even though the service has an extensive coverage, this service is not structured based on a rational design. Most of the service is programmed to serve with a frequency of 7 times per week. However, it is not always executed as planned. This situation has a direct effect on the costs and availability of vehicles because there is insufficient time to provide adequate maintenance to them.

Because there is not any rational design being applied, there is not any division of sectors nor have routes been diagrammed. Consequently, a low collection performance has been observed on the collection workers' part. Additionally, it has been observed, a low transport load per trip (taking into account the design load capacity of these vehicles). Over-time hours are also generated because the service cannot be completed within the 8 hours shift.

Moreover, there are not any procedures to control, to monitor and to evaluate the service which can help to define the flaws or low performances on time and can help to apply the corrective measures.

b. Objectives

Because of the foregoing, a pilot project was planned which had the following main objective.

- To improve the efficiency of waste collection by means of design and implementation of a rational collection plan, and establishment of monitoring and evaluation methods of the collection service.

Expected Outputs

Through the design and implementation of a rational collection plan, the following outputs are expected.

- New collection routes of the pilot project area are designed under the concept of maximizing the use of resources (human resources, equipment, and infrastructure in general).

- As part of the service design, the collection frequency is modified in such a way as to change it from a seven times a week frequency to three times per week frequency (from Monday to Saturday). This new frequency would allow having one day for maintenance of the collection fleet.
- Knowledge and experience are transferred to the technical, operative, and monitoring personnel of DIMAUD; in such a way as to achieve an adequate training that can allow the professionals to design and/or to optimize the routes, the operative personnel to be able to perform the service correctly and the monitoring personnel to be able to control the service effectively.

Regarding the procedures to establish monitoring and evaluation methods, the following outputs were expected.

- Procedures to gather information related to the development of the service are created.
- Service quality indicators are defined, which allow an evaluation of the service in a simple and easy manner.
- A reporting system between the collection department and other departments, which are involved directly in the collection service in order to coordinate and monitor the activities between them, is established.

Finally, the attainment of objectives and the experience obtained through the Pilot Project are included in a proceeding manual.

c. Selection of the Target Area

The selection of the target area was done jointly with the Counterpart team. The sector called San Pedro was selected for the pilot project. The area is located in Juan Diaz Corregimiento.

The selected area has the following characteristics:

- The service was programmed to consider a frequency of seven days per week. However, this frequency was not done all the time or, in some cases, the area was not covered completely. This was confirmed when we observed the area where wastes were scattered on the streets, containers were filled up to their capacities and unexpected large number of bags and recipients full of wastes were placed in front of the houses, while in the nearby streets the wastes have been collected.
- There are detached houses areas and aggregated areas; consequently, the collection is done door to door, point to point, and a mixed of both types.

- The area is predominantly residential; however, there are small commercial and industrial sectors.
- There are a variety of socio-economical strata which is reflected on the type of houses, population density, and road structure.
- There are a large number of streets and passages that are not accessible for the collection vehicles.
- The area has steep slopes and flat zones.

The area selected includes 20 residential sectors with a total of 12,000 persons and 2,940 houses which are based on a projection for 2002 taking into account the population growth rate obtained from the General Controller Office of the Panama Republic, Department of Statistics and Census. Table G-1 details the information by residential sectors.

Table G-1: Number of Houses and Residents in the Pilot Project Area

Residential Sector	Projection for 2002	
	Nos. of Houses	Nos. of Persons
El Sitio	139	457
Residencial Bernal	23	88
Bosques del Hipódromo	11	42
San Cristóbal	635	2816
Altos del Complejo	98	421
La Cantera	24	100
San Pedro	538	2344
San Pedro 2	398	1475
Altos del Hipódromo	281	1073
Los Almendros	93	347
El Nance	65	249
Urb. Nuevo Hipódromo	149	669
Urb. Altos de San Pedro	150	565
Urb. El Guayacán	55	222
Urb. El Laurel	37	151
Villa Venus 2	55	216
Villa Venus	79	344
Urb. Camino Real	17	57
Villa Inés	62	256
Santa Pera	31	108
Total	2,940	12,000

Source: General Controller Office of the Panama Republic, Department of Statistics and Census, modified.

d. Project Design Matrix

Project Design Matrix was formulated in order to clarify purpose, expected outputs, activities and necessary inputs as shown in Table G-2.

Table G-2: Project Design Matrix of the Pilot Project of Collection Improvement

Narrative Summary	Objectively verifiable indicators	Means of Verification	Important Assumptions
Overall goal Collection Efficiency is improved in Panama District			
Project purpose To improve the efficiency of Waste Collection in San Pedro	The service is provided with the frequency and schedule established. Indicators showing collection efficiency is improved, e.g., ton/trip	Daily reports Indicators established through the pilot project	DIMAUD will take the Pilot Project as a base to apply its experiences in other Corregimientos of Panama. The personnel in charge of the pilot project remains in DIMAUD.
Output 1. A rational plan of collection is designed and implemented. 2. The personnel satisfies the work plan and the norms 3. The service is monitored according to a control program 4. The information records are kept up to date 5. The technical personnel are trained to design the routes.	1.1. Route Map Designed 1.2 Manual of Procedures 2.1 The pilot project area is covered with collection service established 3. Collection routes are monitored everyday. 4. Data is kept everyday. 5. 100% of the targeted personnel have received training.	This report This report Daily reports/monitoring report Monitoring report/ Record of the training evaluation Daily reports Records for the training evaluation	
Activities 1.1 To produce a map of the area 1.2 To elaborate procedure manual 2.1 To train drivers and collection workers 2.2 To elaborate operation manual for collection 3.1 To elaborate monitoring program 3.2 To train monitoring personnel in conjunction with 2.1 4.1 To elaborate format to input data 4.2 To elaborate Daily Work Order to give it to the driver 5.1 To train technical personnel	Inputs Study Team Personnel 2 persons (1 person in charge and 1 assistant) Equipment 10 containers, 3 walkie-talkies, 2 odometers, 1 PC, 1 Set of Office 2000 software, 1 Printer Panamanian C/P Personnel 1 collection chief, 2 supervisors, 8 persons in the crew (two shifts). Equipment existing trucks in good condition (1 main, 1 reserve), maintenance facilities and equipment, project office Training The Panamanian C/P will receive training during the pilot projects		Residents agree with the implementation of the pilot project.

G.1.2 Implementation Method

a. Work Schedule

The pilot project was executed during the period between July 29 and September 15, 2002. Previous to this period, some activities took place; these activities were directed mainly to obtain field information (Public Opinion Survey) and to procure equipment for the service.

The following figure shows the work schedule of the Pilot Project.

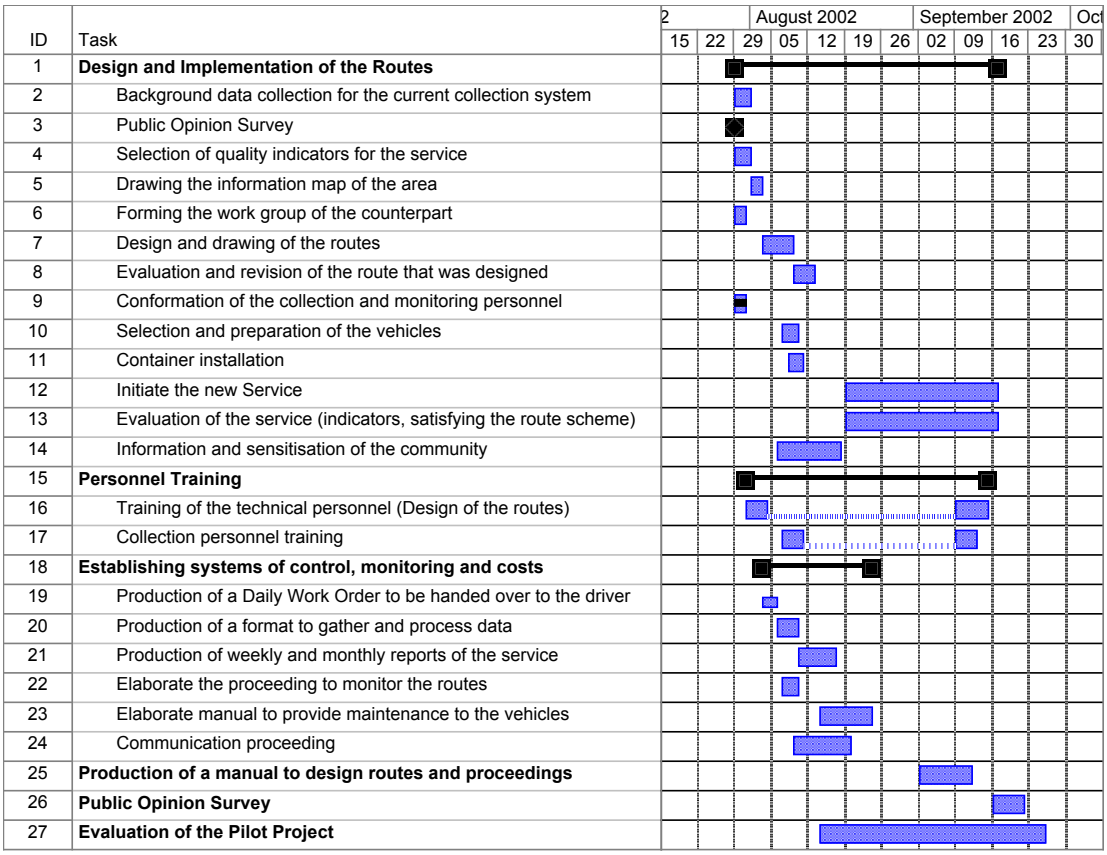


Figure G-1: Work-Schedule of the Pilot Project

b. Implementation Method

b.1 Public Opinion Survey before the Pilot Project

On July 6 and 7 a public opinion survey regarding solid waste collection service quality took place in the 20 residential sectors of the pilot project area. The survey had the purpose of knowing the perception among residents about the service and, subsequently, to compare the results with a second POS which would take place after the project had finished. The survey was conducted by a Panamanian NGO called FAS Panama. A total of 185 houses, which met a confidence interval of 95% for the total number of houses in the area, were interviewed. Through this survey, the following were found.

- The female respondents represented a majority (66.5%) of the total interviewees.
- 53.1% of respondents believe that the collection service was good; less than 1% believed the service was very bad.
- Regarding the collection frequency, 52.4% of those interviewed responded that it was done on a daily basis, 20% responded that their frequency was equal to or less than three times per week.
- Approximately 75% of those interviewed believed that the service was done at the established hour.
- Among the main problems that the residents had with the personnel and collection equipment were: bad odors (21.3%), leaching took place (16.5%), and waste was scattered (15.7%).
- 77.3% of the interviewees said that there is always somebody at home when they collect wastes and approximately 54% said that either the mother or father is in charge to take out the wastes.
- There was a high pre-disposition to collaborate with the pilot project; 84.3% of those interviewed responded that they were willing to collaborate with the pilot project in order to improve the waste collection service.

b.2 Evaluation of Current Routes

The evaluation of the routes includes three activities which correspond to:

i. Data gathering related to the collection service and the Pilot Project

ii. Measuring time and motion of the current route

iii. Evaluation of the current collection routes

i. Data gathering related to the collection service and the study area.

Information was collected in conjunction with the counterpart related to the collection service in San Pedro area. This work included the current route layout on a map. The data gathering was done mainly by the technical personnel with the support of the truck driver who service the area.

On the site, it was also identified the type of collection. Door to door, point to point or mixed collection manners were established in the residential sectors. In case that point to point collection takes place, the location of the containers was determined, as well as their capacity

and number of houses or sectors which they service. All the previous information was drawn in map scale 1:2000. The Map includes the following information:

- Limits for each one of the residential sectors
- Identification of the roads where access is difficult for the collection vehicles
- Identification of the traffic direction for each passage, street or avenue
- Identification of roads with traffic congestion problems and their peak hours
- Topographical characteristics of the site and other particular characteristics of the area
- Identification of the location of the depot and the sanitary landfill

Besides, from the Work Orders which had been used by the Collection Department to monitor and control routes, the information of May and June was gathered, such as information related to number of trips per day, tons per trip, time the truck departs from Carrasquilla, time the truck enters and exits the landfill site, and number of persons related to the service (driver and collection workers). This data was input in a computational format called Optimizaruta which had been elaborated previously and was used to calculate the indicators which help to evaluate the routes.

ii. Additional Data Gathering

In order to have additional background information related to the time on the route, the route was monitored and each activity of time was taken during July. Subsequently, a new Work Order format was elaborated which reflected the time and motion data required. The new format was used during the first 17 days of August. The new data was input into the computer format Optimizaruta and the parameters were calculated. These parameters were used for the diagnostic of the route. Figure G-2 shows the daily Work Order new format.

Additionally, the collection of industrial waste was done separately from the domestic waste with the purpose to define the amount of industrial waste in that sector.

MUNICIPIO DE PANAMA
Dirección de Aseo
ORDEN DE TRABAJO

Codigo Institucional _____ N° _____

Identificación

Auto N° _____ Tipo _____ Turno _____
Area _____ Zona _____ Ruta _____
Hora Salida _____ am pm Hora llegada _____ am pm Tiempo Usado _____ hrs.
Kilometraje Salida _____ Kilometraje Llegada _____ Km Total _____
Combustible _____

Personal

Nombre	Función	N° de Empleado	Sueldo Mensual

Viajes al Relleno Sanitario

N° de viaje	Inicio Ruta Hora	Inicio Ruta Km	Término Ruta Hora	Término Ruta Km	Relleno Ingreso Hora	Relleno Ingreso Km	Relleno Salida Hora	Relleno Salida Km	Tiempo Relleno	Tonelaje Ton.
1										
2										
3										

Equipo Alquilado

Marca _____ Tipo _____ Placa _____ Por hora B/.____

Jefe Departamento _____ Supervisor _____ Conductor _____

Observaciones _____

Función: R = Recolectar; C = Conductor; S = Supervisor

N° Vehículo _____ Fecha _____ N° _____

Marque con un gancho (/) lo que está en buenas condiciones, con una (X) lo que está en malas condiciones y con una (N) lo que no se aplica

	Frenos		Llantas de repuesto
	Embraque		Llave y Gato
	Temperatura		Herramientas
	Dirección		Radios
	Aceite		Antenas
	Batería		Aire Acondicionado
	Bomba hidráulica		Tapizado
	Toma fuerza		Alfombras
	Llantas		Extintores
	Luces		Encendedor
	Parabrisas		Documentos
	Limpia parabrisas		Pala
	Bocina		Trinche
	Retrovisores		Escobillón
	Vidrios laterales		Rastrillo
	Pintura		Machete

Descripción de los daños _____

Nombre _____ Firma _____

Figure G-2: New Work Order Format

iii. Diagnostic of the Route

During the first week of the pilot project, the counterpart was instructed about the indicators which are generally used to evaluate the collection service[1]. Subsequently, taking into account the data which can possibly be gathered, the following indicators were selected for the experiment.

Table G-3: Indicators to Evaluate the Collection Service

Indicator	Formula	Unit
Tons/collection time	Tons collected per month / Collection Time during a month	Ton/Collect. hr
Tons/paid hours	Tons collected per month / Hours paid per month (Assist.+Driver)	Ton/paid hr
Tons/worked hours	Tons collected per month / Total hours worked per sector per month	Ton/worked hr
Tons/trip	Tons collected per month / Number of trips per month	Ton/trip
Tons/Assistant/day	Tons collected per month / Number of effective assistants per month	Ton/assist./day
Kilogram/Kilometer per sector	Tons collected per month x 1000 / Distance covered per sector in a month (km)	Kg/km sector
Kilogram/total kilometers covered in a month	Tons collected per month x 1000 / Total length covered in a month (km)	Kg/total km
Fuel Performance	Distance covered in a month (km) / Amount of fuel per month (gallon)	Km/gl

Based on the background information from May, June, July, and August, the indicators for the current route were calculated by using the calculation format Optimizaruta. The data obtained was compared with an acceptable range defined in a document "Indicators for the Management of Public Cleansing" OPS/CEPIS/PUB/01.72[2]. The following table shows the values for these indicators.

[1] Indicadores para el Gerenciamiento del Servicio de Limpieza Pública. OPS/CEPIS/PUB/01-72
[2] See Manual of Proceeding to Optimize the Route

Table G-4: Performance of the Collection Service before the Pilot Project

Indicator	Unit	May	June	July	August	CEPIS Reference
Tons vs Collection Hours	Ton/Collect. hr	-	-	2.28	1.93	2.3 a 2.6
Tons vs Paid Hours	Ton/paid hr	0.29	0.30	0.30	0.28	0.30 a 0.35
Tons vs Worked Hours	Ton/work. hr	1.20	1.27	1.33	1.24	-
Tons/trip	Ton/viaje	4.98	5.74	6.26	5.98	-
Tons/assistant/day	Ton/assist./day	3.29	3.64	3.23	3.47	4.5 a 5.0
Kilogram/kilometer sector	Kg/km sector	-	-	-	587.58	500 a 600
Kilogram/total kilometer	Kg/km total	-	-	-	128.21	100 a 150
Fuel Performance	Km/Gl	-	-	-	5.79	8 a 11

Note: The indicators for August are calculated based on 17 days of work.

As the previous table shows, only the indicators kilogram/kilometer-sector and kilogram/total kilometer fell within an acceptable range. The rest of indicators were below the minimum. Consequently, it was concluded that the route should be optimized. The indicator Tons vs. worked hours does not have any reference value; however, it was calculated with the purpose to use it as a comparative value during the pilot project development.

Once the comparison had been established, the average values were regarded as baseline data. Additionally, the optimum indicator values were defined as shown in Table G-5. These values would serve to diagnose and to evaluate the routes.

Table G-5: Indicators for Collection Work

Type of Collection (Urban Zone)	Acceptable Range	Optimum Value
Tons vs. Total Collection Time (door to door or mixed, 3 assistants)	2.3 to 2.6 ton/hour	2.45 ton/ hour
Tons vs. Total Collection Time (point to point, containers, 3 assistants)	2.8 to 3.2 ton/ hour	3.0 ton/ hour
Tons vs. Total Paid Hour	0.30 to 0.35 ton/hour	0.33 ton/hour
Tons per trip vs. maximum payload	-	0.9 to 1.05
Tons vs. nos. of assistances	4.5 to 5 ton/assist./day	4.5 ton/assist./day
Fuel consumption	The indicator value should be established according to the characteristics of the collection vehicle which should be defined by the manufacturer; it has been fixed as 7 km/gal for this specific case	

b.3 Route Design

The route design included the following activities.

i. Training of the technical personnel

ii. Division in Sectors

iii. Drawing route on a Map

iv. Verification of the Route

v. Training of the operative personnel

Before the pilot project implementation initiated, the counterpart nominated the professionals and personnel who would participate directly in this experience. This nomination was done based on requirements from the Study Team which are the following.

Collection and Monitoring Personnel:

- To have worked at least three years in the entity
- The health condition should correspond to the work which is being executed
- Between 25 and 45 years old
- Proved responsibility in the workplace
- No alcohol nor drug problems
- Respectful of the regulations and his/her superiors
- Preferably to have worked in the pilot project area

Technical Personnel

- To have knowledge regarding the current collection service
- To be involved with the current control systems of the collection service
- To have participated or have knowledge of the system which has been used to program the current routes

Based on the previous requirements, the counterpart selected the following personnel.

- 2 Collection Technicians
- 1 Computer Science Technician
- 1 Chief Coordinator
- 1 Supervisor Coordinator
- Supervisors
- Drivers
- Collection Workers

i. Training of the Technical Personnel

Before the collection routes were designed, the technical personnel were trained about the design procedures. The training process included the following.

- Calculation procedure to define the waste generation; the production during normal and peak days according to the collection frequency
- Proceedings to calculate indicators
- Calculation proceedings to define the number of sectors and sub-sectors
- Calculation proceedings to verify the number of tons which are transported by truck during a shift based on the time and motion register
- Proceedings to define the limits of Sectors and Sub-sectors
- Proceedings to draw the routes on a map; regulations to draw the routes
- Proceedings to verify the routes
- Proceedings to implement the route
- Method to evaluate the routes

The training was done simultaneously to the activities related to the management and analysis of the collected information, calculation of indicators, and the design of routes. Subsequently, this was reinforced each week after the implementation of the new routes.

The training also included the proceedings related to the management of information and operation of calculation formats.

ii. Division of Sectors

The first design phase of the new routes corresponded to the division of sectors; the following conditions were established to undertake the service:

Collection frequency	3 times per week
Collection vehicle payload	8.5 tons
Number of trips per shift	2
Number of days worked during the week	6

Subsequently, the amount of waste collected monthly was calculated. This amount corresponds exclusively to household waste taking into account that industrial wastes should be handled separately. In order to calculate the amount of waste to be collected, the waste from industries (calculated beforehand) was subtracted to the average value of tons collected monthly. Once the design tonnage was defined, the amount of waste collected during the maximum accumulation days and on normal days was calculated. The calculations were done for a complete sector or residential area. For the latter case, the generation was defined based

on a per capita generation which was obtained from the monthly generation and the number of persons per sector.

The generation results correspond to:

Total average production per month	290 Ton/month
Total average production per week	66.9 Ton/week
Industrial production per week	13.2 Ton/week
Production in the Residential Sector	53.7 Ton/week
Production Per Capita	0.64 Kg/per/day

Table G-6: Waste Generation Amount in the Pilot Project Area

Residential Sector	Residents Year 2002	Weekly Generation	Generation on a Peak Day	Generation on a Normal Day
	Nos.	Tons/week	Tons/day	Tons/day
El Sitio	457	2.0	0.9	0.6
Residencial Bernal	88	0.4	0.2	0.1
Bosques del Hipódromo	42	0.2	0.1	0.1
San Cristóbal	2,817	12.6	5.4	3.6
Altos del Complejo	421	1.9	0.8	0.5
La Cantera	100	0.4	0.2	0.1
San Pedro	2,344	10.5	4.5	3.0
San Pedro 2	1,475	6.6	2.8	1.9
Altos del Hipódromo	1,074	4.8	2.1	1.4
Los Almendros	347	1.6	0.7	0.4
El Nance	249	1.1	0.5	0.3
Urb. Nuevo Hipódromo	669	3.0	1.3	0.9
Urb. Altos de San Pedro	565	2.5	1.1	0.7
Urb. El Guayacan	222	1.0	0.4	0.3
Urb. El Laurel	151	0.7	0.3	0.2
Villa Venus 2	216	1.0	0.4	0.3
Villa Venus	344	1.5	0.7	0.4
Urb. Camino Real	57	0.3	0.1	0.1
Villa Inés	256	1.1	0.5	0.3
Santa Pera	108	0.5	0.2	0.1
Grand Total	12,001	53.7	23.0	15.3

The number of sub-sectors was calculated taking into account.

- The number of sub-sectors is calculated for the maximum generation day
- Each sub-sector is defined for the area that a truck covers in a shift
- Peak day generation 23.0 Ton/day
- Generation on a normal day 15.3 Ton/day
- Collection vehicle capacity 8.5 Ton
- Number of trips per working day 2
- Number of eight-hours shift 1
- Number of days the sub-sector is serviced in a week 3
- Number of days worked in a week 6

$$N^o subsectores = \frac{Tons\ \ peak\ \ day}{Collection\ Capacity\ \ for\ \ one\ \ trip\ \ x\ \ N^o\ \ of\ \ trips\ \ per\ \ day} = 1.4 = 2$$

$$N^o\ \ of\ \ Subsectors\ \ Serviced\ \ by\ \ one\ \ truck = \frac{\left(N^o\ \ of\ \ days\ \ worked/week\right)\ x\ \ N^o\ 8hrs.\ Shifts}{N^o\ \ of\ \ days\ \ of\ \ service\ \ in\ \ the\ \ week\ per\ sector} = 2$$

$$N^o\ \ of\ \ Trucks = \frac{Total\ \ Number\ \ of\ \ Sub-sectors}{N^o\ \ of\ \ Sub-sectors\ \ Serviced\ \ by\ \ one\ \ truck} = 1$$

Consequently, the San Pedro sector includes 2 sub-sectors according to the following denomination

Sub-sector	Day of Service
1-1	Monday-Wednesday-Friday
1-2	Tuesday-Thursday-Saturday

After the sub-sectors have been defined, the total number of tons that can be collected during a working day was verified with taking into account the following

- Two peak days are generated during the week, one for each sub-sector (Monday and Tuesday); consequently, 11.5 tons/day can be collected.
- Non-collection time that had been found based on the existing data

Non-Collection Time

Time	Hours
Depot-Sector	0.38
Sector-Landfill	0.55
Landfill	0.52
Landfill-Sector	0.35
Landfill-Depot	0.42

Verification

Variable	Values	Unit
Tons to be collected/peak day	11.5	Tons/day
Collection Velocity	2.5	Tons/hour
Non-collection time 1st trip	1.8	Hour
Maximum Tonnage/1st trip	8.5	Tons/trip
Collection Time 1st trip	3.4	Hour
Total Time 1st trip	5.2	Hour
Remaining Time for 2nd trip	2.8	Hour
Non-collection time 2nd trip	1.5	Hour
Time available for collection in the 2nd trip	1.3	Hour
Tons to be collected in the 2nd trip	3.0	Tons/trip
Required collection time for 2nd trip	1.2	Hour
Total Tons which are collected in a working day	11.5	Tons/working day
Hours of work	7.9	Hour
Remaining time during the working day	0.1	Hour

It was confirmed that the total amount of tons which would be accumulated during the day of maximum generation could be collected in 8 hrs. Subsequently, it was defined the physical sub-division of the sub-sectors. A map at a scale 1:2000 was used for that purpose.

iii) Drawing of the Route on a Map

After the sub-sectors have been defined, the route was drawn on a map. The number and capacity of the containers were calculated. Their original locations remained unchanged. Figure G-3 and Figure G-4 show collection routes and location of the containers.

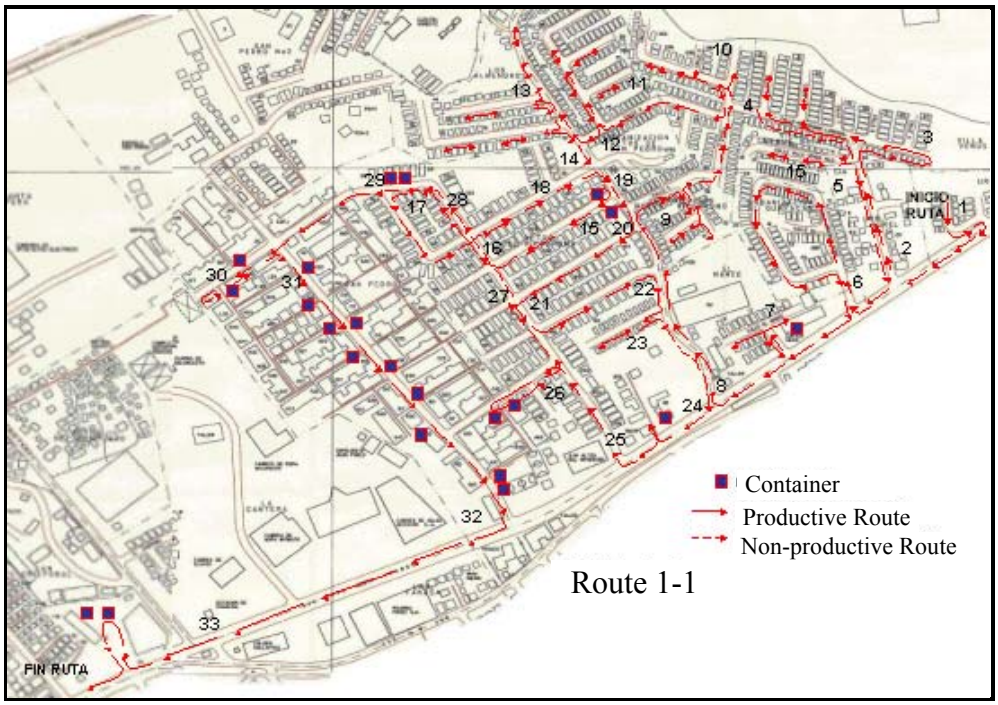


Figure G-3: Designed Collection Route (1-1)

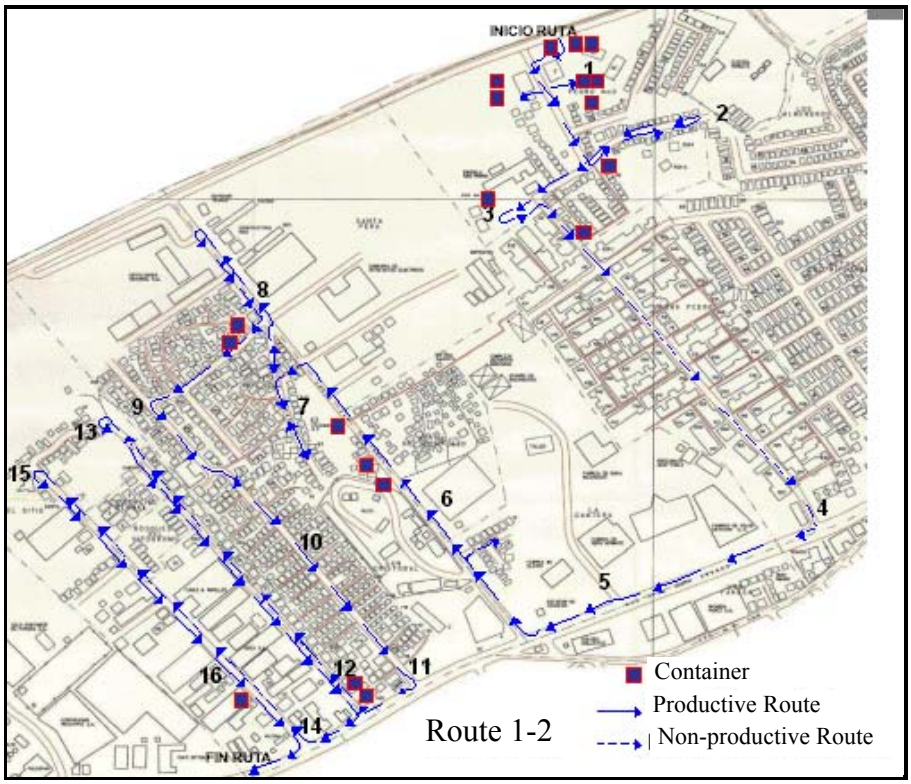


Figure G-4: Designed Collection Route (1-2)

iv) Verification of the Route

After the route was drawn, the collection technical personnel and the Study Team conducted a fieldwork to verify the design.

v) Training of the technical personnel – Sensitization of the Community

Once the routes have been verified and approved, a training session was conducted with the drivers, collection workers, and supervisors of the collection service. The main issues discussed were the following

- Definition of the collection service, related activities such as waste collection itself, collection time, transport time, and non-collection time.
- Responsibilities defined by type of work and functional relation between them
- Interpretation of the symbols used to draw the routes, such as the initial and final point of the route; direction of the route, route in service and exclusive transport, monitoring points.
- Manner to execute the service, door to door collection, lifting of containers, identifying waste which is not included in the service, manner to operate the compactor system, procedures to load and unload, detection of large generators
- Use of safety tools, issues related to risks and accidents in the workplace which are inherent for this activity.

The training was reinforced on the field by following the route with drivers, collection workers, and supervisors in order to identify clearly the route and to establish a relationship with the drawing.

Simultaneously to the training of the operative personnel, meetings with representatives of the residents were organized in order to inform them of the changes in the service, manner to store and discharge the wastes, and the participation and cooperation that is expected from the residents. This activity finished with the distribution of informative flyers which was done by DIMAUD´s Department of Relations with the Community. Subsequently, once the pilot project had been initiated, additional meetings took place with the purpose to reinforce what was informed previously.

Besides, in the week before the implementation of the new routes, the containers were installed.

b.4 Implementation and monitoring of the routes

On August 19, the new collection service initiated. Everyday the time and distances were monitored for each one of the routes by using the new format of the Work Order.

- During the first week the time and motion data were taken jointly by the technical person and the driver. Subsequently, this task was done exclusively by the driver.
- In the first week new containers were added on locations where previously only baskets, called tinaqueras, had been placed previously. The use of these baskets had increased the collection time considerably.
- In the second week the industrial wastes which originally were excluded from the collection route, were added to the route. This decision was taken because DIMAUD did not have vehicles dedicated exclusively to collect industrial wastes. It was not necessary to design new routes because the industries are located within the routes already designed and the truck had capacity to transport them.
- Every week the routes were monitored by the technical personnel and the supervisors to confirm that the collection service is carried out as planned.
- The time and motion data was input daily to the calculation format called Optimizaruta and the results were evaluated.

G.1.3 Results

a. Administrative Findings

During the development of this pilot project, the following findings were obtained:

- It was unknown the number of clients who were served and the amount of waste which was generated in the residential areas. Similarly, it was also unknown how much of waste was generated from the industrial sector.
- The routes were defined by the drivers and occasionally they did not cover the complete area which was assigned to them.
- Industrial wastes collection was done every other day.
- No control is done over the time and motion on the route. Only the exit and entrance time to the depot (Carrasquilla) and the landfill were registered. Evaluations that relate the time employed daily in the sector and the amount of tons collected were not either conducted.

- The collection department was not aware about the existence and use of indicators to evaluate the service.
- Collection is done on a daily basis, even though this collection often does not cover the area totally.
- The collection department ignores completely the use of resources and costs which are associated with the service because its main function is directed to provide a daily service as it is programmed and to respond timely to special situations which take place during the working hours and that are associated with complaints from the residents. DIMAUD ignores this information because every department in the institution works as an isolated unit which prevents the technical personnel from having information such as: fuel consumption, oil consumption, maintenance done to the vehicles, tire consumption, over-time paid to the personnel, distribution of uniforms, safety equipment, and tools, and the corresponding expenditures related to these activities. Consequently, it is difficult to evaluate the service from the technical and economical perspective.
- There is no coordination between the maintenance department and the collection department; this situation makes it difficult to implement a maintenance program for the fleet.
- The collection department is not involved on the control of overtime hours; moreover, the compensation hours which are given instead of overtime salary are not authorized nor monitored by this department. The human resources department defines the compensation time based on the attendance record of each worker; this situation is grave regarding the control of costs.
- Monitoring of the routes is not done on a daily basis. A complete and real monitoring by the supervisor was not observed to take place.

The previous findings can lead to infer that, in addition to optimize the design of the current routes, it is indispensable to modify the functional structure of DIMAUD in such a way as to achieve that all related departments can establish an adequate coordination among them.

b. Results of the Pilot Project

Table G-7 presents comparison of indicators before and after the pilot project.

Table G-7: Results of the Pilot Project

Indicators	units	Before	After	After/Before
Days of Work	Days/month	31	25	0.81
Tons collected per month	Tons/month	290.0	290.2	1.00
N° of trips per month	Trips/month	51	37	0.73
Collection kilometers per month	Km/month	449	300	0.67
Total Kilometers per month	Km/month	2061.0	1608.9	0.78
Collection Hours	Hr/month	139.5	112.2	0.80
Real Hours Worked per Route per Month	Hr/month	230.2	174.3	0.76
Hours paid to the driver	Hr/month	251.2	209.6	0.83
Hours paid to the collection worker	Hr/month	738	600	0.81
Fuel Consumption per month	Gl/month	356	269	0.76
Tons vs Collection Hour	Tons/hour	2.10	2.59	1.23
Tons vs Hours paid	Tons/hour	0.29	0.36	1.22
Tons vs Hours worked	Tons/hour	1.26	1.66	1.32
Tons/trip	Tons/trip	5.74	7.84	1.37
Tons/worker/day	Tons/worker/day	3.41	4.49	1.32
Kilogram/Kilometer/sector	Kg/km	587.58	967.27	1.65
Kilogram/Total kilometers	Kg/km	128.21	180.36	1.41
Fuel performance	Km/gal	5.80	5.98	1.03

b.1 Working Hours

The amount of wastes collected (generation) during the month that the pilot project was implemented is equal to the average value obtained in previous month in the sector. Even though the amount of wastes collected remained unchanged, the indicators related to the direct cost of the personnel decreased as Figure G-5 shows.

The pilot project managed to reduce the hours paid to the driver in 41 hours (17%) and to the collection worker in 138 hours (19%). Table G-8 presents comparison of labor costs before and after the pilot project. The pilot project reduced the cost per ton in 18%; if the variable workmanship is considered.

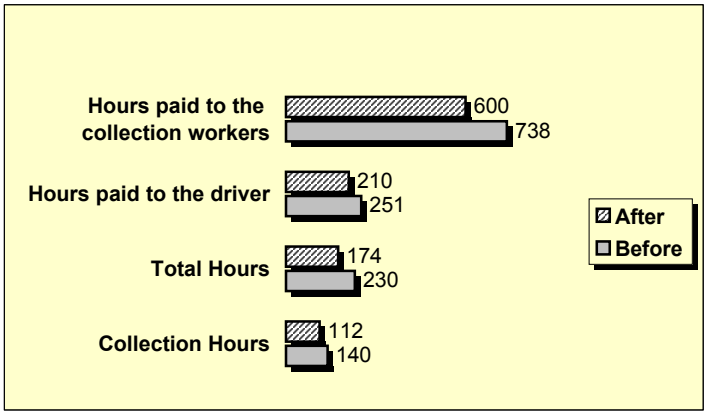


Figure G-5: Comparison of Working Hours before and after the Pilot Project

Table G-8: Comparison of Labor Costs before and after the Pilot Project

Labor costs	Driver	Worker
Annual salary	5005	4433
Vacations	385	341
Social Security + Education Insurance + Professional Risk	773	685
Annual Policy	254	254
Accident provision/disease + absence	190	168
Clothes and security equipment	111	343
Annual total cost	6718	6225
Legal hours/month	173	173
Cost per hour	3.2	3.0
Total cost/month (Before)	3021	
Total cost/month (After)	2473	
Cost of ton (before)	10.4	US$/Tons
Cost of ton (after)	8.5	US$/Tons

b.2 Collection Vehicle

Similarly, the pilot project reduced the total hours of the truck from 230 to 174 hours per month, which represents a reduction of 24%. The reduction that was achieved in time exclusively dedicated to collection was 28 hours, which represents a reduction of 20%.

Regarding fuel consumption, there was a reduction of 24% with respect to the initial value as Figure G-6 shows. The truck operation was evaluated economically taking into account the following expenses.

Investment Cost: It is estimated that the truck depreciates in 60 months. The operation of the vehicle is considered to take place 6 days a week and 16 hours per day.

Maintenance cost: It is supposed that ideal preventive maintenance takes place. This maintenance even includes tire replacement. The cost per hour of operation was determined. The detailed cost is shown in Table G-9.

Fuel and lubricant cost: It was established a value per hour for fuel and lubricant consumption as shown in Table G-10.

Through the optimization of routes, there was a reduction of costs associated to the collection truck for about 24%.

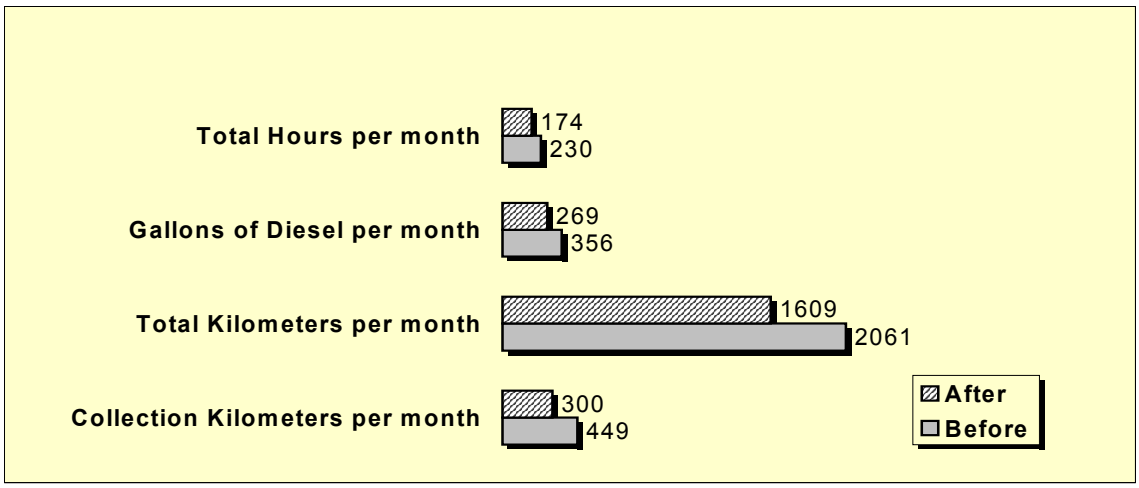


Figure G-6: Comparison of Use of Collection Vehicles before and after the Pilot Project

Table G-9: Costs of Ideal Maintenance

Maintenance	Total Cost (US$)	Cost per hour (US$/hr)
Maintenance and oil change every 250 hours	194	0.78
Maintenance and change of clutch every 1500 hours	940	0.47
Repair of the injection and turbo system every 2500 hours	1750	0.70
Maintenance of the front axle every 2500 hours	926	0.37
Maintenance of brakes every 2000 hours	180	0.09
Repair of the suspension springs every 2500 hours	500	0.20
Maintenance of the hydraulic system every 3000 hours	2300	0.77
Change of tires every 3500 hours.	1050	0.30
Maintenance and repair of the gear change every 5000 hours	504	0.10
Maintenance of air compressor every 5000 hours	870	0.17
Repair of compactor every 5000 hours	750	0.15
Repair of engine every 10000 hours	2482	0.25
Repair and maintenance of the differential every 10000 hours	1164	0.12
Labor		0.45
Maintenance cost per hour		4.91

Table G-10: Operation Costs of Collection Vehicle

Operation Cost for the Truck	US$
Investment	81783.5
Investment cost per month	1363.1
Insurance	221.9
Plate	1.8
Total cost per month	1586.8
Hours per month	416.0
Investment cost per hour	3.8
Fuel and lubricant cost per hour	2.3
Maintenance cost per hour	4.9
Total cost per hour	11.0
Cost for month of operation (Before)	2538.1
Cost for month of operation (After)	1921.5
Cost per ton (Before)	8.8
Cost per ton (After)	6.6

b.3 Travel Distance

The average distances in respective collection activity were evaluated. The results are shown in Table G-11. As the table shows, the largest reduction is derived from the traveled distance from the Landfill to the route (a reduction of 53%). The reduction in this sector was expected because previously the second trip covered the area farther from the landfill site. The other distances that show a reduction correspond to collection during the first and second trip (34% and 16% respectively). There was 15% of reduction in total distance traveled, initially the routes covered a total of 80.1 km; it become 68 km after the route was optimized.

Consequently, it can be said that the Pilot Project has achieved to optimize the routes efficiently.

Table G-11: Comparison of Distances in Respective Collection Activity

Path	Before (km)	After (km)	Reduction
Depot - Route	10.6	10.1	4%
Collection 1st trip	11.5	9.7	16%
Route - Landfill 1st trip	14.2	14.0	1%
Landfill - Route	12.8	6.0	53%
Collection 2nd trip	7.5	4.9	34%
Route - Landfill 2nd trip	14.2	14.0	2%
Landfill - Depot	9.3	9.4	0%
Grand Total	80.1	68.0	15%

b.4 Indicators

Indicators to monitor and evaluate the collection woks have been established in the pilot project. Table G-12 shows values in the indicators before and after the pilot project.

Table G-12: Indicator Values before and after the Pilot Project

Indicators	Before	After	Optimum	After/Before	After/Optimum
Tons vs. Collection Hours	2.1	2.6	2.5	24%	-4%
Tons vs. Paid Hours	0.29	0.36	0.33	24%	-9%
Tons vs. Worked Hours	1.3	1.7	-	31%	-
Tons per Trip vs. Designed Payload	0.8	0.9	0.9	13%	0%
Tons per Worker per Day	3.4	4.5	4.5	32%	0%
Fuel Consumption	5.8	6.0	7.0	3%	14%

Indicator Tons/Collection Time: The pilot project achieved to attain the optimum value established. This optimum figure was even exceeded. The value has increased by 24%. The most important reasons to attain a better value for this indicator are: reduction of frequency which allows collecting a larger amount of wastes in the same distance in a shorter period of time; reduction of non-productive paths; exchange the baskets (tinaqueras) by containers which helped to make it easier to unload the wastes in the truck.

Indicator Tons vs. Paid Hours: The result was positive. The optimum value was exceeded in 9% and the initial value was exceeded in 24%. This value is inversely proportional to the direct labor costs. As this value increases, the cost related to personnel will be smaller, in other words, the working hours will become more productive. Similar to the previous case, the reduction of non-productive distances is an important factor to increase this indicator. Other important aspect is to strictly follow the schedule established, which avoids rush hour of traffic and expects the cooperation of the residents to discharge their wastes on time.

Tons vs. Hours worked: The results indicate that an increment of 32% has been achieved in the amount of tons collected per hour of work which results in an increment of productivity and reduction on the use of the truck. The outcome is really remarkable because the same amount of wastes have been collected in less time which leads to a reduction of direct costs of operation of the truck and affects positively its projected mechanical conditions because for an equal period of time (for example, one year), the hours of work have been reduced.

Indicator Tons/Trip: The direct comparison of this indicator is not valid because before the implementation of the pilot project, the collection was done with a smaller capacity truck. Taking the previous situation into account, it was established a comparison through the ratio Tons/trip vs. Maximum payload of the truck. The optimum value of this ration should be between 0.9 and 1.05.

From the Table G-12, it can be observed that the pilot project has achieved to increase in 12% the previous ratio. A better use of the vehicle payload was achieved and the optimum value could be attained which indicates that the routes have been established adequately and the vehicle is not overloaded.

Indicator Tons/worker/day: As a result of the pilot project the daily performance of the collection workers could be attained. There was a 32% performance increment from the initial value. The optimum value could be achieved. This indicator is important because it indicates a reduction of labor costs and no overtime hours are generated. The best performance is attained in part due to the change in frequency taking into account that the worker has to travel less distance in order to collect the same amount of waste. Additionally, a better manner of discharge has been achieved (installation of containers in replacement of basket or tinaqueras) and has helped remarkably to increase the performance.

Another important result obtained through the pilot project is related to the personnel who provides the service and have to do with the improvement in the quality of the service. It was observed that during the collection, all the wastes were picked up and the area is kept clean. specially, that area around the containers and tinaqueras. Wastes are not left scattered in the public areas as it used to take place previously. The correct loading of wastes and cleansing around the collection area did not prevent an improvement in the performance of the workers. Consequently, it can be concluded that it is possible to provide the service with high quality and still attain adequate performance values at the same time.

Indicator Fuel Performance: In spite that the fuel performance was improved in 3% compared to the initial situation, it was not possible to attain the optimum value. Reasons are that there are many steep slopes in the area and there are a large number of narrow passages. This situation can force the driver to make additional maneuvers and can also force the driver to work on reverse. It is important to note that fuel performance should better be measured as a function of hours of work rather than be based on the kilometers. When a point to point (use of containers) system is implemented, the distance traveled is minimal compared to the door to door collection. If fuel performance is expressed based on the hours of work, the optimum range should be between 1.2 and 2 Gallon/hour.

Indicator Kilogram/kilometer/sector: The optimization of the routes allowed to increase considerably the amount of wastes collected per kilometer of collection. As shown in Table G-12, the optimum value was even exceeded in 60% and the initial value was exceeded in 65%. An increment on the value of this indicator reflects the service cost because for the same distance, a larger amount of wastes are collected. The remarkable increment of this indicator is due to the reduction in frequency, before the pilot project there was a daily frequency established and, consequently, the wastes collected represented one day of generation. After the pilot project was initiated, the frequency was reduced to three days per week which lead to an increment in wastes generated that represent twice as much as a normal day and three times as much as a peak day.

Table G-13: Waste Amount Collected per Travel Distance before and after the Pilot Project

Indicators	Before	After	Optimum	After/Before	After/Optimum
Kg/km/sector	587.6	967.3	600.0	65%	61%
Kg/total km	128.2	180.4	150.0	41%	20%

Indicator Kilogram/total kilometers: The pilot project has led to an improvement in this indicator. As shown in Table G-13 the optimum value was exceeded in 20% and the initial value was exceeded in 41%. The results attained for this indicator are due to the sum of effects that optimize the route, such as, frequency reduction, optimum routing design, better discharge manner of wastes, increment in the performance of the collection workers, etc.

c. Results of the Public Opinion Survey

As it is pointed out previously, during the last weekend, a second public opinion survey was conducted with the purpose to know the opinion of the residents about the Pilot Project. The survey was applied to 20 residential areas where the pilot project focused. As much as possible, the same households interviewed during the first POS were interviewed again. A total of 182 households were interviewed for a confidence interval of 95%. Results of the POS are the following.

- In reference to the initial survey, a 66.5% of those interviewed were female.
- 59.89% of those interviewed say that they are aware of the pilot project; 47.4% of them were informed through a flyer; 16.5% of them through collection personnel; 14.7% of them through the survey or some relative; and 13.8% of them was informed through meetings.

- Out of those who expressed they are aware of the Pilot Project, 64.2% believes that the service provided during the pilot project is good. 19.3% evaluates the service good. 11% believes it is regular. 5.5% believes it is bad and 0% believes it is very bad.
- 70.33% of those surveyed believes that during the last weeks, it has been observed an improvement on the cleansing of the public roads and areas surrounding the baskets or tinaqueras. 4.4% believes it has gotten worse and 25.27% believes that it has remained the same.
- Faced by the question on whether it is convenient to maintain the collection service according to the days already established in the pilot project, 78.02% of those surveyed responded positively, and 21.98% responded negatively.
- Among those interviewed who answered positively, 50% believe that the service should be maintained because it remains clean; 32.39% believe the service should be maintained because wastes are better collected; 15.49% because the schedule is observed. 2.11% because any other reason and 3.11% did not answered.
- Among those interviewed who answered negatively to the same question, 65% responded that it is not convenient to keep the service because the schedule is not adequate for them; 15% did not answered, 12.5% are not interested and they noticed more wastes scattered and 7.5% mentioned other reason.
- 68.13% among those surveyed said they know the service schedule; 29.12% said they do not know it and 2.75% did not respond.
- The most important problems that still remain unsolved even after the Pilot Projects´ implementation according to the interviewers are: bad odors (24.70%), scattered waste (19.28%), and liquid leaching (15.06%).
- 31.23% of those interviewed would be willing to undertake separation of wastes into organic and inorganic in order to improve the collection service quality, 24.43% responded they would be willing to be organized in a community with the purpose of collaborating with the Municipality, 22.92% responded they would be willing to sell and/or donate recyclable materials, and 20.40% would be willing to assist to meeting and talks about the best way to manage wastes.

From the results of the POS, it can be inferred that only 60% of those interviewed were aware about the Pilot Project development and that the most common way to inform the residents is through flyers. The previous result indicates that for future optimization of routes, it is necessary to reinforce the communications with the community, maybe by incorporating

communication programs with the junta comunales, schools, sport centers, etc. It would also be convenient to reinforce the distribution of flyers by conducting this activity in different schedules and also requiring 800 ASEO to have a more active participation toward the community. It is important to mention that among the media used to inform the residents, the second place is occupied by collection personnel. This shows how important in the route optimization process is to train the personnel that provides the service.

The perception of the part of the community that is aware about the Pilot Project is very favorable because approximately 84% considers that the service that is being provided is good. Regarding all those who were surveyed, all of them have also observed changes in the service and an improvement on the service quality because 70% considers that the street and public roads, in general, remain clean; 78.2% believes that it is convenient to maintain the collection service as it was implemented during the pilot project mainly because it remains clean, the wastes are better collected and the schedule is followed as planned.

On the other hand, those who estimate that it is not convenient to maintain the collection service as it was designed in the pilot project argue that the schedule is not convenient for them, but they do not question the quality of the service.

Bad odors constitute the main concern for those surveyed in reference to the problems that still prevail. Regarding this issue, it is convenient that as soon as possible a program to wash containers is introduced because they are the main cause of bad odors.

G.1.4 Evaluation and Conclusions

The results of the pilot project were evaluated as follows.

a. To improve the collection efficiency through the design and implementation of a rational collection plan.

In order to achieve the objective, three goals were proposed initially which include the design of optimum routes, modification of the frequency, and transfer of knowledge.

a.1 Optimization of Use of Collection Vehicles

The load being transported per trip has increased with respect to the maximum payload of the vehicle. The design of the routes have led to use 90% of the payload capacity of the truck, whereas previously only 82% was used (both values are monthly averages). The minimum values obtained before the pilot project represented 30% and 39% of the payload for the first and second trip respectively; whereas, for the pilot project these values increase to 63% and 75% respectively.

a.2 Increment of the efficiency on the collection service

The following has been achieved regarding collection efficiency.

- The total operation time of the vehicle was reduced in 24%.
- The hours which would be paid to the driver was reduced in 17%.
- The hours which would be paid to the collection worker was reduced in 19%.
- Fuel consumption was reduced in 24%
- The total distance traveled in one month was reduced in 22%.
- The collection distance was reduced in 33%.
- The number of trips in one month was reduced in 27%.

a.3 The collection service has attained levels of efficiency and competitiveness

- Through the pilot project, competitive levels within the Latin American market could be attained. Performance levels were achieved within the optimum range which can ensure the effectiveness of the service. Values in the indicators obtained from the pilot project are higher than the initial values. These values also fall within the optimum range values as it is shown in the following paragraphs.
- The indicator of tons collected vs. collection time was increased in 23%. A monthly value of 2.6 tons/hr was obtained; the optimum range is found between 2.3 to 2.6 ton/hour.
- Tons collected vs. hours paid increased in 24%. The optimum range falls between 0.3 and 0.35 tons/hour. The value obtained for this parameter was 0.36 ton/hr.
- Tons vs. hours of work increased in 32%.
- The ratio of Tons/trip vs. payload capacity of the truck increased in 12%. The optimum value should be between 0.90 and 1.05. The value obtained was 0.92.
- The performance of the collection personnel increased in 32%. The optimum recommended value is between 4.5 and 5 ton/worker/day. Through the pilot project 4.5 was attained.
- The kilograms of wastes collected per kilometer of collection increased in 65%. The optimum range of reference lies between 500 and 600. Through the pilot project, this range was exceeded by obtaining a value of 967 kg/km/sector.

- The kilograms collected vs. the total distance traveled increased in 41%. A value of 180 kg/km was obtained. The optimum range lies between 100 and 150 kg/km.
- Fuel performance increased in 3% by attaining a value of 6 km/gl. It was not possible to attain the optimum range between 7 and 8 km/gl.

In addition to increase the efficiency of the service, its quality has improved as well. The days and hours of service have been closely observed and an optimum collection service has been provided. Moreover, after the service was provided no wastes scattered on the streets has been observed. These achievements can only be possible due to the constant participation of all the personnel who took part in the Pilot Project. They implemented what they learned through the training program and another goal of this project was attained as a result. An adequate route design and daily monitoring of the parameters by the technical personnel lead to required adjustments of the routes. A constant monitoring of the routes by the technical personnel and supervisors ensured that the routes´ design was followed as planned and also ensured that the service provided an adequate coverage. Finally, the correct implementation of the route and loading of wastes into the truck by the driver and collection workers had a positive effect in an increment of the performance and effectiveness of the service.

The previous results reflect a reduction of direct costs of the service. As it was calculated previously, the direct costs by the personnel as well as those derived from the collection vehicle have experienced a reduction compared to the initial costs, as the following graphs shows.

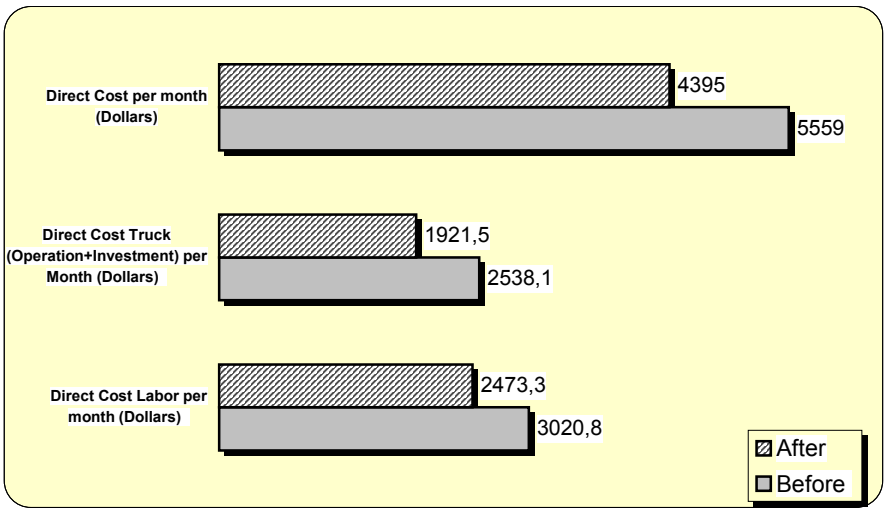


Figure G-7: Direct Collection Costs before and after the Pilot Project

The pilot project managed to reduce the direct labor and vehicle costs in 21%. Before the Pilot Project's implementation the direct cost from this sector was 5,559 dollars/month. Subsequently, with the Pilot Project the cost went down to 4,395 dollars/month which represent savings of 13,967 dollars/year in one route. Currently, DIMAUD has 100 routes. If the previous result is generalized to the other routes then there could be savings of 1.4 millions of dollars per year.

The previous result leads us to conclude that DIMAUD's collection service can be improved considerably through a rational collection plan. This plan will not only allow to increase the efficiency and quality of the service, but also to reach an adequate competitive level which can help to reduce the costs.

b. To establish monitoring and evaluation methods for the collection service

Through this pilot project, the technical personnel were trained in identifying and gathering basic information which is necessary to evaluate the service.

In fact, as a result of the Pilot Project, a new Work Order format has been designed which allows monitoring the time and motion in the routes, fuel consumption, tons collected and identification of the operation and monitoring personnel.

Simultaneously to the elaboration of the new Work Order format, the technical personnel has started to implement a calculation format called Optimizaruta which represents a useful tool to calculate indicators and other variables which allow the evaluation of the service.

Now that the Pilot Project has finished, the professionals of the collection department are aware and knowledgeable on how to control the equipment and personnel performance, cost control and service quality.

Consequently, it is concluded that the personnel who participated in the Pilot Project is capable to expand this experience to other routes and to improve the collection service substantially.

During the development of this experience, it was confirmed that reports are not exchanged sufficiently among the different departments which could ensure an adequate and timely communication between them. This communication could lead to a control of resources and monitoring of parameters. In view of the foregoing, it is considered indispensable to establish in the short term a communication system between the departments.

Taking into account the results attained during the Pilot Project, from both the technical-economical and the client perspectives, it is concluded that the changes introduced during this Pilot Project were positive. Mainly because there were some doubts on the type of

response from the population due to the implementation of the Pilot Project; the population was used to have a daily collection frequency. However, all the objectives were attained; moreover, the population is satisfied with the new frequency because it does not alter the service quality, on the contrary it has improved the service.

Finally, the results show that it is totally feasible to implement a route optimization program with the resources available in DIMAUD. As the result of this program, savings can be obtained in the short term and the client can be provided of a service of good quality and competitive.

G.1.5 Recommendations

In the following paragraphs, some recommendations are provided which can help to ensure continuity and to expand the Pilot Project.

It is advisable to maintain the monitoring of routes which have been optimized and input the data from this monitoring activities into the database in order to sustain the evaluation process which can help to compare the results between different periods (months, years, etc.) and to compare the indicators from the routes with optimum indicators.

It is recommended to implement as soon as possible the new format for Work Orders in order to have background information related to the time distribution in the routes and be able to conduct a diagnostic about them. However, the drivers should be trained in advance on how to fill them up.

It is also recommended to make an expansion program to optimize the routes which can be developed under a criteria of geographical expansion; priority should be given to those routes with lower performances. For example, for the case of the Pilot Project, the routes which have been optimized correspond to San Pedro sector; it is advisable that the following routes to be optimized are located in adjacent sectors to San Pedro; if there is more than one sector, then priority should be given to those which have lower performances.

Additionally, it is advisable to undertake the optimization of routes by following strictly the proceedings manual. Modifications should not be implemented during the monitoring process based on preliminary results because it will obstruct the data gathering process and the optimization itself.

Before the optimization of routes continue, it should be verified if there are any ICI´s in the sector and it should also be defined if these wastes will be managed separately or mixed with household wastes. In order to take a decision in this regard, it is advised to make a preliminary classification taking into account their characteristics and volume.

The collection and supervision personnel should be trained continuously; even if the routes have not been optimized yet.

It is recommended to implement as soon as possible a program of preventive maintenance of the fleet. The maintenance can be executed directly by DIMAUD or through external companies. It is important that the maintenance is executed according to the specifications of the manufacturer or truck dealer. Initially, this preventive maintenance can be done on the new trucks; other trucks can be incorporated gradually, an examination and general maintenance should be done beforehand.

It should be maintained the monitoring and evaluation of the routes which have been optimized. Any reduction on the efficiency or quality should be investigated immediately in order to prevent a return to preceding conditions.

It is recommended to implement as briefly as possible to exchange the reports among the departments in order to control adequately the service. It is advisable to manage at least the following information listed in Table G-14 between the departments.

Table G-14: Recommended Reporting Manners among the Departments in DIMAUD

From	To	Information	Frequency
Collection Department	Human Resources Department	Shifts and schedule of the personnel	Monthly
		Program of overtime hours derived from extraordinary works	Daily
		Approval of vacation requests and compensation time	Weekly if there are any
Human Resources Department	Collection Department	Hiring of new personnel	Daily
		Medical licenses	Daily
		Request to authorize compensation time and vacations	Weekly
		Occurrence of labor accidents	Daily
		Cessation of personnel	Daily
		Transfer of personnel	Daily
		Personnel Listing Report	Monthly
Collection Department	Maintenance Department	Hours/day worked per truck	Daily
		Hours/month worked per truck	Monthly
		Mechanical failure present on the route, daily	Daily
		Requirement of vehicles per working day	Weekly
		Fuel Consumption per truck	Monthly

From	To	Information	Frequency
Maintenance Department	Collection Department	Listing of trucks in working condition	Weekly
		Listing of trucks and date when they will receive preventive or repair maintenance; the replacement truck has to be defined	Weekly
		Vehicles which are not operating and their replacement due to mechanical failure	Daily
		Damage caused to the vehicles due to accidents and bad operation	Weekly
Collection Department	Management Control Department	Quality indicators per route	Monthly
		Tons collected per route	Monthly
		Identification of new routes	When it takes places
		Hours worked per truck	Monthly
		Fuel consumption per month per truck	Monthly
		Hours worked per month per worker	Monthly
Commercialization Department	Collection Department	Listing of new clients	When it takes place + Monthly Report
		Request of new containers	When it takes place
		Verification of complaints from the commercial area	When it takes place + Monthly Report
Collection Department	Commercialization Department	Listing of new clients according to field information	When it takes place + Monthly Report
		Report on the installation of containers	When it takes place + Monthly Report
		Listing of large generators	When it takes place + Monthly Report
		Modification on the type of waste that is being collected	When it takes place + Monthly Report
		Monthly listing of tons collected per ICI´s route	Monthly
Collection Department	Street Sweeping Department	Tons collected per street sweeping route	Weekly
		Program of Special Assignments (Operativo)	Monthly
Street Sweeping Department	Collection Department	Program for street sweeping and bags collection	Monthly
		Modifications of street sweeping routes	When it takes place + Monthly Report
Collection Department	Final Disposal Department	Identification of special wastes which are collected	Monthly
		Classification of wastes per route	Every time a route is created or modified
Final Disposal Department	Collection Department	Monthly Amount of Tons collected per truck per route	Monthly
		Identification of the vehicle, day and hour when it discharged wastes which are prohibited	When it takes place

G.2 Separation at the Source

G.2.1 Outline

a. Background

Separation of wastes at generation sources is crucial for introducing a recycling system in the future. However, there is no official separation system in Panama District at present. A kind of consensus had been made between the C/P and the S/T that municipal officers should know what the separation at the source is and what kind of problems might arise by the activities.

b. Objectives

This pilot project has the following objectives.

- To verify validity of separation at the source recommended in the Master Plan (M/P)
- To make this pilot project an origin of recycling activities

Besides the objectives mentioned, to transfer knowledge and skills regarding separation to the Panamanian C/P and persons concerned is an important role of the pilot project.

c. Selection of Target Group

Municipal officers of two municipal buildings were selected as target groups of this pilot project, i.e., DIMAUD, Carrasquilla, and Municipality, EDEM, because DIMAUD, Carrasquilla, is the headquarters of the SWM service provider and EDEM is a principal municipal building where most of municipal services are carried out and large number of personnel work.

c.1 Dirección Municipal de Aseo Urbano y Domiciliario (DIMAUD, Carrasquilla)

The main facilities of this organization are located in San Francisco Corregimiento, Avenida 1 C Sur, Carrasquilla.

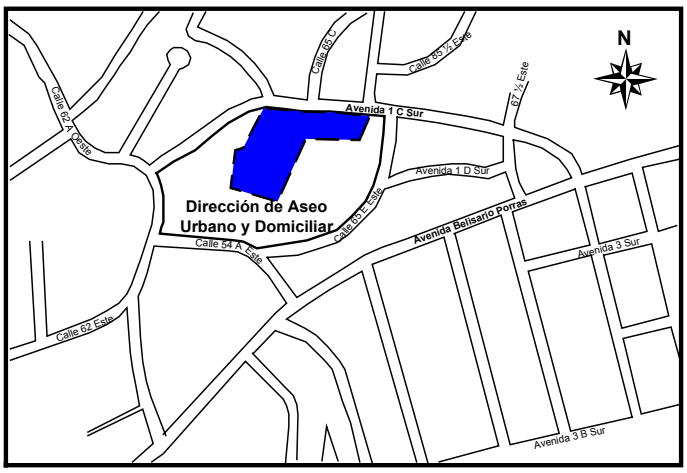


Figure G-8: Location of DIMAUD (Carrasquilla)

The following are profile of the building.

- 36 office areas and complementary services
- 289 Permanent Officers, **PO** (they stay inside the office during the working hours).
- 171 Floating Officers, **FO** (They do not stay in their offices because their assignments are on the field).
- 15 Offices which recover the white paper, 41.67 % of the total by using two types of containers one (generally a box) for white paper and the other one for the rest.
- Waste collection inside the premises is done by General Services office (once a day) regularly during the morning.
- The facilities are distributed in just one level.

Level	Nos. of Offices	PO	FO	Offices which dispose their wastes in a mixed manner	Offices which Recover White Paper	Offices which separate Kitchen Waste	Offices which separate Paper and Food
1	36	289	171	21	15	None	None

- Special activities or complementary services regarding wastes generation are Barbershop, Clinics, Restaurants, and Computing services.

c.2 Municipality (EDEM)

These facilities harbor a large number of offices, where most of the sections of the Municipality operate, and where large number of visitors is serviced; it is located in Santa Ana Corregimiento, Avenida B and calle 15. It is better known as EDEM.

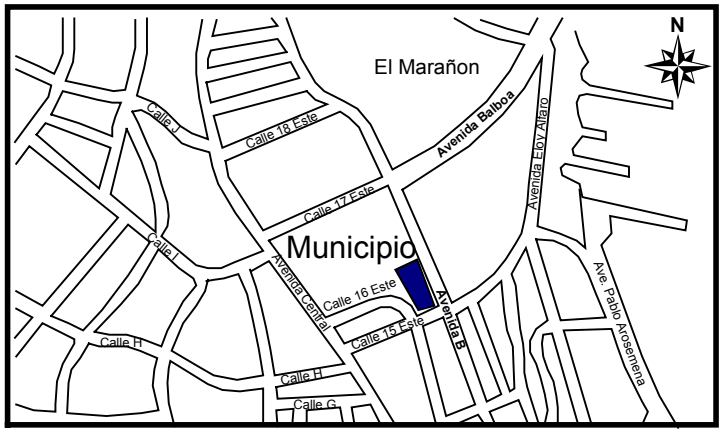


Figure G-9: Location of Municipality (EDEM)

The following are profile of the building.

- 62 office areas and complementary services
- 677 Permanent Officers, (**PO**)
- 250 Floating Officers, (**FO**)
- The facilities are distributed in eight levels
- 15 offices recover white paper, 24.19% out of the total identified.
- 9 offices with independent containers for food wastes, 14.52% out of the total identified.
- 7 of the previous separate both white paper and food wastes,
- 45 offices store their wastes on a mixed manner, in just one container
- 17 use two containers for white paper or food wastes and the others.
- 7 offices use three containers: for white papers, food wastes and others.
- The distribution of offices, officers, and type of material being recovered was found as follows:

Level	Nos. of Offices	PO	FO	Offices depositing mixed wastes	Offices recovering White Paper	Offices separating Food Wastes	Offices separating Paper and Food Wastes
Ground level	15	188	107	12	3	1	1
1	1	13			1		
2	2	22	4	1	1		
3	12	73		12			
4	3	36	43	2	1	1	1
5	8	58	6	7	1		
6	13	127		7	6	3	3
7	8	160	63	4	2	4	2
Total	62	677	223	45	15	9	7

- Separate activities or complementary services in view of wastes generated are found in Clinics, restaurants, computing and printing centers.

d. Project Design Matrix

A Project Design Matrix was made in order to clarify purposes, inputs, expected outcomes and activities of the pilot project. It is shown in Table G-15.

Table G-15: Project Design Matrix of the Pilot Project of Separation at the Source

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal 1. Viable M/P is formulated 2. Separation at the source is expanded.	-	-	-
Project Purpose 1. Separation at the source is verified. 2. The pilot project becomes an origin of recycling activities.	1. Data and information obtained are analyzed and evaluated. 2. Recycling committee is established and the separate collection is continued.	1. Report of this study 2. Member list of the recycling committee and observation at each building	• The M/P is reviewed based on the results of the pilot project. • DIMAUD establishes a section to expand this pilot project to other institutions. • Other institutions understand necessity of recycling.
Outputs 1. Data and information regarding separation that is useful for reviewing the M/P are obtained. 2. Knowledge and skills regarding separation to the C/P and persons concerned are transferred. 3. Persons concerned are encouraged to conduct separate collection.	1. Amount and composition data for one month is obtained. 2.1. A large number of persons understand proper concept of recycling. 2.2. A large number of persons learn to separate materials properly. 3. A large number of persons are encouraged to continue the separate collection.	1. Record of the amount and composition survey 2.1. Results of Opinion survey 2.2. Record of the amount and composition survey 3. Results of the opinion survey	• Decision makers in the municipality and DIMAUD do not oppose to the pilot project.
Activities 1.1. Introduce separate collection 1.2. Carry out amount and composition survey 2.1. Hold workshops before the pilot project 2.2. Deliver leaflets 2.3. Put signs 2.4. Carry out on the job training 3. Hold workshops at the end of the pilot project	**Inputs** Human Resources • One member of the S/T • Members of the C/P • NGO Materials • Containers • Equipment for the amount and composition survey • Materials for the educational campaign		• Employees in DIMAUD and EDEM accept that the separation introduced and participate the pilot project. **Preconditions** • JICA and the Panamanian side agree to conduct the pilot project.

G.2.2 Implementation Method

The pilot project is a combination of two aspects. One is technical aspect, i.e., amount and composition survey of recyclable materials. The other is social aspect, i.e., educational campaign for encouraging to separate waste and to inform how to do it. This section describes work schedule and method of implementation of the pilot project.

a. Work Schedule

The formulation of the implementation plan was developed jointly between the Panamanian C/P and the Study Team. The pilot project was implemented for about one month, from the 15th of July until the 16th of August, followed by analysis and evaluation.

The pilot project consisted of the following five stages.

1. Diagnosis of the current situation.
2. Planning
3. Preparation
4. Execution
5. Analysis and evaluation

a.1 Diagnosis of the current situation

To know the current conditions of the facilities and the operations that are done related to solid waste management, e.g., who is responsible to do collection, what type of containers are used for storage, location of the containers, when and how many times collection is done, after wastes are collected where they are disposed. All the previous information was required with the purpose to have a better idea about the internal flow of wastes and actors of this process. Additionally, it can give an idea on the impact that separate collection can have when it is implemented.

a.2 Planning

From the information obtained in the previous phase, the following four separation categories were defined:

- White paper
- Other recyclable materials
- Food wastes
- Others

The number of containers was calculated, taking into account the space available in the participants' offices and their availability in the market in number, sizes and quality. It was calculated one container per 10 officers. Additionally, the collection support equipment,

number of persons who would be assigned, how to inform the participants, and evaluation methods were defined.

a.3 Preparation

As part of the preparation, an Opinion Survey was executed; containers were acquired; a flyer was produced; and instruction sheets were elaborated. Additionally, information to the officers was given through 24 times workshops, which were attended by 474 officers equivalent to 49% (474/966) of the permanent offices of the buildings.

a.4 Execution

After the preparation, separation at the source was implemented at the buildings. Data necessary to analyze and evaluate this pilot project was collected.

a.5 Analysis and Evaluation

Data and information were analyzed and validity of the separate collection for the M/P was evaluated.

Activities carried out in this pilot project are shown in the following table.

Table G-16: Work Schedule of the Pilot Project of Separation at the Source

Period	Activity
24 Jun – 30 Jun	**Diagnosis of the current situation** • To obtain the number of offices, number of employees, storage system, collection frequency, and operation responsible
01 Jul – 07 Jul	**Planning** • To establish categories of waste for separation • To calculate the number of containers to be used for every facility • To elaborate an Opinion Survey before the implementation • To elaborate flyers • To elaborate instruction sheet showing the type of materials to be deposited • To elaborate a presentation with information for the officers of the project
08 Jul – 14 Jul	**Preparation** • To undertake the Opinion Survey before the implementation • To give informative talks to officers • To deliver the flyers • To purchase the containers and bags which were used during the project • To elaborate forms to obtain data • To define the methodology to be employed • To schedule the sampling • To initiate placing the containers, with the respective bags and posters with instructions where to place the materials

Period	Activity
15 Jul - 21 Jul	**Execution** • Placing the containers was continued • Data collection initiated and adjustments were done to the formats • The methodology was adjusted • Information was processed
22 Jul – 28 Jul	**Execution** • Closure of the first week of data collection • Evaluation meeting • Data processing
29 Jul - 04 Aug	**Execution** • Closure of the second week of data collection • Evaluation meeting • Data processing
05 Aug – 11 Aug	**Execution** • Closure of the third week of data collection • Evaluation meeting • Data processing • Elaboration of a Opinion Survey to evaluate the project • Elaboration of the presentation of results for the workshop of participant officers • Workshop to present the results and to form a follow-up group in EDEM • To initiate weight sampling of non-recyclables for a period of 8 days • To initiate obtaining volumes of recyclable materials, among the selected samples
12 Aug – 18 Aug	**Execution** • Closure of the fourth week of data collection • Opinion Survey to evaluate the project • Evaluation meeting • Data processing • To elaborate the presentation for the workshop of DIMAUD´s participant officers • Workshop to present results and to form a follow-up group • Finalization of weight sampling for non-recyclables • Finalization to obtain volumes of recyclables materials, among the selected samples • Workshop to form the follow-up group • Finalization of Data collection and closure of the fifth week
19 Aug – 25 Aug	**Analysis and evaluation**

b. Method of Amount and Composition Survey of Recyclable Materials

b.1 Separation Categories

Waste was mainly divided into two categories, i.e., 'Recyclable' and 'Non-recyclable'. As white papers were separated for recycling at both buildings before the pilot project, the recyclable materials were further divided into 'White Paper' and 'Other Recyclable Materials.' Consequently, the waste in the buildings was categorized as below.

Table G-17: Separation Categories

Category	Sub-category
Recyclable	White paper
	Other recyclable • Papers (color paper, magazines, newspapers, cardboard, folders) • Aluminum • Glass • Plastic
Non-recyclable	Food waste Others

Four types of containers were used depending on the separation category.

- White paper: carton box (existing)
- Other recyclable: plastic container (newly provided for the pilot project)
- Food waste: plastic container (existing)
- Others: plastic/metal container (existing)

b.2 Samples and Measurement

Only recyclable materials, i.e., white paper and other recyclable were subject to amount survey. Besides, the other recyclable materials were subject to composition survey. Those were classified into sub-categories such as color paper, magazines, aluminum and plastic. Then, each sub-category was weighed.

Number of samples is shown in the table below.

Table G-18: Measurement Items and Number of Samples of Separation at the Source

Place	Measurement Items	Material	1st week	2nd week	3rd week	4th week	5th week	Total
Carrasquilla	Amount	White Paper	33	33	33	33	33	165
		Other Recyclable	35	35	35	35	35	175
	Composition	Other Recyclable	5	5	5	5	5	25
EDEM	Amount	White Paper	55	55	55	55	55	275
		Other Recyclable	55	55	55	55	55	275
	Composition	Other Recyclable	13	13	13	13	13	65

c. Method of Educational Campaign

Basically, all persons who discharge waste at the buildings were subject to the educational campaign. However, ways of approach to them were different depending on type of persons. In order to evaluate the effect of the educational campaign as well as the implementation of the pilot project, opinion surveys were conducted before and after it.

Media	Target group
Workshop	Permanent officers
Flyer	Permanent officers and floating officers
Sign	Permanent officers, floating officers and visitors

Workshop

Two types of workshops were conducted before and the end of the pilot project. Objectives of the workshops were as follows.

i. Workshop before the pilot project

- To tell them importance and necessity of separation at the source,
- To inform about the objectives and procedures of the pilot project, and
- To motivate the personnel to participate actively on the pilot project.

ii. Workshop at the end of the pilot project

- To train about recycling through an environmental educative video,
- To inform the participants of the progress of the pilot project,
- To know the opinions of the officers about the viability of a permanent program on separation which can be implemented by the officers and endorsed by the superior management, and
- To form the Recycling Committee for continuing the separate collection after the pilot project by themselves.

d. Delivery of Containers

Separation of Other Recyclable Materials was newly introduced by the pilot project. Containers (32 gallons, or 121.1 litters) for storing them were procured to the buildings.

G.2.3 Results

a. Amount and Composition Survey on Recyclable Materials

a.1 Amount of Recyclable Materials

i. White Paper

Amount of white paper measured at the both building are summarized in Table G-19, Table G-20 and Table G-21. White papers measured at the first week included one that had been accumulated in the previous weeks. Therefore, the data of the first week was elided. Generation amount of the white paper in DIMAUD was 37.64 kg/week (5.38 kg/day) and one in EDEM was 46.86 kg/week (6.69 kg/day). The generation amount per permanent officer was 0.020 kg/pers./day in DIMAUD and 0.011 kg/pers./day in EDEM. Average of the generation rate of the two buildings were 0.014 kg/pers./day.

Table G-19: Amount of White Paper at DIMAUD (Carrasquilla)

Unit: kg

Office	Nos. of offices	Week				Total	Average per week
		2	3	4	5		
Administrative office	33	51.60	22.00	26.48	30.16	130.24	32.56
Restaurant	1	9.87	0.20	-	-	10.07	2.52
Computer Center	1	5.22	1.50	3.06	0.45	10.23	2.56
Total	35	66.69	23.70	29.54	30.61	150.54	37.64
Average per office	-	1.91	0.68	0.84	0.87	-	-

Table G-20: Amount of White Paper at Municipality (EDEM)

Unit: kg

Office	Nos. of offices	Week				Total	Average per week
		2	3	4	5		
Administrative office	52	44.57	55.93	34.28	25.54	160.32	40.08
Restaurant	1	-	-	-	-	0.00	0.00
Computer Center	1	3.12	4.37	6.97	2.52	16.98	4.25
Printing Shop	1	2.44	7.71	-	-	10.15	2.54
Total	55	50.13	68.01	41.25	28.06	187.45	46.86
Average per office	-	0.91	1.24	0.75	0.51	-	-

Table G-21: Amount of White Paper per Permanent Officer

Unit: kg

Building	Nos. of officers	White paper per week	White paper per officer per week	White paper per officer per day
DIMAUD	265	37.64	0.142	0.020
Municipality	615	46.86	0.076	0.011
Average	440	42.25	0.096	0.014

ii. Other Recyclable Materials

Amount of other recyclable material measured at the both buildings are summarized in Table G-22, Table G-23 and Table G-24 Generation rates of Other Recyclable Materials per permanent officer were 0.039 kg/pers./day in DIMAUD and 0.027 kg/pers./day in EDEM. The average was 0.031 kg/pers./day.

Table G-22: Amount of Other Recyclable Materials at DIMAUD (Carrasquilla)

Unit: kg

Office	Nos. of offices	Week				Total	Average per week
		2	3	4	5		
Administrative office	31	103.79	50.75	44.76	39.41	238.71	59.68
Restaurant	1	6.75	5.05	3.35	4.39	19.54	4.89
Computer Center	1	8.68	6.10	11.34	1.59	27.71	6.93
Total	33	119.22	61.90	59.45	45.39	285.96	71.49
Average per office	-	3.61	1.88	1.80	1.38	-	-

Table G-23: Amount of Other Recyclable Materials at Municipality (EDEM)

Unit: kg

Office	Nos. of offices	Week				Total	Average per week
		2	3	4	5		
Administrative office	52	137.44	68.35	127.26	91.43	424.48	106.12
Restaurant	1	0.17	0.2	-	0.4	0.77	0.19
Computer Center	1	3.63	4.88	0.34	1.79	10.64	2.66
Printing Shop	1	13.32	1.05	16.22	0.54	31.13	7.78
Total	55	154.56	74.48	143.82	94.16	467.02	116.76
Average per office	-	2.81	1.35	2.61	1.71	-	-

Table G-24: Amount of Other Recyclable Materials per Permanent Officer

Unit: kg

Building	Nos. of officers	Other recyclable per week	Other recyclable per officer per week	Other recyclable per officer per day
DIMAUD	265	71.49	0.270	0.039
Municipality	615	116.76	0.190	0.027
Average	440	94.13	0.214	0.031

a.2 Composition of Other Recyclable Materials

Table G-25 and Table G-26 show composition of Other Recyclable Materials in DIMAUD and Municipality respectively.

Table G-27 shows combined composition of the two buildings.

Papers such as color paper, newspaper and cardboard occupy major part of the compositions, about 60% in DIMAUD and about 90% in EDEM. Other materials shows lower portions, the composition rates of aluminum and glass together were 7.82% in DIMAUD and 4.38% in EDEM, the average was 6.04%.

For recycling, it is crucial that generators appropriately separate materials at the source. The item of others in the Other Recyclable Materials shows degree of appropriate separation manner. The others are non-recyclable materials. Those should not be put in the containers for the Other Recyclable Materials. The portion of the others is generally called as 'Impurity Rate.' The impurity rates were 11.57% in DIMAUD and 4.18% in EDEM. Compared each other, there may be a room to improve this value in DIMAUD.

Table G-25: Composition of Other Recyclable Materials at DIMAUD (Carrasquilla)

Unit: kg

Type of material	Week				Total
	2nd	3rd	4th	5th	
Color paper	12.346	1.474	2.693	1.843	18.356
Magazine	8.789	0.000	0.000	0.227	9.016
Newspaper	1.361	1.786	0.369	1.786	5.302
Cardboard	3.558	2.920	6.691	2.029	15.198
Folders	1.162	0.407	0.539	0.162	2.270
Sub-total (paper)	27.216	6.587	10.292	6.047	50.142
Aluminum	0.198	0.241	0.113	0.170	0.722
Glass	1.177	0.397	2.693	0.369	4.636
Plastic	3.884	3.912	1.616	2.023	11.435
Others	3.058	2.481	1.843	0.779	8.161
Total	35.533	13.618	16.557	9.388	75.096

Unit: %

Type of material	Week				Average
	2nd	3rd	4th	5th	
Color paper	34.75	10.82	16.27	19.63	20.36
Magazine	24.73	0.00	0.00	2.42	6.79
Newspaper	3.83	13.11	2.23	19.02	9.55
Cardboard	10.01	21.44	40.40	21.61	23.36
Folders	3.27	2.99	3.26	1.73	2.81
Sub-total (paper)	76.59	48.36	62.16	64.41	62.87
Aluminum	0.56	1.77	0.68	1.81	1.21
Glass	3.31	2.92	16.27	3.93	6.61
Plastic	10.93	28.73	9.76	21.55	17.74
Others	8.61	18.22	11.13	8.30	11.57
Total	100.00	100.00	100.00	100.00	100.00

Table G-26: Composition of Other Recyclable Materials at Municipality (EDEM)

Unit: kg

Type of material	Week				Total
	2nd	3rd	4th	5th	
Color paper	36.790	14.770	20.469	6.372	78.401
Magazine	3.686	0.397	0.255	0.085	4.423
Newspaper	2.637	10.135	2.552	1.871	17.195
Cardboard	2.322	4.830	2.608	3.147	12.907
Folders	2.424	0.454	0.709	1.786	5.373
Sub-total (paper)	47.859	30.586	26.593	13.261	118.299
Aluminum	0.204	0.170	0.085	0.142	0.601
Glass	4.564	0.241	1.616	0.123	6.544
Plastic	1.069	0.198	0.267	0.795	2.329
Others	1.316	1.014	0.210	1.673	4.213
Total	55.012	32.209	28.771	15.994	131.986

Unit: %

Type of material	Week				Average
	2nd	3rd	4th	5th	
Color paper	66.88	45.85	71.14	39.83	55.93
Magazine	6.70	1.23	0.89	0.53	2.34
Newspaper	4.79	31.47	8.87	11.70	14.21
Cardboard	4.22	15.00	9.06	19.68	11.99
Folders	4.41	1.41	2.46	11.17	4.86
Sub-total (paper)	87.00	94.96	92.42	82.91	89.33
Aluminum	0.37	0.53	0.30	0.89	0.52
Glass	8.30	0.75	5.62	0.77	3.86
Plastic	1.94	0.61	0.93	4.97	2.11
Others	2.39	3.15	0.73	10.46	4.18
Total	100.00	100.00	100.00	100.00	100.00

Table G-27: Combined Composition of Other Recyclable Materials both DIMAUD (Carrasquilla) and Municipality (EDEM)

Type of material	Unit: kg/week			Unit: %		
	DIMAUD	EDEM	Total	DIMAUD	EDEM	Average
Color paper	18.356	78.401	96.757	20.36	55.93	46.72
Magazine	9.016	4.423	13.439	6.79	2.34	6.49
Newspaper	5.302	17.195	22.497	9.55	14.21	10.86
Cardboard	15.198	12.907	28.105	23.36	11.99	13.57
Folders	2.270	5.373	7.643	2.81	4.86	3.69
Subtotal (paper)	50.142	118.299	168.441	62.87	89.33	81.33
Aluminum	0.722	0.601	1.323	1.21	0.52	0.64
Glass	4.636	6.544	11.180	6.61	3.86	5.40
Plastic	11.435	2.329	13.764	17.74	2.11	6.65
Others	8.161	4.213	12.374	11.57	4.18	5.98
Total	75.096	131.986	207.082	100.00	100.00	100.00

a.3 Density

Density of other recyclable materials is measured once at the 5th week. The results are shown in Table G-28.

Table G-28: Density of Other Recyclable Material

Unit: kg/m^3

Type of material	Density
Color paper	118.43
Magazine	115.72
Newspaper	65.09
Cardboard	74.15
Folder	67.28
Aluminum	98.25
Glass	284.29
Plastic	51.84

According to George Tcobanoglous, Hilary Theisen and Samuel A. Vigil, in their book "Integrated Solid Waste Management", the following average in densities were reported.

Range of Densities
(Kilograms-cubic meters)

Material	Minimum	Maximum	Value Obtained
Paper	41	130	118.43
Cardboard	41	80	74.15
Aluminum	65	240	98.25
Glass	160	480	284.29
Plastic	41	130	51.84

b. Educational Campaign

As activities of the pilot project, workshops were held, leaflets were delivered and sings were put on the walls in order to deliver information how to separate materials as well as to tell the participants importance of recycling and to motivate them to actively participate and to continue the separation.

Workshops were held before the pilot project targeting all the permanent officers and at the end of it targeting selected permanent officers. One-hour workshops before the pilot project were carried out 24 times at DIMAUD and Municipality between July 9 and 12. Then, three-hour workshops at the end of the pilot project were held one time at Municipality and DIMAUD on August 8 and 13 respectively. Table G-29 shows data about participation.

Table G-29: Participation to Workshops

Workshop	Nos. of targeted officers	Nos. of participants	% of participation
Before	966	474	49.1
At End	83	67	80.7

c. Opinion Survey

An Opinion Survey was done to 149 officers, 46 from the DIMAUD and 103 from the Municipality before the pilot project and the other to 150 officers, 47 from DIMAUD and 103 from the Municipality at the end of the pilot project, as a basic principle, one sample at least was picked up from each office. The results were presented in Table G-30 and Table G-31. Some of important results were described in the following.

- Although only about 20 % of participants understood what is recycling appropriately, 90% become to have correct idea about it at the end of the pilot project.
- About 60% in EDEM showed unwillingness to the introduction of separation before the pilot project, however about 100% actually participated in the separation.
- Four separation categories were introduced in the pilot project. 90% both before and the end of the pilot project said that the categorization was appropriate.
- Regarding formulation of a recycling committee for continuation of the pilot project, 62% in DIMAUD and 85% in EDEM made affirmative answer before the pilot project. The portion was improved at the end of the pilot project to more than 90% in each building.

- Majority (75%) answered that the container used for the Other Recyclable Materials was appropriate.
- Almost all (about 100%) said that the municipality should support activities to continue and expand the separation at the source.

Table G-30: Results of Opinion Survey before the Pilot Project

Question	Municipality	DIMUD
1 What do you understand for recycling?	20.39 % has a clear concept 66.02%, the concept is acceptable 13.59%, wrong concept	17.39%, has a clear concept 45.65%, has an acceptable concept 36.96%, wrong concept
2. Do you consider that it is necessary a recycling program within the municipality?	93.20%, Yes 3.88%, No 2.91%, Do not know	91.30%, Yes 4.35%, No 4.35%, Do not know
3. If the municipality were to introduce a system of separate collection of wastes would you be interested in participating?	91.26%, Yes 6.80%, No 1.94%, Do not know	39.13%, Yes 58.70%, No 2.17%, Do not know
4. Would you be willing to separate in four parts?	88.35%, Yes 10.68%, No 0.97%, Do not know	91.30%, Yes 8.70%, No 0.00%, Do not know
5. If the answer to the previous question is NO, what are the reasons?	Out of the 10.68% who responded NO to the previous question: 0.98% Requires a lot of effort 0.98% Requires more containers 7.84% It is inconvenient for a normal activity of the office 90.20% Did not give any reason	Out of the 8.70% who responded NO to the previous question: 2.17% Requires a lot of effort 6.52% Requires more containers 91.30% It is not inconvenient for a normal activity of the office
6. In your department are paper wastes or other materials being separated?	36.89%, Yes 61.17%, No 1.94%, Do not know	45.65%, Yes 54.35%, No
7. What do you do with white paper waste that is recovered in your office?	12.62%, We sell it 5.83%, We donate it 81.55%, Others	36.96%, We sell it 10.87%, We donate it 52.17%, Others
8. Would you be willing to be part of a separation and recovery committee within the municipality?	62.14%, Yes 25.24%, No 6.80%, Do not know	84.78%, Yes 4.35%, No 10.87%, Do not know
9. What would be your main motivation if your answer was YES to the previous question?	Out of the 62.14% who answered YES to the previous question, 62.14%, Concern about the Environment 0.97%, Interest that the Sanitary landfill extends its service life 36.89%, My siblings encourage me to do it	Out of the 84.78% who answered YES to the previous question, 60.87%, Concern about the environment 2.17%, Interest that the Sanitary landfill extends its service life 36.96%, My siblings encourage me to do it

Table G-31: Results of Opinion Survey at the end of Pilot Project

Question	Ans. %	DIMUD	Ans. %	Municipality
1 Among the different statements which one would better represent the concept of Recycling?	25.53	To reduce wastes as much as possible	11.65	To reduce waste as much as possible
	19.15	To separate used materials and prevent their disposal in order to sell them subsequently	18.45	To separate used materials and prevent their disposal in order to sell them subsequently
	46.81	The process to collect used materials to process them again and to elaborate new products	65.05	The process to collect used materials to process them again and to elaborate new products
	4.26	None of the previous	1.94	None of the previous
	4.26	Do not know / Did not respond	2.91	Do not know / Did not respond
2 Do you consider that recovery of materials contributes to.....	31.91	The conservation of natural resources	33.98	The conservation of natural resources
	19.15	To obtain additional income	24.27	To obtain additional income
	42.55	The two previous answers	37.86	The two previous answers
	2.13	Nothing	2.91	Nothing
	4.26	Do not know /Did not respond	0.97	Do not know / Did not respond
3 Did you participate actively in the project to separate wastes?	23.40	A lot	35.92	A lot
	46.81	Moderately	50.49	Moderately
	10.64	Little	11.65	Little
	8.51	Nothing	1.94	Nothing
	10.64	Do not know/ Did not respond	0.00	Do not know / Did not respond
4 Did your co-workers participate actively in the project?	31.91	Very actively	21.36	Very actively
	23.40	Actively	42.72	Actively
	38.30	Moderately	34.95	Moderately
	6.38	Little	0.97	Little
	0.00	Nothing	0.00	Nothing
5 Do you consider that it was achieved to recover all the materials that are produced in your office by following all the instructions in the separation project?	31.91	All of them	25.24	All of them
	27.66	Most of them	33.98	Most of them
	31.91	Moderately	36.89	Moderately
	8.51	Little	2.91	Little
	0.00	Nothing	0.97	Nothing
6 Do you believe that it is appropriate to separate the wastes and deposit them in four containers?	93.62	Yes	90.29	Yes
	4.26	No	9.71	No
	2.13	Do not know / Did not respond	0.00	Do not know / Did not respond
7 If the answer to the previous question was NO, why?	50.00	It is a lot of effort and the containers were too far	10.00	It is a lot of effort and the containers were too far
	50.00	The instruction flyers did not motivate	70.00	The instruction flyers did not motivate
		The large number of containers caused confusion	20.00	The large number of containers caused confusion
		Takes a lot of time out of the work schedule		Takes a lot of time out of the work schedule
		More containers should have been placed		More containers should have been placed

Question	Ans. %	DIMUD	Ans. %	Municipality
8 Do you consider that the containers used for other recyclable materials were the most adequate?	25.53	Very appropriates	18.45	Very appropriates
	51.06	Appropriates	58.25	Appropriates
	10.64	Regular	14.56	Regular
	10.64	Inappropriate	6.8	Inappropriate
	2.13	Do not know / Did not answer	1.94	Do not know / Did not answer
9 Did you have any problem to store the white paper?	12.77	The cardboard box was missing after the first two weeks	24.27	The cardboard box was missing after the first two weeks
	8.51	The cardboard box was missing after the first three weeks	3.88	The cardboard box was missing after the first three weeks
	19.15	Never had box, but we recovered the paper	10.68	Never had box, but we recovered the paper
	53.19	None	60.19	None
	6.38	Do not know / Did not answer	0.97	Does not know / Did not answer
10 Would you be willing to continue the separation if the project continues?	95.74	Yes	98.06	Yes
	2.13	No	1.94	No
	2.13	Do not know / Did not answer	0.00	Do not know / Did not answer
11 Do you believe that a committee to separate materials should be formed to continue the recovery of recyclable materials?	91.49	Yes	90.29	Yes
	6.38	No	5.83	No
	2.13	Do not know / Did not answer	3.88	Do not know / Did not answer
12 Do you consider that the Municipal authorities should support the continuity of this activity (separation) and promote them in the Communities?	95.74	Yes	99.03	Yes
	4.26	No	0.97	No
	0.00	Do not know / Did not answer	0.00	Do not know / Did not answer

G.2.4 Evaluation and Conclusion

a. White Paper

As white paper had been separated in some offices before the pilot project, the personnel were open-minded to its separation. Besides, there are monetary incentives, as the price of white paper when it is sold is quite good. Continuation of separation of the white paper is recommendable.

In order to make recycling activity feasible, large amount of materials has to be transported at a time for reducing the transportation cost. The generation rates of the white paper in the buildings are not so high. It should be stored for a certain period until its amount be enough to be attractive by a buyer. If the white paper is accumulated by 500 kg and is sold to a buyer, it takes about three months in DIMAUD and two and half months in EDEM. The price of the white paper is between US$0.18 and 0.26 per kg according to the Recycling Market Survey. 500 kg of white paper could be sold at between US$90 and 130.

Although the generation rate is likely to be different depending on types of business, the average obtained in the pilot project, 0.014 kg/pers./day (per permanent officer), could be a good indicator for other public institutions.

b. Other Recyclable Materials

Papers occupy major part of the compositions. Aluminium and glass were far less than the papers. To separate the materials other than papers is inefficient at present. Effort of separation shall concentrate on the papers.

c. Educational Campaign

About 50% of target personnel (474/966) participated in the workshops that were held before the pilot project. Although the participation rate to the workshops was not so high, the results of the opinion survey show that considerably large number of personnel acquired correct knowledge about recycling at the end of the pilot project.

About 80% of target personnel (67/83) attended the workshops that were held at the end of the pilot project for aiming at encouraging continuation of the pilot project. Although the workshops targeted the selected personnel, considerably large number of personnel (more than 90%) was encouraged to continue the separation.

According to the mentioned above, it could be said that the integrated approach of educational campaign applied in this pilot project, i.e., holding workshops, delivering leaflets, putting signs, showing photos and videos, was quite effective to deliver the information and to raise awareness of the participants on the separation and recycling. And participation itself was likely to be effective.

Degree of understanding of separation was different between the two buildings, as the impurity rates shows. This implies that manner of educational campaign needs to be adjusted depending on character of target group.

d. Method of Data and Information Gathering

Technical data and social information obtained through the pilot project are good enough to review the M/P. It can be said that the combination of different types of information makes us possible to profoundly consider the results.

e. Sustainability

All the activities were conducted together with the C/P and the NGO. Knowledge and skills how to introduce the separation, how to conduct the amount and composition survey and how to organize a recycling committee were transferred to them.

Meanwhile, considerably large number of personnel in the both buildings has understood the idea of separation and recycling properly and has been encouraged to continue the pilot project. Besides, a recycling committee has been formulated in DIMAUD at the end of August to continue and expand the pilot project.

Consequently, it can be said that the pilot project is ready to be an origin of recycling activities, as they have the knowledge, the skills, the experiences and the organization. It is expected that this will lead the expansion of the activity to the whole municipal buildings.

G.2.5 Recommendations

The following are recommendations to continue and expand the separation at the source.

- Expansion of the pilot project to other municipal buildings is recommendable.
- Separation of papers in public institutions is recommendable.
- Storage at the source needs to be considered carefully.
- Educational campaign shall be implemented with introduction of the separation.
- Educational campaign shall use various media, such as workshop, leaflet, sign and video, to bring good results effectively.
- Establishment of a recycling committee in each building is recommendable.
- The municipality shall authorize the activities of separation and the recycling committee.

G.3 Landfill Operation Improvement

G.3.1 Outline

a. Background

The Cerro Patacon Landfill has some facilities necessary for a sanitary landfill, such as leachate collection facility and landfill gas removal facility. However, daily soil caver was not implemented and landfilling schedule was not established, then, the operation had a room to improve. Therefore, it was expected to demonstrate appropriate landfilling as well as to gather basic data to plan the landfill operation rationally.

Waste-pickers were practicing in the landfill. The landfill operation was often hampered by their activity. Meanwhile they exposed themselves to danger of accident with heavy equipment and collection vehicles. Therefore, a measure to improve the current situation was expected.

b. Objectives

This pilot project has the following objectives.

- To establish a method to operate landfill rationally and designedly
- To establish a method to improve the present situation regarding waste-pickers

Besides the objectives mentioned, to transfer knowledge and skills regarding proper landfill operation to the Panamanian C/P and persons concerned was an important role of the pilot project.

c. Selection of Target Area

The Cerro Patacon Landfill has mainly two areas for wastes called *organic waste* and *inorganic waste* respectively. The *organic waste* is that daily collected from households and business entities by ordinary collection works. The *inorganic waste* is bulky waste collected by special collection services and/or hauled by waste generators. The *organic waste* occupies most of the whole waste disposed in the Cerro Patacon Landfill. Therefore, it is first of all important to dispose the *organic waste* properly.

A new landfill operation method was introduced in a small scale, as it may bring about the mess to introduce the new method at once in a full scale.

d. Project Design Matrix

A Project Design Matrix PDM) was made in order to clarify purposes, outputs, activities and inputs of the pilot project. Table G-32 shows the PDM and Figure G-10 schematizes flow of the pilot project.

Table G-32: Project Design Matrix of the Pilot Project of Landfill Operation Improvement

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal Landfill operation is carried out rationally and designedly on full scale.	The whole *organic waste* landfill site is operated properly.	Data recorded, observation of the operation	-
Project Purpose 1. Landfill operation is carried out rationally and designedly in the pilot project area 2. The present situation regarding waste-picker is improved.	1. Landfill operation is carried out according to the method established. 2. Landfill operation and waste-pickers activities are separated.	1. Data recorded, observation of the operation 2. Observation of the operation	• The landfill method established is expanded to full scale.
Outputs 1. A proper landfill operation method is established. 2. A rule to separate the waste-pickers' activities and the landfill operation is established.	1. There is a document to describe the method. 2. There is a document to describe the rule.	1. This report 2. This report	• The C/P and the contractor learn the method. • The C/P and the contractor understand the importance and necessity to operate the landfill properly.
Activities 1.1 Design a landfill operation method 1.2 Carry out the landfill operation method 1.3 Collect data and information to verify the validity of the method. 2. Design a rule to separate the waste-pickers' activities and the landfill operation	**Inputs** Human Resources • Members of the S/T • Members the C/P • NGO • Contractor Materials and Equipment • Heavy equipment • Soil • Equipment for measuring cells		• The Contractor of landfill operation agrees to conduct the pilot project. **Preconditions** • JICA and the Panamanian side agree to conduct the pilot project.

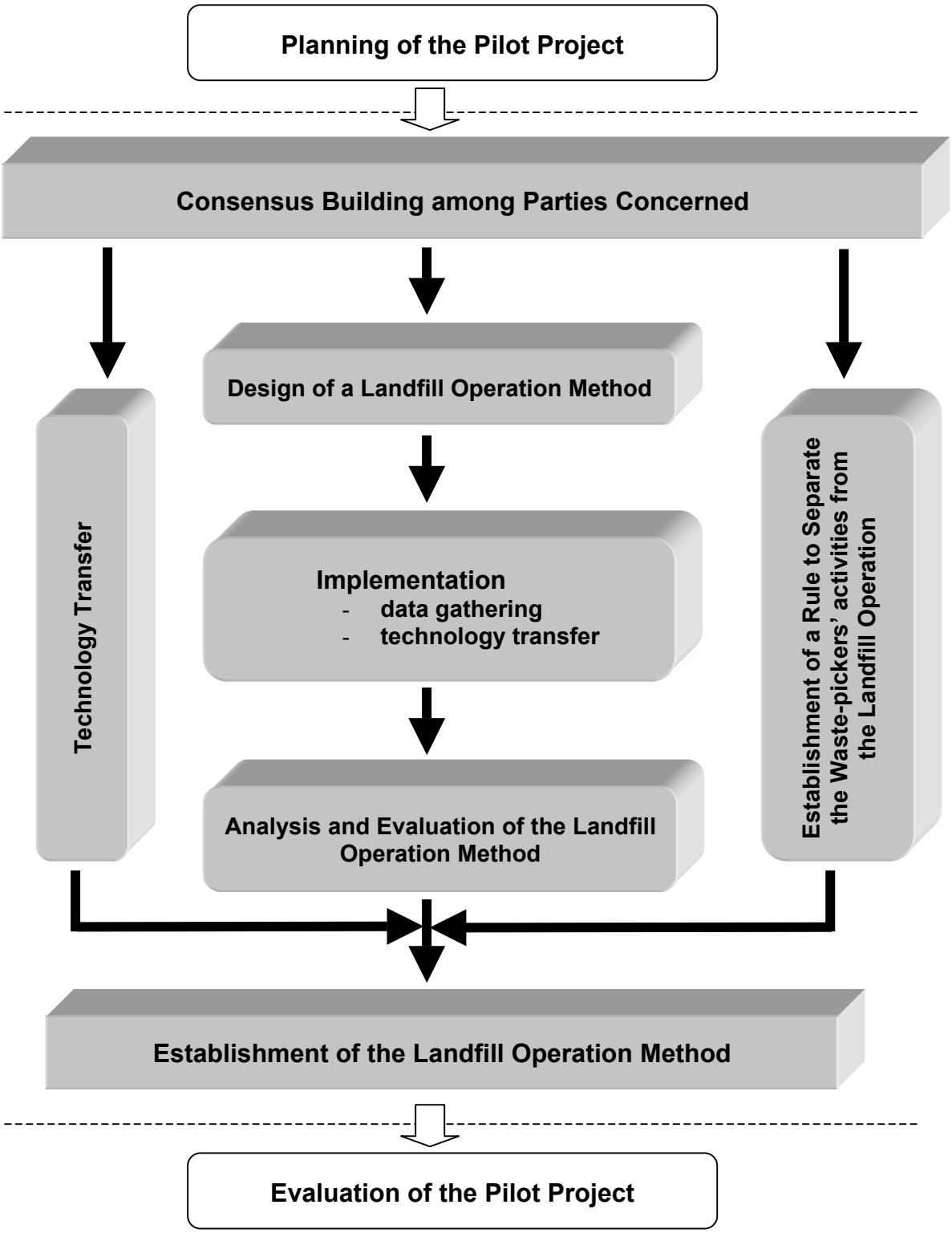


Figure G-10: Flow of the Pilot Project

G.3.2 Implementation Method (Design of Landfill Operation Method)

A landfill operation method was designed at the end of July through discussions and consultations among the C/P, the contractor in charge of landfill operation and the S/T. Table G-33 shows summary of the landfill operation method designed at the beginning the pilot project. Followed by the table, how the design has been set is discussed.

Table G-33: Landfill Operation Method designed at the Beginning the Pilot Project

Items	Description
Heavy equipment 1. One Bulldozer, D7 class (28 ton) 2. Excavator 3. Dump truck	 for accumulation and compaction of waste for excavating soil and for making banks at edge for carrying soil
Performance capacity of bulldozer	55 m^3/hr
Bulk density of waste	Unloaded waste: 0.35 ton/m^3 Compacted waste: 0.70 ton/m^3
Waste amount received	20 ton/hr (120 ton/day, 24 units of 16-yd^3 compactors)
Operation hour 1. Receiving waste 2. Accumulating and compacting 3. Covering soil	From 8:00 to 17:00 (lunch time from 12:00 to 13:00) From 8:00 to 15:00 (6 hours) From 9:00 to 16:00 (6hours) From 16:00 to 17:00 (1 hour)
Dimension of cell	L x W x H = 10.0 x 10.0 x 2.0 m Volume; 200 m^3 Slope; 1 to 3
Soil cover	Thickness; 15 cm 34 m^3/day
Countermeasures to rainwater	Slope of surface of cells is 2.0%
Supervision	Define an area where waste is disposed of on the day Measure a cell after operation every day

a. Performance Capacity of Heavy Equipment

A D7 class bulldozer was supposed to use for the pilot project at first. The weight of the bulldozer was assumed about 28 tons according to the specification of CATERPILLAR. In order to estimate performance capacity of the bulldozer, Table G-34 was used. The D7 was assumed 21-ton class bulldozer. Operating efficiency is depending on type of soil. As no operating efficiency is set for waste, it was assumed as 0.45 on the safe side. The distance of moving waste was assumed as short as 20 m. Consequently the performance capacity was set up as **55 m^3/h**.

Table G-34: Performance Capacity of Heavy Equipment

Unit: m^3/hr

Type	Operating efficiency	Dozing Distance (m)						
		20	30	40	50	60	70	80
15ton class bulldozer	0.45	34	26	22	19	16	14	13
	0.60	45	35	29	25	22	19	17
	0.70	52	41	34	29	25	22	20
21ton class bulldozer	0.45	55	43	35	30	26	23	21
	0.60	73	57	47	40	35	31	28
	0.70	85	67	55	47	41	36	32
32ton class bulldozer	0.45	91	72	59	51	44	39	35
	0.60	122	96	79	67	59	52	47
	0.70	142	112	92	79	68	61	54

1) Equation: 60 x (dozing amount/time) x operating efficiency / cycle time
2) Cycle time: 0.038 x dozing distance + 0.65
3) Operating efficiency: See the table below
4) Dozing amount: 15ton class 1.75m^3, 21ton class 2.85m^3, 32ton class 4.77m^3

Type of soil	Operating efficiency	
	Ground	Dig up
Sand	0.65	0.7
Sandy soil		
Gravel soil	0.55	0.6
Cohesive soil		
Gravel	0.4	0.45
Crushed rock	-	0.35

b. Bulk Density of Unloaded Waste

According to the Time and Motion Survey, average payload of 16yd^3 (12.2m^3) collection vehicle was about 5 ton. This leads to 0.41 ton/m^3 of bulk density of waste in vehicle. When the waste is unloaded on the ground, it will be loosed. Bulk density of waste after being unloaded is assumed as **0.35 ton/m^3**.

c. Operation Hour

Operation hour of the pilot project was set as Table G-35 shows; waste was to be received for 6 hours, to be compacted for 6 hours, and to be covered for one hour.

Table G-35: Operation Hour

Hour	Receiving	Compacting	Covering
8:00-9:00			
9:00-10:00			
10:00-11:00			
11:00-12:00			
12:00-13:00	Lunch Break		
13:00-14:00			
14:00-15:00			
15:00-16:00			
16:00-17:00			

d. Waste Disposal Amount

According to the above mentioned:

i. Waste disposal amount per hour is 20 ton/h.

$$55m^3/h \times 0.35ton/m^3 = 19.25ton/h \qquad say, \quad 20ton/h$$

ii. Waste disposal amount per day is 120 ton/day.

$$20ton/h \times 6hours = 120ton/day$$

iii. The amount is equivalent to 24 collection vehicles (16 yd^3).

$$120ton/day \div 5ton/vehicle = 24vehicles$$

e. Design of Cell Size

It is said that bulk density of compacted waste is between 550 and 1,200 lb/yd^3 (326 – 712 kg/m^3)[3]. The value was derived from waste in USA. Considering the nature of waste in developing countries, its bulk density was set as 700 kg/m^3 (0.7 ton/m^3). As the waste amount dealt with in a day was set as 120 ton, it would become 171 m^3.

$$120ton \div 0.7ton/m^3 = 171m^3$$

Amount of cover soil necessary is often said between tenth and fifth of waste amount. Various literatures recommend various thicknesses for daily cover soil, but it generally falls in between 15 and 30 cm. With taking into account the above mentioned, 20% (fifth) of waste volume was considered as cover soil amount. It becomes $34m^3$. Bringing them together, the volume of cell is to be $205m^3$.

[3] George Tchobanogrous, Hilary Theisen and Samuel A. Vigil, 1993, Integrated Solid Waste Management, McGraw Hill

$$171m^3 \times 20\% = 34m^3$$
$$171m^3 + 34m^3 = 205m^3$$

Considering area and slope for bulldozer' operation, the size of cell was set as follows.

- Length: 10m
- Width 10m
- Height: 2m
- Slope: 1:3

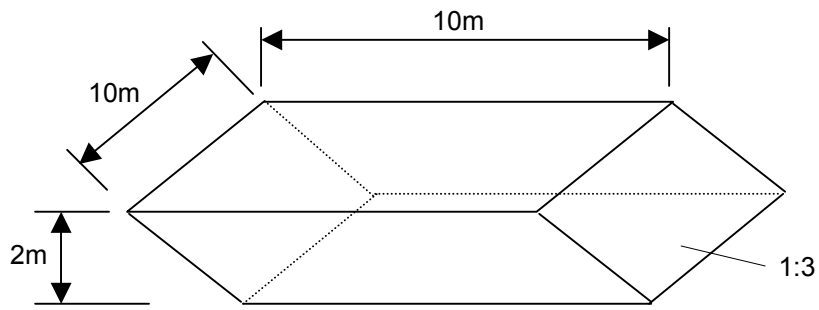


Figure G-11: Dimension of Cell

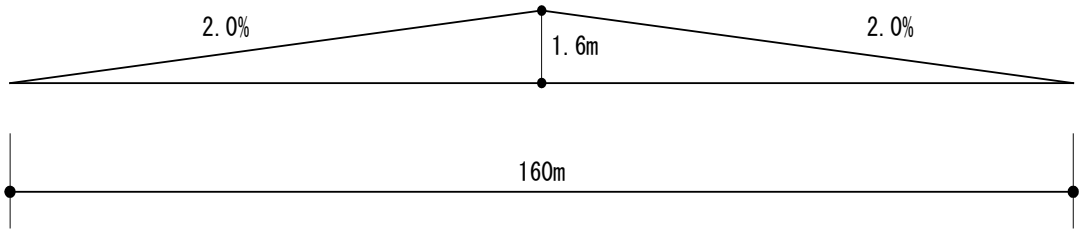
f. Soil Cover

As mentioned above, amount of cover soil was set as 20% of waste volume, i.e., 34m^3. The area to be covered with soil everyday would be 226 m^2 according to the dimension of cell. These figures gave 15cm thickness of cover soil. This was in the range of recommended thickness of cover soil. Then, the thickness was judged as appropriate as daily cover soil.

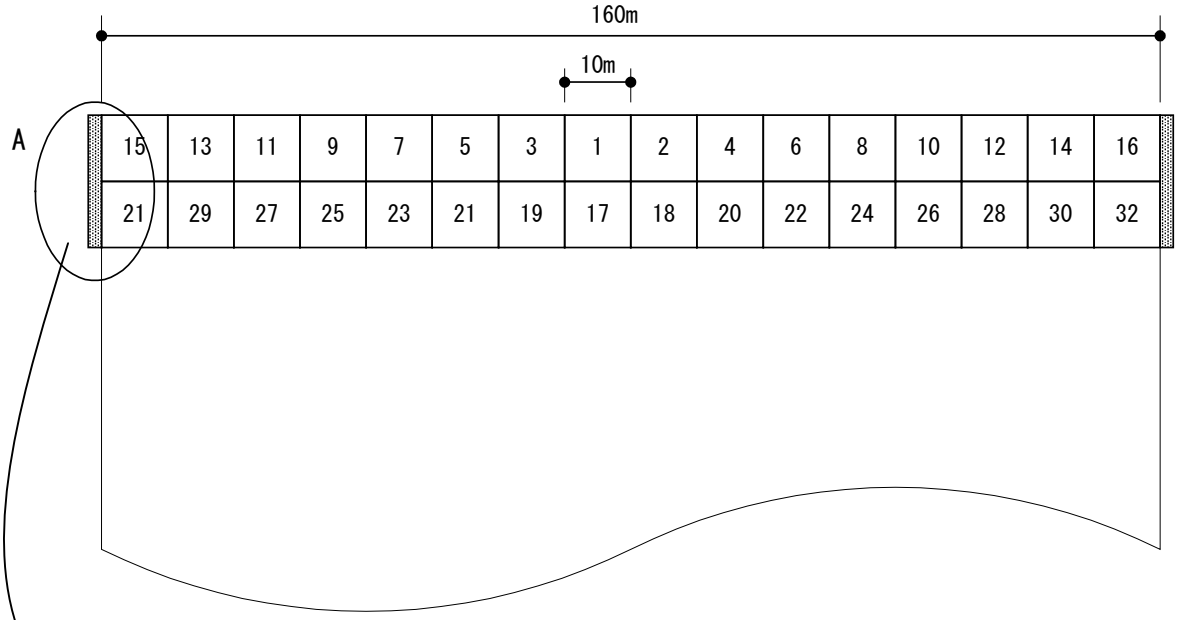
$$10m \times 10m + 10m \times 6.3m \times 2 = 226m^2$$
$$34m^3 \div 226m^2 = 0.15m \quad (15cm)$$

g. Countermeasures to Rainwater

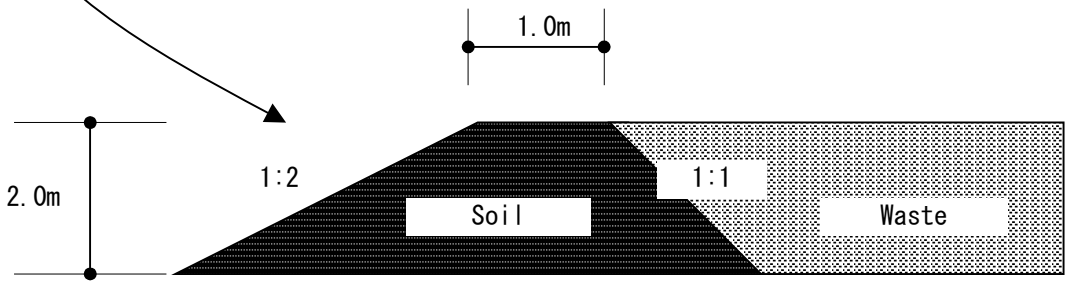
Rainfall at the Cerro Patacon Landfill is very intense and heavy. Therefore, it was designed to slope the surface of the cells at 2% and to make a bank with soil at edges. Besides, it was planed to begin the operation at the center of the landfill and to move to the edge in order to avoid that the operation area would be inundated. Numbers in Figure G-12 (B: Landfilling Schedule) shows order of landfilling. 1 means the 1st day of operation, 2 is the 2nd day of operation in sequence.



A: Slope of Landfill Surface



B: Landfilling Schedule



C: Bank at Edge

Figure G-12: Consideration of Rainwater

G.3.3 Results

The pilot project was implemented from the beginning to the end of August 2002, for about one month. In order to analyze and evaluate 1) performance capacity of bulldozer, 2) bulk density of waste after compaction, 3) required amount of cover soil and 4) operating efficiency of collection vehicle, the following data were gathered during this period. This section presents such data obtained.

- Waste amount disposed and number of collection vehicles
- Operating time of heavy equipment
- Finished dimension of cells
- Amount of cover soil
- Unloading time of collection vehicle

a. Heavy Equipment used in the Pilot Project

At the beginning of the pilot project, a bulldozer of D7 was supposed to use. However, 3 types of heavy equipment were assigned eventually, because the D7 was damaged and could not be repaired, then alternate equipments were delivered. Equipments used in the pilot project were the following.

Table G-36: Heavy Equipment used in the Pilot Project

Equipment	Type	Operating weight*
D8 (Caterpillar)	Bulldozer	About 37 ton
D65 (Komatsu)	Bulldozer	About 18 ton
D6R (Caterpillar)	Bulldozer	About 18 ton
CAT 815 (Caterpillar)	Compactor for road construction (soil)	About 20 ton

* According to specifications

b. Waste Amount Disposed

Waste amount disposed of during the pilot project is shown in Table G-37. About 24 units of 16-yd^3 compactor trucks were received per day as planned. However, 36 units were accepted to dispose of in the last week to check if the heavy equipments were able to deal with larger amount of waste than planed.

Average waste amount brought by the 16-yd^3 compactor truck (5.4 ton/truck) was a little higher than expected (5.0 ton/truck).

Table G-37: Waste Amount Disposed

Unit: ton/day

No.	Date	Waste (ton)	Nos. of vehicle	Waste (ton/vehicle)
1	8/ 5	149.91	27	5.6
2	6	136.35	24	5.7
3	7	127.38	25	5.1
4	8	128.86	24	5.4
5	9	148.00	24	6.2
6	12	131.04	24	5.5
7	13	134.82	24	5.6
8	14	128.55	26	4.9
9	16	128.96	24	5.4
10	19	89.38	17	5.3
11	21	116.84	23	5.1
12	22	146.48	25	5.9
13	23	125.06	24	5.2
14	26	181.17	36	5.0
15	27	199.27	36	5.5
16	28	123.00	24	5.1
17	29	201.86	36	5.6
Total		2,396.93	443	*5.4

*: Average

c. Operating time of Heavy Equipment

As Table G-38 shows, heavy equipment that was most used in the pilot project was D65P. The second one was D8L, the third one was CAT815 and the least used one was D6R. D8L was mostly used for compaction, because it was not suitable for the work of covering soil, as the pilot project area was too small for the large equipment. CAT815 was used only for the compaction together with bulldozer. It could not do the work of covering soil, as the tire is not designed for such work. D65P was the most suitable for use in the pilot project. It compacted waste well in a small area and covered waste with soil appropriately.

Table G-38: Operating Time of Heavy Equipment (by type of equipment)

Unit: minute

Equip	Compaction	Soil cover	Idling	Total
D8L	1,369	218	1,036	2,623
	52.2%	8.3%	39.5%	100.0%
D65P	2,892	1,202	1,658	5,752
	50.3%	20.9%	28.8%	100.0%
D6R	0	62	0	62
	0.0%	100.0%	0.0%	100.0%
CAT815	642	0	791	1,433
	44.8%	0.0%	55.2%	100.0%
Total	4,903	1,482	3,485	9,870
	49.7%	15.0%	35.3%	100.0%

Table G-39: Operating Time of Heavy Equipment (by day)

Unit: minute

No.	Date	Compaction	Soil cover	Idling	Total	Equip.
1	8/5	559	N/A	163	722	CAT815+D65P
2	6	516	35	403	954	CAT815+D65P
3	7	427	30	279	736	CAT815+D65P
4	8	428	24	471	923	CAT815+D65P
5	9	313	26	142	481	D65P
6	12	272	103	127	502	D65P+D8L
7	13	201	150	470	821	D65P+D8L
8	14	219	131	174	524	D65P+D8L
9	16	263	125	136	524	D65P+D8L
10	19	175	73	210	458	D65P+D6R
11	21	203	73	166	442	D65P
12	22	266	123	86	475	D65P+D8L
13	23	194	110	108	412	D65P+D8L
14	26	231	105	160	496	D65P+D8L
15	27	198	154	138	490	D65P+D8L
16	28	164	134	112	410	D65P
17	29	274	86	140	500	D65P
Total		4,903	1,482	3,485	9,870	

N/A: Not Available

d. Finished Dimension of Cell

As Table G-40 shows, the average finished dimension of cells was almost according to plan (L x W x H = 10 x 10 x 2). For some days, heights showed considerably lower than the plan. This was due to height of the original level. In order to maintain the height of cells' surface, the height of cell was kept at lower than planned.

The average bulk density of waste after compaction, 0.755 ton/m^3, was higher than planned, 0.7 ton/m^3. The minimum bulk density was 0.546 ton/m^3 and the maximum was 0883 ton/m^3.

Table G-40: Finished Dimension of Cells

No	Date	Dimension of Cell				Waste	
		Length (m)	Width (m)	Height (m)	Volume (m^3)	Amount (ton)	Density (ton/m^3)
1	8/5	9.50	10.00	2.08	197.60	149.91	0.759
2	6	8.85	9.00	1.96	156.11	136.35	0.873
3	7	8.20	9.15	2.13	159.81	127.38	0.797
4	8	8.70	9.70	1.99	167.94	128.86	0.767
5	9	9.50	10.00	2.00	190.00	148.00	0.779
6	12	7.00	10.00	2.14	149.80	131.04	0.875
7	13	8.00	9.50	2.01	152.76	134.82	0.883
8	14	9.20	10.00	1.79	164.68	128.55	0.781
9	16	9.20	10.30	1.89	179.10	128.96	0.720
10	19	9.10	11.60	1.55	163.62	89.38	0.546
11	21	7.10	9.70	2.13	146.69	116.84	0.797
12	22	8.60	10.40	2.00	178.88	146.48	0.819
13	23	10.75	10.90	1.92	224.98	125.06	0.556
14	26	14.00	10.33	1.80	260.39	181.17	0.696
15	27	14.53	9.90	1.65	237.35	199.27	0.840
16	28	16.60	9.37	1.33	206.87	123.00	0.595
Average		9.93	9.99	1.90	183.54	137.19	0.755

e. Cover Soil

The average soil amount used for covering waste, or 54.4 m^3, was considerably much more than planed, or 34 m^3. There is a large difference between the calculated thickness and the measured thickness as shown in Table G-41. The measured thickness was obtained by subtracting the height measured before covering soil from the height measured after covering soil. Meanwhile, it was regarded the thickness of soil was sufficient from the observation during the pilot project, as the waste was properly covered with soil. According to the mentioned above, possible causes of the difference between the calculated thickness and the measured one are as follows.

- Actual height of cell without cover soil might be lower than one measured before covering soil, because the waste was further compacted during being covered with soil. Then, actual thickness of soil cover might be higher than the measured one.
- Some amount of soil was not carried to the area where the waste was covered with soil, as there was some distance between the area where soil was unloaded by trucks and the area where waste was disposed of.

- Operators of heavy equipment were not used to the operation manner applied to the pilot project. Waste was often tumbled and mixed with soil. This might reduce the thickness of cover soil.
- Soil amount was measured by counting number of buckets of the excavator. This measurement manner may contain a large degree of error.

Table G-41: Cover Soil

No	Date	Area (m^2)	Soil (m^3)	Calculated thickness (cm)	Measured Thickness (cm)
1	8/5	223.17	59.6	27	14
2	6	190.21	87.9	46	4
3	7	191.81	57.3	30	5
4	8	200.1	41.3	21	11
5	9	218.24	42.8	20	7
6	12	184.96	39.8	22	10
7	13	187.15	56.6	30	10
8	14	200.6	37.5	19	6
9	16	211.22	61.9	29	11
10	19	206.95	45.1	22	NA
11	21	181.95	50.5	28	9
12	22	209.52	59.6	28	NA
13	23	248.53	56.6	23	13
14	26	283.07	55.8	20	13
15	27	271.23	59.6	22	3
16	28	264.69	58.9	22	8
Average		217.09	54.4	26	9

f. Unloading Time of Collection Vehicle

Table G-42 and Table G-43 show time spent for unloading waste from collection vehicles at the pilot project area and at Etapa I respectively. In the pilot project area, an area where waste should be disposed of was designated clearly everyday, the collection vehicles were guided by personnel on the site and there was no activity by the waste-pickers. In Etapa I, disposal areas were not clearly designated and many waste-pickers worked in the site. The difference between the average in the pilot project area, or 6 minutes, and one in Etapa I, or 10 minutes, may be due to the differences of situation on the sites.

Table G-42: Discharge Time (Pilot Project Area)

Unit: Minute

No	Date	Nos. of vehicle	Discharge	Average
1	8/5	27	247	9
2	6	24	154	6
3	7	25	145	6
4	8	24	132	6
5	9	24	139	6
6	12	24	142	6
7	13	24	145	6
8	14	26	160	6
9	16	24	130	5
10	19	17	94	6
11	21	23	122	5
12	22	25	129	5
13	23	24	122	5
14	26	36	189	5
15	27	36	223	6
16	28	24	117	5
17	29	36	201	6
Total/Average		443	2,591	6

Table G-43: Discharge Time (Etapa I)

Unit: Minute

No	Date	Nos. of vehicle	Discharge time	Average
1	5	22	232	11
2	6	124	1,260	10
3	7	112	1,078	10
4	8	104	983	9
5	9	100	1,161	12
6	12	120	1,167	10
7	13	123	1,320	11
8	14	138	1,531	11
9	16	113	1,053	9
10	19	127	1,058	8
11	21	120	1,351	11
12	22	124	1,202	10
13	23	132	1,297	10
14	26	88	874	10
15	27	111	1,089	10
16	28	109	1,129	10
17	29	99	1,013	10
Total/Average		1,866	18,798	10

G.3.4 Analysis and Evaluation of the Landfill Operation Method

a. Performance Capacity of Heavy Equipment

Days when only D65P worked were August 5, 11, 28 and 29 (See Table G-44). The waste amount dealt with was in the range between 28 and 45 ton/hr that is equivalent to 80 and 129 m^3/hr of unloaded waste, when the bulk density is assumed 0.35 ton/m^3. The bulldozer showed much more performance capacity than expected (34 to 52 m^3/hr for 15 ton class bulldozer, See Table G-34). Meanwhile, the bulk density of waste after being compacted by the D65P felled between 0.595 and 0.797 ton/m^3. The lowest bulk density 0.595 ton/m^3 was recorded at the highest waste amount dealt with. This may imply that 129m^3/hr of waste would be overload for D65P.

In the combination use of D65P and D8L, D8L was used mainly for compaction and D65P for covering soil. Therefore, it can be said that the waste amount dealt with reflects the performance capacity of D8L. The range of waste amount dealt with was between 28.9 and 60.4 ton/hr (83 to 173 m^3/hr) and the bulk density after compaction was between 0.556 and 0.883 ton/m^3. As 0.840 ton/m^3 of bulk density was recorded when the highest waste amount (173 m^3/hr) was dealt with the D8L may have more performance capacity than 173 m^3/hr.

Table G-44: Performance Capacity of Heavy Equipment

No.	Date	Waste (ton/day) a	Operating time (min) b	Waste (ton/hr) a/(b/60)	Density (ton/m^3)	Equipment
1	8/5	149.91	559	16.1	0.759	CAT815+D65P
2	8/6	136.35	516	15.9	0.873	CAT815+D65P
3	8/7	127.38	427	17.9	0.797	CAT815+D65P
4	8/8	128.86	428	18.1	0.767	CAT815+D65P
5	8/9	148.00	313	28.4	0.779	D65P
6	8/12	131.04	272	28.9	0.875	D65P+D8L
7	8/13	134.82	201	40.2	0.883	D65P+D8L
8	8/14	128.55	219	35.2	0.781	D65P+D8L
9	8/16	128.96	263	29.4	0.720	D65P+D8L
10	8/19	89.38	175	30.6	0.546	D65P+D6R
11	8/21	116.84	203	34.5	0.797	D65P
12	8/22	146.48	266	33.0	0.819	D65P+D8L
13	8/23	125.06	194	38.7	0.556	D65P+D8L
14	8/26	181.17	231	47.1	0.696	D65P+D8L
15	8/27	199.27	198	60.4	0.840	D65P+D8L
16	8/28	123.00	164	45.0	0.595	D65P
17	8/29	201.86	274	44.2	N.A	D65P
Average		141.00	288	33.2	0.755	

b. Bulk Density of Waste after Compaction

Figure G-13 shows that relation between bulk density of waste after compaction and time spent for compacting waste. Although the number of samples is small, the graph may imply the following.

- The maximum bulk density of waste after compaction will be around 0.8 ton/m^3. It would not exceed 0.9 ton/m^3.
- D8L will achieve the maximum bulk density immediately.
- D65P can achieve the planned bulk density, or 0.7 ton/m^3, with a little workload. It requires twice as the workload to realize the maximum density, 0.8 ton/m^3.

Consequently, it is recommendable for D65P to spend time to compact waste about two minutes per ton of waste, where the planned bulk density of 0.7 ton/m^3 will be achieved economically. Meanwhile, much less time for compaction shall be spent in case that D8L is used, i.e., one or less minute per ton of waste.

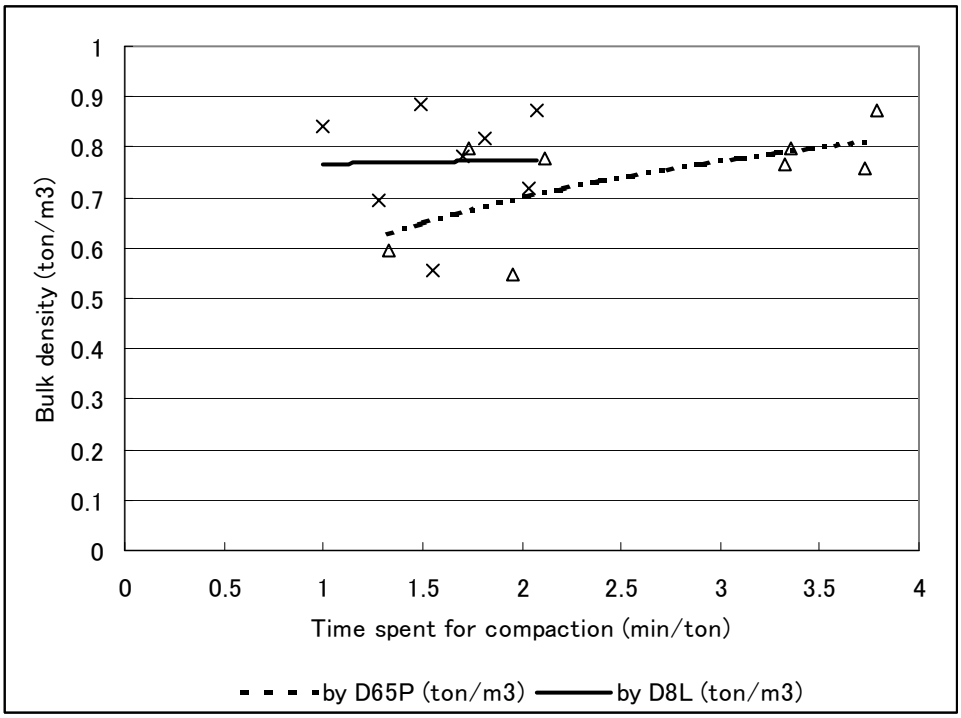


Figure G-13: Relation between Density and Compaction Time

c. Required Amount of Cover Soil

As mentioned in the section of Implementation, soil amount that was actually used, 54.4 m^3 on the average, was much more than the planned, 34 m^3, i.e., 1.6 times as planned. The less amount of soil is used, the longer life of landfill is realized. The use of soil will be reduced by the following.

- Operators learn appropriate operation.
- Soil is put as close to the operation area as possible.
- Height of cell is increased up to 3 m, then, surface area is reduced in proportion to volume of waste.

d. Recommended Landfill Operation Method

Based on the implementation, analysis and evaluation of the landfill method designed at the beginning of the pilot project, a landfill operation method is recommended shown in Table G-45.

Table G-45: Recommended Landfill Operation Method

Items	Description
Heavy equipment 1. Bulldozer, D6 and D7 class 2. Bulldozer, D8 class 3. Excavator 4. Dump truck	 : for accumulating and compacting waste, and covering waste with soil : for accumulating and compacting waste : for excavating soil and for making banks at edge : for carrying soil
Performance capacity of bulldozer 1. D6 and D7 class 2. D8 class	Waste amount for compaction : 30 ton/hr (2 min/ton); D7 could deal with more than this. : 60 ton/hr (1 min/ton) Note; if distance between where waste is discharged and where waste is compacted is more than 20 m, the performance capacity will decrease.
Bulk density of waste 1. Unloaded waste 2. Compacted waste	 : 0.35 ton/m^3 : 0.70 ton/m^3
Dimension of cell 1. Length 2. Width 3. Height 4. Slope	 : More than 10.0 m : More than 10.0m : 2.0 to 3.0 m : 1 to 3
Soil cover 1. Thickness 2. Amount	 : 15 cm : 20 % of waste volume
Countermeasures to rainwater	Slope of surface of cells is 2.0%
Supervision	Define an area where waste is disposed of on the day Measure a cell after operation every day

G.3.5 Rule to Separate the Waste-pickers' Activities and the Landfill Operation

Objective of sanitary landfilling is to dispose waste sanitarily and quickly without giving serious negative impacts on the environment.

Waste picking is incompatible to the sanitary landfilling. Those should not be carried out coincidentally. Waste picking shall not be allowed from a viewpoint of appropriate landfill operation. The society should also not overlook the unsanitary, dangerous and atrocious activity of waste picking in the landfill. Therefore, it is expected that the waste picking in the landfill will be prohibited.

However, it is not undesirable that the waste picking in the landfill is definitely prohibited before the waste-pickers find alternative means of living, if the society considers the fact that the waste-pickers have earned their bread and butter by the activity. It is desirable that the prohibition of waste picking in the landfill carried out stepwise in parallel with the program to create job opportunity for the waste-pickers. In this regard, it is very important that the organizations concerned participate in the program and carry out their responsibilities without shifting all responsibilities onto the landfill owner.

The society altogether should consult on the issue of waste-pickers. It will take a long time. However, the problem exists at present and measures to improve it are expected. The following are what are discussed and agreed by the C/P and the S/T.

- The operation area does not have fence to restrict access of unauthorized persons. This has made the situation uncontrolled.
- The fence will be constructed around Etapa II by December 2002.
- Waste-pickers will be checked at a gate and registered.
- Operation area and area for waste picking will be divided clearly to avoid accidents.

G.3.6 Evaluation and Conclusion of the Pilot Project

Valuable data were obtained through implementation of the pilot project. Those data were beneficial to formulate the Landfill Operation Method. It can be evaluated that the plan of data gathering and its implementation were appropriate. However, it is true that the data lacked coherence a little as some types of heavy equipment were used simultaneously for the same activity.

The pilot project was implemented mainly by the C/P under the guidance of the S/T. Several operators have learned to formulate cells appropriately. In this manner, the C/P and the

contractor have understood what is the sanitary landfilling and learned skills to carry out landfilling appropriately, which will lead to full-scale operation of sanitary landfilling.

One of important roles of pilot projects is to actually show expected outcome and to prod persons concerned to change for improvement. Through this pilot project, the C/P and the contractor have realized that they can implement the sanitary landfilling by themselves and what sort of effects it brings. It can be evaluated that the pilot project fully carried out the important role.