

# Comprehensive Solid Waste Management Project for Matamoros, Tamaulipas

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### Project Type:

Water	<input type="checkbox"/>	Closure	<input type="checkbox"/>	Public Sector	<input checked="" type="checkbox"/>
Wastewater	<input type="checkbox"/>	Rehabilitation	<input type="checkbox"/>	Private Sector	<input type="checkbox"/>
Municipal Solid Waste	<input checked="" type="checkbox"/>	Expansion	<input type="checkbox"/>	Public/Private Partnership	<input type="checkbox"/>
Other	<input type="checkbox"/>	New Facility	<input type="checkbox"/>		

### Main Applicant:

City of Matamoros, Tamaulipas  
C.P. Ramón Antonio Sampayo Ortiz  
Mayor  
*Sexta entre González y Morelos*  
*H. Matamoros, Tamaulipas*  
C.P. 87300  
Telephone (88) 12-0650  
Fax (88) 12-0859

## CHAPTER I

### 1. Foreword

This document was prepared by ETEISA de C.V. as part of the tasks for the development of the Comprehensive Solid Waste Management Master Plan for Matamoros, included in the Technical Assistance provided by the BECC to the municipality.

The document integrates all elements of the "Project Certification Criteria" document published in November, 1996, and meets all requirements established in such guidelines.

## 1. Project Justification.

At the present time the city of Matamoros, located within the United States-Mexico border area, is home to 348,186 residents who generate 145,558 tons of waste each year. The Urban Sanitation utility has deficient solid waste operations and management.

Existing collection equipment and infrastructures are deficient, and their condition is inappropriate for operation. Installed capacity provides a 68% coverage rate. Private companies that charge a fee for their services collect 27% of waste, and it has been estimated that 5% of all waste remains at streets and vacant lots.

In addition to insufficient equipment, processes are deficient due to the lack of comprehensive solid waste management planning. The organizational framework employed for current processes exhibits major gaps (lack of operation manuals, organization, control systems, regulations, etc.) that result in operating problems that in turn make the existing structure perform even more deficiently.

Disposal of waste is done at two open dump sites authorized by the city, which lack appropriate controls to mitigate negative impacts to the environment, cause serious health problems and pose risks of polluting the soil and ground water supply, in addition to negative impacts on the landscape.

The 33 ha. municipal dumpsite has operated as such for more than 15 years. It is located 9 km south of Matamoros.

The second dumpsite is a topographic depression located in the southeastern part of the city, next to Colonia Cavazos Lerma. The 1 ha. depression is known as *Pozo Abelardo de la Torre*, and presents the same sanitary conditions as the main dumpsite, in addition to permanent flooding at its lowest section.

There are also 13 illegal dumpsites that *carretoneros* [garbage haulers] use to dispose of the waste they collect.

In 1997, the city started the construction of a sanitary landfill located 9 km south of the city. The works developed so far include peripheric fencing of an 8 ha tract of land, construction of a 2.15 ha cell, a 1600 m<sup>2</sup> leachate pit, and a 4 m<sup>2</sup> inspection booth. These projects were built using federal grants.

At this time Matamoros faces the following problems related with inadequate solid waste management:

1. Proliferation of illegal dump sites.
2. Air pollution caused by indiscriminate garbage burning at the municipal dumpsite, which has generated serious operation problems for the "Servando Canales" International Airport.

3. Generation and propagation of odors resulting from the degradation of organic material exposed to the environment.
4. Generation of gases (biogas) with characteristics that can negatively affect the health of dumpsite workers and residents of adjacent colonias.
5. Potential contamination of surface and ground water due to shallow water table levels.
6. Dispersion of waste into areas adjacent to the dump site, affecting the aesthetics of the area.
7. Margination of scavengers who separate by-products inside the dump (*pepenadores*).
8. Spread of gastrointestinal diseases caused by vectors originated at existing disposal sites.

## **1.2 Background**

In 1983, Mexico and the United States signed the La Paz Agreement, wherein both countries committed to cooperate for the protection, enhancement and conservation of the border area environment. The border was defined as the area that covers 100 km to both sides of the land and sea boundary that divides the two countries.

Furthermore, under La Paz Agreement guidelines, in 1990 the presidents of Mexico and the U.S. agreed to develop a Comprehensive Border Environmental Plan to incorporate institutional and high society participation formulas to ensure the enforcement of environmental protection measures.

Other similar agreements on environmental issues were established under the Border XXI Program and the Free Trade Agreement signed by Mexico, the United States and Canada.

The Border Environment Cooperation Commission (BECC) and the North American Development Bank were created to meet the above commitments and respond to water supply, wastewater treatment, and municipal solid waste management problems found at the U.S.-Mexico border.

On March 7, 1996, the *Colegio de Ingenieros Civiles de Matamoros* presented the Border Environment Cooperation Commission some alternatives to solve the solid waste management problem at this locality. Although the proposal was adequate, the *Colegio de Ingenieros Civiles* was not the most appropriate sponsor to request BECC certification for the project, and as such, the first application did not move forward.

However, since that first approach, municipal authorities, aware of the serious problem posed by the management of solid waste, contacted BECC officials and exchanged a series of analysis that concluded on November 30, 1996 with a formal petition submitted by city officials in the Step I-Preliminary Presentation form to apply for Technical Assistance to further define the Comprehensive Project proposed.

The request was analyzed and accepted by the BECC Committee, and several companies were invited to submit technical and economic proposals for the development of a Comprehensive Master Plan. The plan's objective was to establish, according to a comprehensive diagnosis, strategies and action plans to increase the efficiency of solid waste management processes. In addition, the plan was intended for the development of the Sanitary Landfill's final design, since this was considered as the only viable solution to solve solid waste final disposal problems.

The Master Plan was under development from October 1997 to May 1998, and was submitted to municipal authorities, the Mexican Ministry of Social Development (SEDESOL), BECC and NADB on July 10, 1998.

The document herein is based on the Master Plan and the new Sanitary Landfill's Final Design.

### **1.3 Project Description**

In light of the above problems, the proposed project will attempt to use a comprehensive approach not only to provide the city with infrastructure and equipment required to increase the efficiency of its processes, but also to focus on institutional development to ensure a permanent efficiency increase.

The project proposes restructuring the waste collection system's organization through the creation of a utility decentralized from the city. The utility must operate within a scheme that encourages community participation for decision-making processes by including a Citizen's Committee, and bases its operation on a specific mission statement that defines and disseminates policies, objectives and goals throughout all levels of the new organization.

The new utility must have all organizational, managerial and operating manuals required, as well as control and information systems that enable the organization to plan actions and correct deviations from the proposed plans.

Action plans have been proposed to ensure the utility's sustainable development and increase social participation. Also, the new legal framework for local solid waste management (Sanitation Regulations and Revenue Laws) establishes obligations and responsibilities of the different players involved in the process (Attachment 1, Proposed Sanitation Regulations).

In addition, the project includes a \$12,477,000 pesos investment to purchase equipment needed to increase the efficiency of collection and final disposal processes for the first stage. A detailed description of these is included in Chapter 3 of this document. Furthermore, the project includes the construction of a \$5,717,500 pesos Sanitary Landfill in accordance with applicable environmental regulations (NOM-083-ECOL-96, Attachment 1).

User fees need to be charged to ensure a healthy and sustainable project development. Proposed fees are differential and based on the analysis of current operating and management costs, as well as debt service and amortization of assets needed to complete the project. The assumption is that a municipal transition fund will be used during the project's first 7 years, but will be reduced by 15% annually.

The proposed fee structure has been financially evaluated using a 12% discount rate and shows a 16.5% IRR and a \$2,617,698 pesos NPV for the planning period.

This project will benefit 363,239 current Matamoros residents. The annual projected population growth rate is 2.5%, therefore, it has been estimated that the project will benefit more than 500,000 residents by the end of the planning period.

The above goals will be met through a phased strategic plan for the short, mid and long term.

### ***Investment Plan***

TERM	YEAR(S)	INVESTMENT
Immediate future	1998	21,194,500
Short-term	1999 a 2001	17,616,500
Mid-term	2002 a 2007	49,105,000
Long-term	2008 a 2013	41,901,000

### ***Immediate Future (1998)***

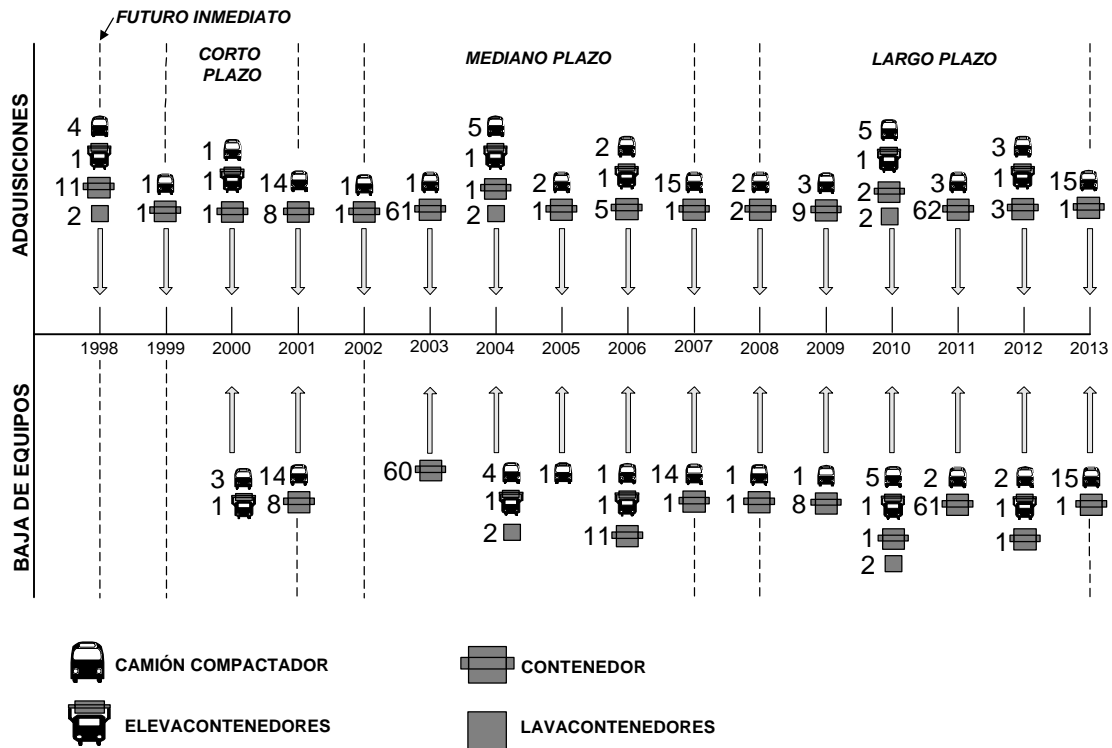
This period is characterized by a reformulation of the current operating structure. The goal is to make the most efficient use of existing infrastructure and purchase equipment to start providing 100% coverage. This will be made possible by re-zoning and adding previously underserved colonias to collection routes. The following investments will be made to achieve the above goals:

- Purchase 4 collection vehicles, with a recommended 15m<sup>3</sup> capacity.
- Rehabilitate 3 existing units.
- Purchase container lift trucks and two vehicles to wash containers.
- Purchase 11 size-12 metal containers with capacity for 2.7 m<sup>3</sup>
- Rehabilitate 8 containers to be used for two more years.
- Construction of landfill supplementary works (administrative offices, scale booth, rainwater diversion works, etc.) and the first landfill cell with a 1.6 years life cycle.

Table 1.1 shows investments required for satisfactory performance of the proposed structures.

**TABLE 1.1 INFRASTRUCTURE PURCHASE AND SUBSTITUTION PROGRAM**

CUADRO 8.1 PROGRAMA DE ADQUISICIÓN Y SUSTITUCIÓN DE INFRAESTRUCTURA



**The service will have the following characteristics:**

- Three 8-hour operating shifts will be maintained.
- Each dispatched vehicle will make one trip per shift.
- Existing containers will be appropriately redistributed and located to provide service to colonias.
- Service will be provided by using 43 routes distributed along three shifts.
- In average, 18 vehicles with three employees each will be used at each shift.
- The utility expects to increase service coverage by 32%. This will result in 100% coverage for residential customers.
- Four routes for collection of containers in three shifts were designed.
- Within this period, the Public Sanitation General Directorate (DGLP) must implement a preventive and corrective maintenance program for all available infrastructures.
- Training courses at least once a year for operating personnel have been proposed for the following areas:
  - Appropriate use of collection vehicles
  - Safety measures
  - Customer service
  - Quality of service

### ***Short-term (1999-2001)***

#### ***Investments***

- By the end of the planning period, a total of 16 collection vehicles will be purchased, and 17 will be retired.
- Collection units will increase from 19 at the beginning of 1999 to 20 by the year 2001. This represents 11% more installed capacity, compared with the previous period.
- By the year 2000, the existing lift trucks will be retired, and a new unit will have to be purchased. Two vehicles and two container washers will be maintained during the planning period.
- 10 containers will be purchased. 8 containers will be retired. At the end, there will be 81 containers in service.
- The training program will continue, although less frequently than the previous phase. New components will be added:
  - Courses:
    - Supervision
    - Administration
    - Customer service
  - Quality sensitization program
- Individuals responsible for vehicle maintenance will receive refresher and training courses as often as operating personnel.
- Mechanical equipment and containers will receive preventive and corrective maintenance.
- The second landfill cell will be built.

### ***Mid-term (2002-2007)***

Service coverage will continue at 100%. Considering the projected population increase, the following actions will have to be taken during this period:

#### ***Investments***

- The number of collection vehicles will increase from 20 –at the end of the previous period— to 26. A 30% increase (see Table 1.1)
- 2 lift trucks will be replaced
- Containers:
  - 77 will be purchased
  - 72 will be retired. At the end, 68 containers and 2 container washers will be available.
- Training courses for DGLP personnel, including mechanics, will continue
- Preventive and corrective maintenance will continue to be implemented
- The third and fourth landfill cells will be built.

### ***Long-term (2008-2013)***

This phase covers the last six years of the planning period. Strategies implemented in previous phases must be continued to guarantee that service is provided to residential and special sources, and the downtown area.

### ***Investments***

- 32 collection units will be purchased and 26 units will be retired.
- Two lift trucks and 2 container washers will be purchased
- 79 containers will be purchased; 73 containers will be retired. This is a 6% increase compared to the end of the previous period
- The fifth landfill cell will be built
- Continue with:
  - Training courses for DGLP personnel, including mechanics
  - Preventive and corrective maintenance programs.

Tasks proposed for the *Sanitary Landfill Final Project* are included in the Schedule of Events for the construction and operation of the Matamoros Sanitary Landfill (Chapter 3 of this document).

## **CHAPTER II**

### **2.1 Human Health and Environment**

The project will provide an opportunity to solve pollution and health problems that affect not only Matamoros but also Brownsville, Texas. Some of the most outstanding problems are: air pollution due to constant fires generated at existing landfills, pollution of surface and ground water (by leachates) that supply various economic activities, elimination of harmful fauna such as flies, mosquitoes, rats, cockroaches, and other pests that are harmful for public health and produce diseases such as typhoid fever, salmonellosis, infants' diarrhea, dengue, dysentery, and others. (Attachment 2: Identification of Environmental Impacts).

The corresponding environmental assessment (Attachment 2) shows that the project's effects are mostly positive, because it will prevent the proliferation of illegal dumpsites and therefore, the generation of harmful fauna, potential transmission of diseases, and air, water and soil pollution, in addition to improving the aesthetics of the place.

### **2.2 Compliance with Applicable Regulations.**

The project considered applicable regulations (NOM-083-ECOL-1996) for the selection of final disposal sites for municipal solid waste.

The main technical elements considered were as follows:

- ☑ Distance from waste source areas.
- ☑ Land property
- ☑ Site's area and life cycle
- ☑ Topography
- ☑ Surface water and groundwater
- ☑ Soil
- ☑ Geology
- ☑ Material banks for backfilling
- ☑ Vegetation and wildlife
- ☑ Access to site
- ☑ Use of land
- ☑ Climate

It must be noted that at the present time, sanitary landfills may be built and operated on sites that do not comply with 100% of the requirements established by current regulations. However, under such circumstances, engineering measures must be taken to ensure that the environment is not negatively impacted, or if impacts exist, that these are minimal. Clearly, the cost of these actions elevates the sites' construction and operating costs.

In the case of the site selected for the sanitary landfill, the following conclusions were drawn:

1. Minimum distance from airports: 3000 m when turbine engine planes are used; 1500 m when piston engine planes are used. The "Servando Canales" International Airport is located 1.5 km from the projected sanitary landfill. The main problem associated with locating solid waste management facilities close to an airport is the presence of birds attracted by solid waste.

*The project proposes controlling this factor with the use of noise-generating devices.*

2. Respect the right of way for highways, railroads, main roads or farm-to-market roads. Not applicable. No roads exist within or close to the project's influence area.
3. Disposal sites must not be located within protected natural areas. The project is not located within any protected natural area.
4. Respect right of ways of federal public projects, such as oil, gas and other pipe lines, electric power towers, aqueducts, etc. No projects of this nature are located within the area.
5. It must be at least 1500 m (fifteen hundred meters) away from the limits of the urban area that will be served, as well as from rural communities with up to 2500 residents. If this restriction will not be complied with, proof of no impacts to such communities must be submitted. The closest town is located more than 2 km away from the selected site.
6. Municipal solid waste final disposal sites for communities of up to 50,000 residents, or those that receive 30 tons of waste per day, must be located considering only the specifications contained in the Geological Aspects and Hydrogeological Aspects

sections of the Official Mexican Norm. The project has been designed to service a larger population, and has a 350 tons/day capacity. As such, all basic studies required have been considered.

7. The site must be located outside of 100-year flood areas. If this condition will not be met, it must be proved that obstructions of the flow in the flood area, or the possibility of mudslides or erosion that can cause solid waste to be washed out will not exist. An artificial drain that conveys water runs 100 m away from one of the sides of the facility.
8. Municipal solid waste final disposal sites must not be located in swamps, tidelands, or similar areas. The selected site is located outside these types of areas.
9. The distance between the site and surface water bodies with continuous volume of flow must be at least 1000 m (one thousand meters). The site must have a buffer zone able to retain the peak volume of rainfall occurred within the last 10 years in the basin, defined by the area's peripheral canals. The project's design has peripheral canals to collect and appropriately convey natural runoff from outside the project area. Additionally, the closest water body, the "La Palangana" lagoon, is located 1 km away in a straight line.
10. It must be at least 60 m (sixty meters) away from active faults with displacements within the last one million years. No active faults are located within the region.
11. It must be located outside areas where slopes are unstable, i.e. where they can produce ground or rock movements due to static and dynamic processes. The area's topography is relatively flat. As such, no slopes that might generate risks related to mass movements exist.
12. Avoid areas where differential settlements exist or may be generated, causing ground faults or fractures, increasing thus the risk of polluting the aquifer. No sign of such settlements exists. No record of the existence of the above phenomena exists.
13. If the municipal solid waste final disposal site is located over fractured formations, ensure that there is no natural connection with aquifers, and that the infiltration transit factor (f) is  $<3 \times 10^{-10} \text{ s}^{-1}$ . The selected site is not located over fractured materials.
14. If the municipal solid waste final disposal site is located over granular materials, ensure that the infiltration transit factor (f) is  $<3 \times 10^{-10} \text{ s}^{-1}$ . The type of soil in the area is composed of waterproof clay. Its estimated infiltration transit factor (f) is:  $2 \times 10^{-8} / \text{s} < \text{to allowance}$ .
15. The minimum distance from the site to operating and abandoned water wells for household, industrial, irrigation and cattleraising purposes, must be a horizontal projection distance of at least 100 m (one hundred meters) from the largest circumference of the cone of depression. Whenever the resulting distance is less than 500 m (five hundred meters), the latter will be the distance that must be observed. The area does not have any wells for drinking water extraction or other similar purposes. Water demands are met by using Rio Grande water.
16. When potential contamination of surface and groundwater bodies exists, engineering solutions must be implemented. Although the nature of the soil allows for the construction of the sanitary landfill, water tables are shallow -1.5 to 2 meters-. As such, the base will have to be waterproofed with synthetic materials.

An Environmental Impact Statement has been submitted to Tamaulipas' *Secretaría de Ecología* officials and their authorization was issued on October 17, 1998. In addition, the final design has been reviewed by SEDESOL's Solid Waste Department, and the corresponding technical opinion has been issued by this agency.

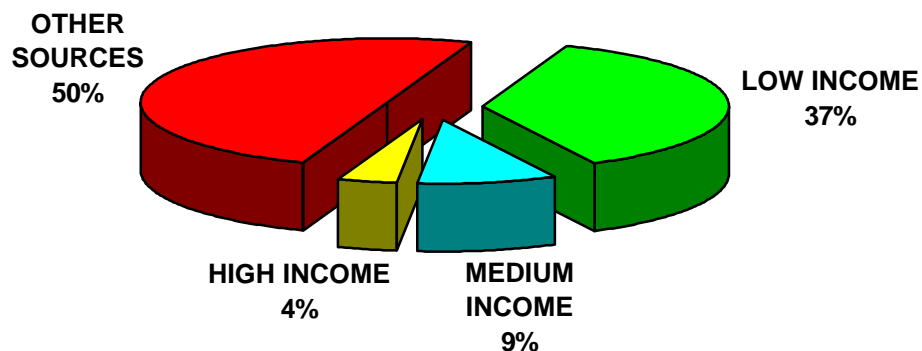
### CHAPTER III

#### 3.1. TECHNICAL FEASIBILITY

##### 3.1.1 Current Status

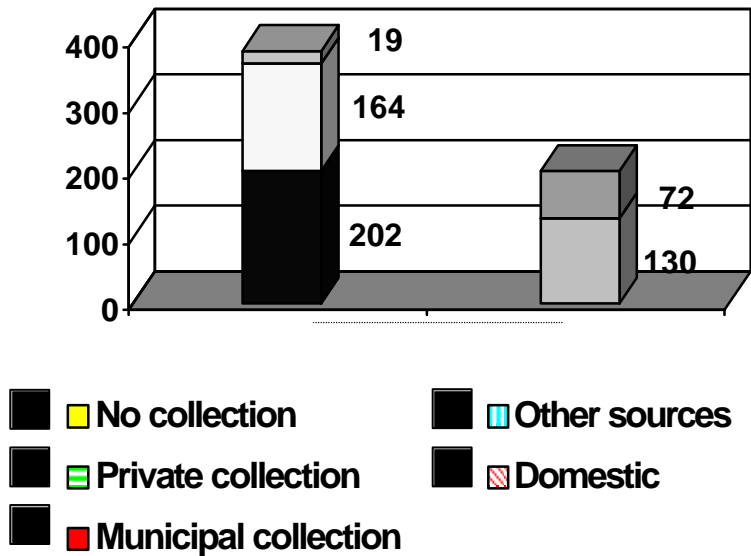
Matamoros currently generates 385 tons of municipal waste per day. Of these, 50% is residential waste and the rest is generated at businesses and industries (see Figure 3.1).

**FIGURE 3.1. SOLID WASTE GENERATION BY TYPE OF SOURCE**



The city collects 202 tons of the total amount of waste generated each day. Of these, 130 tons are residential wastes, while 72 tons are from other sources. Additionally, *carretoneros* and others collect 164 tons/day, while 19 tons remain at public streets and vacant lots (see Figure 3.2).

**FIGURE 3.2. MUNICIPAL SOLID WASTE COLLECTION**

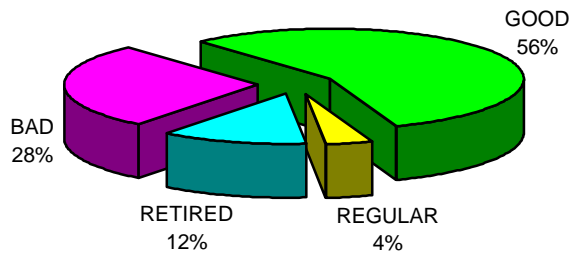


To provide waste collection services, the city has established 90 collection routes divided in three shifts: the first shift operates from 6:00 to 14:00 hours; the second from 14:00 to 21.30 hours, and the third shift from 21:30 to 6:00 hours. Most of the routes are not covered satisfactorily due to problems such as:

- Collectors are unaware of which areas must be covered by each route
- Different collection vehicles converge in the same route
- Rotation of drivers and partners
- Trucks fill up before completing their route
- Trucks frequently get stalled in damaged roadways
- Work schedule differs from areas to be covered
- Trucks divert and lose time selling by-products

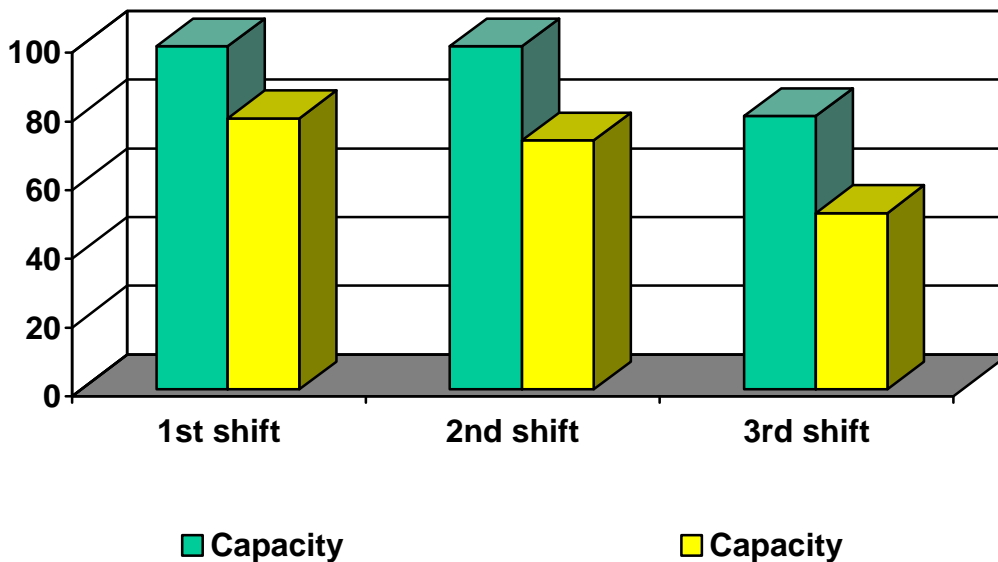
DGLP has 25 collection trucks that are 12 years old each in average. Of these, only 15 can be used at the present time, since the rest of the fleet is in bad conditions (December, 1997; see Figure 3.3.).

**FIGURE 3.3. COLLECTION TRUCKS' OPERATING CONDITIONS**



Due to problems associated with collection, trucks are used at 59% of their installed capacity in average. This significantly decreases service efficiency and increases operating costs (see Figure 3.4).

**FIGURE 3.4. COLLECTION EQUIPMENT EFFICIENCY RATE**



Final disposal of waste is done at two sites authorized by the city. Disposal is at open dumpsites and lacks the necessary controls to prevent environmental and public health impacts. In 1997, the city initiated the construction of a landfill to dispose of waste generated in a sanitary fashion.

The 33 ha. municipal dumpsite has operated as such for over 15 years. It is located 9 km south of Matamoros.

The second dumpsite is a topographic depression located southeast of the city, next to Colonia Cavazos Lerma. This 1-hectare depression is known as *Pozo Abelardo de la Torre*, and presents the same sanitary conditions as the main dumpsite, in addition to permanent flooding at its lowest part.

There are also 13 illegal dumpsites that *carretoneros* use to dispose of the waste they collect.

At this time Matamoros faces the following problems related with inadequate solid waste management:

1. Proliferation of illegal dump sites.
2. Air pollution caused by indiscriminate garbage burning at the municipal dumpsite, which has generated serious operation problems for the “Servando Canales” International Airport.
3. Generation and propagation of odors resulting from the degradation of organic material exposed to the environment.
4. Generation of gases (biogas) with characteristics that can negatively affect the health of dumpsite workers and residents of adjacent colonias.
5. Potential contamination of surface and ground water due to shallow water table levels.
6. Dispersion of waste into areas adjacent to the dumpsite, affecting the aesthetics of the area.
7. Margination of scavengers who separate by-products inside the dump (*pepenadores*).
8. Spread of gastrointestinal diseases caused by vectors originated at existing disposal sites.

## *3.2 Proposal for Operating Design*

### *3.2.1 Introduction*

Two alternatives were evaluated to address the solid waste management problem. The first alternative considers an initial investment to purchase the equipment needed to address current collection needs. The second option proposes gradually replacing equipment during the first five years of operation. As such, coverage level would increase with time.

Both options suggest storage, collection, and sweeping methods that improve current operating conditions by optimizing the use of existing infrastructure and implementing micro and macro-routing methods. Additionally, both alternatives consider building a sanitary landfill and purchasing equipment. The corresponding investment figures are reflected in the financial evaluation model.

### *3.2.2 Storage*

The project proposes to continue using 200-liter drums currently positioned at public places and markets. It has been determined that their capacity is sufficient to address waste collection demands from Monday to Friday. However, on weekends and/or holidays, mobile containers will be assigned to collect excess waste generated by visitors.

For the **Treviño Zapata Market** the project intends to continue using ten existing 200-liter drums. Larger containers cannot be installed in the market because of space limitations. In addition, the place does not permit collection truck access.

For this market, it has been estimated that the maximum amount of waste in 15 years will be 270.5 kg/day. The current storage system can address future demands with its 554 kg/day capacity. Collection frequency will be 7/7 (seven days per week) to ensure quality of the collection service.

The **Barrientos Market** has two 2.7 m<sup>3</sup> containers. This storage capacity meets current (274 kg/day) and future (430 kg/day) demands. Collection frequency will continue at 7/7.

The **Mercado de Artesanías** (Arts and Crafts Market) will continue using five 200-liter drums to meet current and future demands. Collection will be done twice per day, Monday through Sunday, because the market is located in the downtown area.

In all cases, drum and container clean up and maintenance actions will be a basic requirement for the provision of collection services. This will be the basis for a good use and users' acceptance. As such, personnel training courses and a strict supervision and control system have been considered.

Sweeping, collection, treatment and final disposal processes were divided in four phases along the project's planning period, as shown below.

PHASES	TERM	PERIOD
1 <sup>st</sup> Phase	Immediate Future	1998
2 <sup>nd</sup> Phase	Short-term	1999 - 2001
3 <sup>rd</sup> Phase	Mid-term	2002 - 2007
4 <sup>th</sup> Phase	Long-term	2008 - 2013

### 3.3.3. Sweeping

The proposed method seeks to increase coverage, going from the present 66 km/day to 120 km/day by the end of the planning period. In addition, the project proposes the implementation of mechanical sweeping to cover 80 km/day in main streets and avenues.

The above will result in a total 444% service increase during the project's planning period, compared to the current situation. For this purpose, 40% of all sweeping activities will have to be technology-based.

Sweeping actions to be implemented along the project's phases are as follows:

### ***1<sup>st</sup> Phase.- Immediate Future, Sweeping***

Continue using morning and afternoon shifts to provide manual sweeping services, and consider mechanical sweeping during the night shift. At this time, 72 sweepers (employees) and 3 machine operators are available.

The following summarizes the goal proposed for the immediate future:

- Repair and use the city's available sweeping machines.
- Purchase 12 carts, which represents a total 20% increase with respect to the existing 60 carts.
- Cover 180 km/day with manual sweeping. In addition, achieve a 1.5 km per sweeper efficiency rate.
- Use the three sweeping machines to cover 80 km/day.

To achieve the above goals, the following actions are proposed for this phase:

Develop a Routing Study and provide employees training courses to make them aware of the importance of providing a good quality service, and;

Develop a Times & Movements study to promote the elimination of work defects.

A \$500,000 pesos investment has been considered for the development of studies and training courses, in addition to \$52,500 pesos to purchase garbage carts. This phase includes preventive maintenance programs for carts and sweeping machines.

### ***2<sup>nd</sup> Phase.- Short-Term, Sweeping***

The same operating shifts will continue during this phase to maintain efficiency rates achieved at the Immediate Future phase (1.5 km/shift/sweeper and 23 km/shift/sweeping machine). Within this framework, the following modifications and goals are proposed for this period:

- Within this period, 13 carts will be purchased to substitute existing carts and increase installed capacity to 73 carts.
- Hire 1 sweeper to address the increased number of carts.
- Replace sweeping machines in the second and third years to eliminate existing machines that have concluded their life cycle.
- By the end of the period, 176 km/shift/day will be covered.

Within this period the project will consolidate personnel training courses, Routing Studies, and Times & Movements studies. These will be offered at least three times each year to maintain service efficiency.

A total of \$800,000 pesos will be invested during this period to develop studies and train personnel. In addition, \$48,500 pesos will be invested in equipment. As with training, preventive maintenance programs will be consolidated during this phase.

### ***3<sup>rd</sup> Phase.- Mid-Term, Sweeping***

This phase will continue with the same operating shifts to maintain efficiency rates achieved during the Immediate Future phase (1.5 km/shift/sweeper and 23 km/shift/sweeping machine). Within this framework, the following modifications and goals are proposed for this period:

- At this phase, 76 carts will be purchased to substitute existing carts and increase installed capacity from 73 to 76.
- Hire 3 sweepers to address the increased number of carts.
- Replace 1 sweeping machine by the next-to-last year of the period.
- By the end of this phase, 176 km/shift/day will be covered.

Personnel training courses, Routing Studies, and Times & Movements studies will be offered at least once per year to maintain service efficiency.

\$1.6 million pesos will be invested in studies and personnel training during this period. A total of \$2.3 million pesos will be used to purchase equipment.

### ***4<sup>th</sup> Phase.- Long-Term, Sweeping***

The previous operating practices will be continued. In addition, efficiency rates will be maintained.

- Continue using three sweeping machines to provide daily service at the third shift. These will cover a total of 80 km/day. Equipment purchased in previous years will be replaced by the years 2008 and 2013.
- Garbage carts will increase from 76 to 80. This represents a 5% increase within this period, to substitute a total of 80 carts. Four new sweepers will be hired.
- By the end of this phase, 200 km of paved roadways will be swept each day.

The project considers a \$1.6 million pesos investment for studies and training during this phase, in addition to \$ 2.3 million for equipment. Sweeping machines will be purchased with funds accumulated from the depreciation of existing equipment. This period is characterized by an efficient, quality service.

#### ***3.3.4 Collection***

For this process, the project proposes the primary use of sidewalk collection methods, collection at corners in special areas, and containers at peripheral and difficult access areas. In the short term, residential collection coverage will increase from 68 to 100%

with the purchase of equipment and an increased efficiency at all routes, in addition to increased collection truck capacity (5.15 to 5.35 ton/trip).

Significant results may be achieved by redefining routes to optimize collection trips. Preventive and corrective maintenance programs for equipment and infrastructure need to be established. In addition, an equipment and vehicle replacement system is required.

The following are collection actions proposed for the different phases of the project:

### ***1<sup>st</sup> Phase.- Immediate Future, Collection***

The current operating fashion will be redefined to make an efficient use of existing infrastructure, purchase equipment, and start operating at 100% coverage. This will result from redefining collection routes and introducing the service in unserved areas. To achieve these goals, the following investments are proposed:

- Purchase 4 collection vehicles with 15 m<sup>3</sup> capacity..
- Rehabilitate 3 existing vehicles.
- Purchase one lift truck and two container washers.
- Purchase 11 size 12 metal containers with 2.7 m<sup>3</sup> capacity.
- Rehabilitate 8 containers.

During this period, three 8-hour operating shifts will be used. Sixteen trucks will provide collection services to residential areas. Two of the rehabilitated vehicles will collect wastes from businesses, offices and other special sources (hospitals, jail, schools, etc.)

Additionally, a rehabilitated vehicle will be used to support special services, ensuring thus total collection coverage.

Five sectors with 4 routes will be included to collect containers at some of the peripheral colonias, in addition to containers located at public areas. These sectors will have collection every day (7/7) to address the needs of 10% of the total population.

A supervision program will be used to oversee collection routes and evaluate the collection service performance and punctuality. Times & Movement methods will be implemented. In addition, the project will assess if the assigned capacity corresponds to waste generated at the different areas.

At this phase, training courses for an appropriate use of collection vehicles will be established, in addition to safety and service quality measures. Micro-routing studies will be developed to optimize collection routes. Preventive maintenance programs will be implemented.

A total of 500,000 pesos will be invested at this phase to develop studies and personnel training. 3.2 million pesos will be used to purchase equipment, while equipment rehabilitation will require 450,000 pesos.

### ***2<sup>nd</sup> Phase.- Short-Term, Collection***

Within this period, 17 collection vehicles, one lift trucks and 8 containers will be retired. They will be substituted by a larger number of new units with more capacity.

The number of collection vehicles will show a small increase, from 19 in early 1999 to 20 by the end of a two year period: an 11% increase in installed capacity compared to the previous period.

Existing container lifting equipment will be eliminated by the year 2000, and new units will have to be purchased. Two vehicles and container washers will be maintained throughout the whole period.

The utility will continue and increase the frequency of its training program. New courses will be added for supervisory and administrative personnel.

Maintenance programs will be reinforced, especially preventive maintenance programs. Coordination with suppliers will be encouraged for this purpose.

During this period, \$800,000 pesos will be invested to develop studies and train personnel. A total of \$9.8 million pesos will be used to purchase equipment, while \$115,000 pesos will be spent in equipment rehabilitation.

### ***3<sup>rd</sup> Phase.- Mid-Term, Collection***

Service coverage will remain at 100% during this period. The number of containers will grow from 20 at the end of the previous period to 26 by the end of the present phase. This represents a 30% increase. Additionally, 2 ;of the lift trucks will be replaced.

77 containers will be purchased, and 72 will be eliminated. By the end of this period, the utility will have 86 containers and 2 container washers.

Training courses will continue to be offered to personnel, including mechanics.

Preventive maintenance programs will be enhanced, and corrective actions will be emphasized.

During this period, 1.6 million pesos will be invested in the development of studies and personnel training. A total of 16.1 million pesos will be invested in equipment, and 241,000 pesos will be used for equipment rehabilitation.

This period is characterized by an efficient, quality service.

#### ***4<sup>th</sup> Phase.- Long-Term, Collection***

This phase covers the last six years of the planning period. Strategies implemented in previous years must be continued at this stage, since their purpose is to ensure 100% coverage.

31 collection units will be purchased to increase the total from 26 to 32 vehicles. This represents a 23% increase in installed capacity.

26 units will be retired, and two lift trucks will be purchased during this period.

79 containers will be purchased, and 7 will be retired. This will represent a 6% increase compared with the end of the previous period. Two container-washers will be purchased.

Personnel training courses will be permanent, as well as preventive and corrective maintenance programs. Corrective maintenance will be occasional.

During this phase, \$1.6 million pesos will be invested for the development of studies and personnel training courses. A total of 420.6 million pesos will be used to purchase equipment, while \$14,000 pesos will be invested in rehabilitating equipment.

#### ***3.3.5 Treatment***

This strategy proposes activities needed to reduce the amount of waste by promoting waste reduction at sources along a 15-year period.

For this purpose, the composition, physical and chemical characteristics of wastes generated at the different sources will be analyzed to select the most appropriate treatment for each type of waste.

Additionally, wastes with potential for profitable recycling will be identified, and the corresponding market studies will be developed.

Guidelines for the implementation of waste minimization and separation at the source programs for households, businesses and industries, will be established.

The following solid waste treatment actions will be implemented at the different project phases:

#### ***1<sup>st</sup> Phase.- Immediate Future, Treatment***

No treatment actions have been considered, since the utility will emphasize operating process improvements to increase its efficiency.

## ***2<sup>nd</sup> Phase.- Short-Term, Treatment***

Detailed studies will be developed to identify the composition and physical and chemical characteristics of wastes at their source.

An inventory of sources by amount, type and characteristics of waste will be developed.

Potential for waste salvaging will be defined. Marketing studies will be developed. Technical and financial feasibility studies will be prepared to define the most appropriate method: waste salvaging, recycling, reuse, trituration, compacting, composting, separation, etc.

Public awareness campaigns will be designed and implemented to promote waste reduction at households, businesses and industries.

## ***3<sup>rd</sup> Phase.- Mid-Term, Treatment***

The most technically and financially feasible treatment method(s) will be designed and implemented.

Public awareness campaigns will be reinforced to successfully implement the project. Participation of academic institutions, chambers of commerce, etc., will be promoted.

Assistance from the youth will be sought to promote campaigns and implement programs as a community service.

## ***4<sup>th</sup> Phase.- Long-Term, Treatment***

Selected methods will be periodically evaluated. New options to reduce waste and/or apply treatments will be identified and evaluated.

### ***3.3.6 Final disposal***

For final disposal of waste, the project proposes the construction of a sanitary landfill. This method does not cause any nuisance or hazard to public health or safety. Its operation and post-operation phases do not harm the environment. Engineering principles will be used to confine waste to the smallest possible area, and dirt will be applied and compacted to reduce the landfill's volume. In addition, this method will prevent potential problems caused by liquids and gases produced at the landfill as a result of organic material degradation.

The construction of the landfill has been divided in five phases, with their respective operating process.

The total area will be 42 ha. Of these, 8.4 ha will be used as a buffer zone and 33.6 ha will be used for confinement. The landfill's lifetime has been estimated at 10.3 years. Approximately 1.7 million tons of waste will be sent to disposal, as shown in Table 3.1.

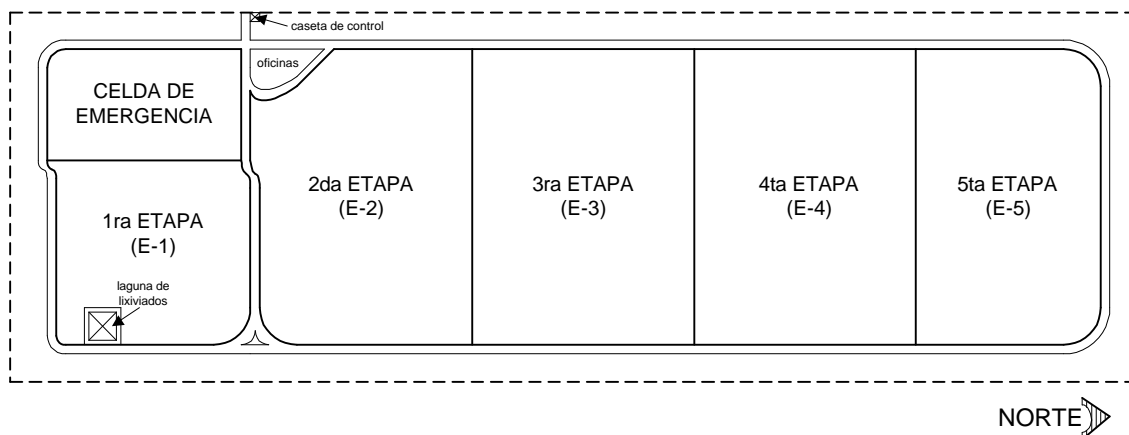
**TABLE 3.1. WASTE FOR DISPOSAL IN PROJECT AREA**

PHASES	Area (ha)	Waste for disposal ton / phase
Emergency cell	2.15	117,342
E-1	3.57	210,441
E-2	6.8	377,689
E-3	6.9	383,733
E-4	7.1	395,831
E-5	6.7	371,650
Total	33.2	1,856,686

The proposed site will be divided in five sections, which represent each of the landfill's construction and operation phases, and have been identified as follows: E-1, E-2, E-3, E-4 and E-5; in addition to the emergency cell. The 2.15 ha emergency cell is currently operating and has an estimated 9-month life cycle. The project has considered including it as an emergency cell; however, since it shows flooding problems, the necessary infrastructure has been designed to remove accumulated water.

Attachment 3 includes construction and operation programs for the Matamoros Sanitary Landfill. Figure 3.5 shows the location of each of the areas.

**TABLE 3.5. SOLID WASTE DISPOSAL PHASES**



***1<sup>st</sup> Phase.- Immediate Future, Final Disposal***

This phase includes the construction of the first cell (E-1) and conditioning the emergency cell with all equipment needed to pump up accumulated water. Additionally, the project includes the construction of supplementary works.

These actions will reflect a \$5.7 million pesos investment in infrastructure, and \$8.2 million pesos to purchase equipment to operate the landfill. \$250,000 pesos will be spent in training courses. In subsequent phases only \$100,000 pesos will be earmarked for this activity.

### ***2<sup>nd</sup> Phase.- Short-Term, Final Disposal***

In the project's first year, disposal of waste at the E-1 cell will be formally initiated. Its operating cost has been estimated at 5.7 million pesos. These costs include management, operation, financing, supervision and environmental monitoring.

By the end of this year, construction of the second cell (E-2) will be initiated. Its total estimated cost is \$3.9 million pesos, and its life cycle will be approximately 2 years. Approximately 377,689 tons of waste will be deposited in this cell, which will be closed by the end of this period.

During the last three months of this phase, construction of the third landfill cell will be initiated. Cost of the third cell will be similar to the second one.

### ***3<sup>rd</sup> Phase.- Mid-Term, Final Disposal***

The third cell's life cycle will end, and two more cells (E-4 and E-5) will be built during this period. By the end of this phase, the last cell will have only one year of operation left.

Investments and operating costs will be similar to those of the other cells.

### ***4<sup>th</sup> Phase.- Long-Term, Final Disposal***

This phase concludes the operation of the fifth cell and completes the project's life cycle. As such, the sanitary landfill will be closed, and post-closure activities will be implemented.

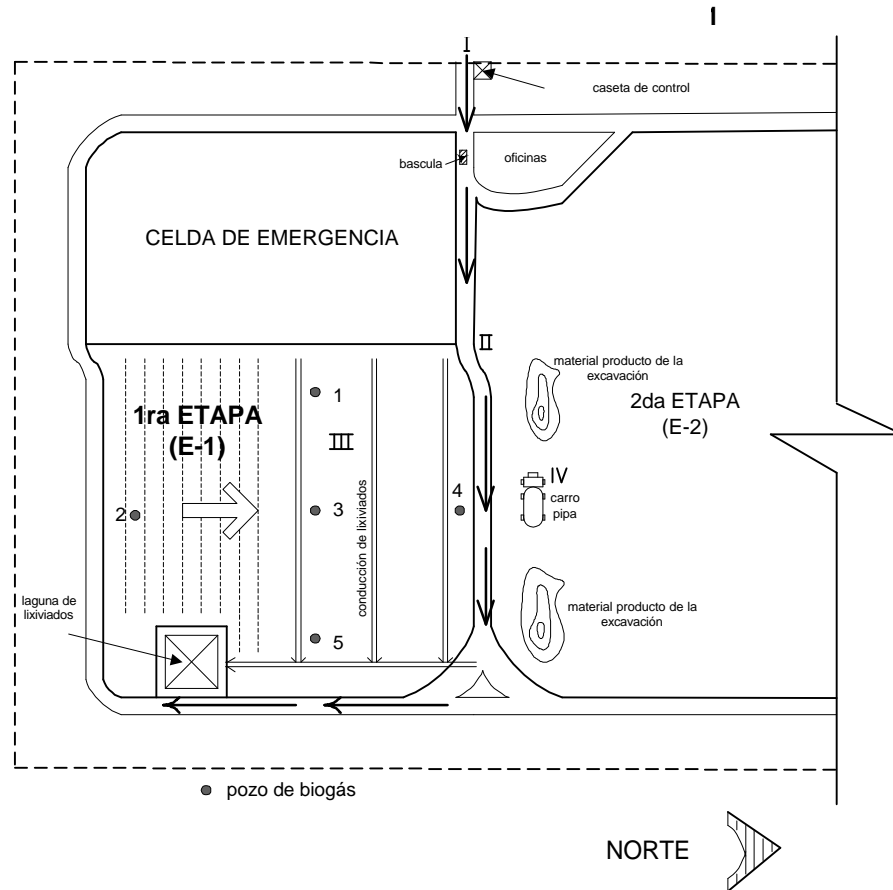
The following paragraphs describe activities considered for the sanitary landfill's planning period.

## **1) START-UP OPERATION PLAN**

The first phase of the project and construction of supplementary works have been considered for this phase. Within this period, wastes will be deposited in the existing

cell, which will be supplied with pumping equipment. Figure 3.6 shows preparations for the first phase.

**FIGURE 3.6. CELL PREPARATION AT PHASE - 1**



Construction of this cell includes:

### 1.1 Roughdressing

The area must be cleared by cutting a 0.10 to 0.20 m thick layer of vegetal material on the ground. Aside from cutting natural vegetation, these operations include piling up the material for treatment.

This activity must be developed in phases, starting at the Southeast end, and downstream, going South to North, to prevent the absence of vegetal material from forming quagmires during the rainy season.

### 1.2 Land Movement

Since the region's groundwater level is very shallow (1.30 to 1.60m), a 0.70 m cut will have to be made, in addition to the 10 cm. used for roughdressing. This activity will be

developed in 2-month periods because preparing the whole area at a time is not convenient, since rain may cause the area to flood and/or silt up as a result of landslides or mudslides.

### *1.3 Land Preparation*

After excavation, the soil must be compacted. This is a mechanical aimed at improving surface resistance, compression and deformation stress characteristics, in such a way that the land performs appropriately since the beginning of the project.

The surface will be compacted to 95% of its maximum dry volumetric weight (MDVW) by adding water as needed to achieve such percentage. The standard Proctor test will be used to determine MDVW.

### *1.4 Impermeabilization with Geomembrane*

After compacting, pit or macrocell slopes will be smoothed out, and the cell will be waterproofed with a geomembrane (high-density 1.0-mm polyethylene) that will be anchored in trenches dug at the top and foot of each slope.

The sanitary landfill will be waterproofed by combining materials. According to the geotechnical study, a 30 m. thick quasi-impervious clay material layer is present at the -2m average level ( $K=1 \times 10^{-9}$  cm/sec.).

## **2) CONTINGENCY PLAN**

### *2.1 Operation during Rain Season*

Problems associated with rains may be solved by implementing the following recommendations:

- An accessible area specially prepared for this type of season must be available. Preparation will consist of reinforcing the area with either demolition material or hardpan, so vehicles can circulate without getting stuck.
- Due to the muddiness of soil, use of the emergency cell is highly recommended during rainy seasons.
- Continuous maintenance for drainage facilities must be implemented. In addition, structures needed for rainwater and leachate drainage must be built.
- Continuous maintenance to interior access roads, since they are significantly deteriorated during this season.

### *2.2 Fire Prevention*

At least 450 m<sup>3</sup> of reserve material should be available for fire prevention. This material will be used to cover a 100 x 15 m, 0.30 thick area.

### *2.3 Control of Harmful Fauna*

Permanent fumigation programs will be implemented.

### *2.4 Hurricane and Tropical Storm Response Program*

Due to the site's geographic conditions, the following measures must be considered for its construction and operation:

- I. Constantly watch weather reports provided by official media.
- II. If a weather phenomenon is approaching, final disposal activities must be postponed. For this purpose, an agreement must be reached with the corresponding authorities to stop collection until further notice.
- III. The site must be kept closed and under strict supervision. Vehicles with waste materials should not be allowed to enter the premises. Vehicles may be parked in a waiting area or yard, and waste in vehicles must be covered with tarpaulins.
- IV. Protection must be provided for facilities such as the scale, power plant, pumping system, biogas collection pits, leachate lagoons, monitoring wells, and other monitoring equipment. For this purpose, anchored tarpaulins or some other type of protection must be used.
- V. Apply greater compacting force to confined waste at daytime, passing the caterpillar tractor or waste compactor more than four times during the day.
- VI. Cover solid waste received during the day and other uncovered waste with a thicker layer (0.60 m is suggested).
- VII. When the machinery is not in use, it must be moved away from the work area and protected under the shed to prevent breakage and jamming that would require machines to be towed or moved by other means.
- VIII. Burners at the biogas system must be put off to prevent sparkles from landing in flammable material or fuel and causing a fire in adjacent areas.
- IX. Gather all unconfined materials such as covering and construction material, etc., to prevent them from being blown away and getting lost, and to avoid a reduction in volume.
- X. Desilt evaporation lagoons and rainwater drainage canals to prevent obstructions that can cause liquid flooding. Priority must be given to leachate lagoons.
- XI. It is important to reforest finished slopes as they are covered, to prevent cover material from eroding or washing away, especially when major rains or hurricanes occur.
- XII. In the administrative area, doors and windows must be protected with plywood or some other type of covering to prevent window breaking and damages to furniture and other objects within the area.
- XIII. Maintain only a 10 people squad and a resident in the area to assist with prevention activities.

## **3) SAFETY PLAN**

### *3.1 Leachate Monitoring Wells*

To ensure that groundwater is free from leachate contamination, the project considers installing two monitoring wells.

### *3.2 Biogas Monitoring*

A biogas emission sampling program will be established to determine its composition, flow and potential for explosion.

### *3.3 Suspended Particles*

Air at the work area will be sampled to determine the concentration of total suspended particles and viable particles.

### *3.4 Protective Cover*

A layer of vegetal soil will be applied to prevent surface sliding and erosion.

### *3.5 Weather Conditions*

Weather conditions will be monitored by checking records from the meteorological station closest to the landfill, and the National Meteorological Service. These parameters will be checked daily during the operation period, and weekly when the project's lifetime is completed.

### *3.6 Access Roads*

Since the main access road is a dirt road, the project proposes irrigation with treated wastewater.

### *3.7 Vehicle Access Control and Weighing*

Entrance of vehicles and individuals will be controlled. Vehicles transporting hazardous waste will be prevented from entering the facility.

### *3.8 Vehicle Parking and Unloading*

The person in charge of the work site will indicate places where collection or other vehicles must unload. Drivers must be guided by attendants when moving and parking vehicles. Attendants will be strategically distributed throughout the work site.

Considering vehicle types and unloading time, two sections will be used for unloading activities: one for slow-unload and the other for quick-unload vehicles.

### *3.9 Sign System*

The sanitary landfill must have a traffic control system and safety and hygiene signs to facilitate operations and prevent accidents. Signs must be placed so as to be visible at distance.

### 3.10 Site Restoration

The site will be restored after the solid waste management facility is closed. Restoration will include activities aimed at supervising conditions related to the landfill's closure.

## 4) QUALITY ASSURANCE PLAN

The operation of the sanitary landfill as an integral part of the solid waste management system poses a series of economic and social challenges that include the development of timely, adequate and inexpensive management, control and coverage activities to control waste generated in Matamoros every day.

To operate the Matamoros sanitary landfill, the project considers:

### 4.1 Daily Cell

Considerations for operation of the daily cell are:

- \* Volumetric weight must be 0.85 ton / m<sup>3</sup>.
- \* Number of vehicles at peak time will be 10.
- \* Cell height must be 3 m.
- \* The daily cell must have a truncated cone shape with a 3:1 slope
- \* Thickness of the covering material layer must be 0.20 m.
- \* Maximum unloading time will be 10 minutes.

### 4.2 Cover Material

The cover material will be taken from the same area during the first three phases. The fifth phase will require material imported from banks. The project suggests the use of material extracted from La Palangana Lagoon or other similar sources.

### 4.3 Landfill's Volume Requirements

Volume requirements for the sanitary landfill were based on waste generation projections and defined volumetric weights. Quality assurance requires the implementation of permanent monitoring of the site's topography.

Table 3.2 shows an estimation of required volume and landfill's lifecycle.

**TABLE 3.2. REQUIRED VOLUME AND LIFECYCLE OF THE LANDFILL**

		Volume to be	No. cells,	Waste for	
--	--	--------------	------------	-----------	--

Phases	Area (ha)	used (m <sup>3</sup> )	including cover material	disposal ton / phase	Life Cycle (Years)
Emergency cell	2.15	146,678	nd	117,342	0.76
E-1	3.57	263,052	434	210,441	1.19
E-2	6.8	472,112	779	377,689	2.13
E-3	6.9	479,666	792	383,733	2.17
E-4	7.1	494,789	816	395,831	2.24
E-5	6.7	464,562	767	371,650	2.10
Total	33.2	2,320,859	3588	1,856,686	10.33

From the above calculations, it can be observed that the site has a 10.33 years lifecycle and enough capacity to receive 1,856,686 tons of waste.

## 5) POLLUTION PREVENTION PLAN

### 5.1 Leachate Control

Liquids will be conveyed to the evaporation lagoon. For this purpose, PVC parallel piping will be laid on the excavation. The system will work with gravity to convey liquids to a lift station that will pump them to the evaporation lagoon, where the corresponding screening may be performed for characterization.

Impermeabilization will be applied to the base and walls of the leachate lagoon. For this purpose, high-density polyethylene geomembrane will be anchored to the surface of a peripheral trench.

### 5.2 Biogas Control

Passive systems will be used. Wells will be approximately 100 m. apart. As such, it has been determined that the number of wells required for the area is 40. Five wells will be installed during the 1<sup>st</sup> and 2<sup>nd</sup> phases, and 5 wells will be installed during the 3<sup>rd</sup> and 5<sup>th</sup> phases. To prevent air pollution, final disposal of gas will be made using a gas burner.

### 5.3 Wastewater

A septic tank will be available in the back of the administrative area. This structure will house an anaerobic treatment system. Treated water will be conveyed to the east for irrigation of green areas at the buffer zone.

## 6) CLOSURE AND POST CLOSURE PLANS

### 6.1 Closure

For closure at the end of the planning period, the following elements will be considered:

- ◆ Final seal
- ◆ Vegetal layer
- ◆ Forestation

## 6.2 Post-Closure

The goal of this phase is to maintain and control physical conditions to obtain a stable area that can be used for a specific purpose. As such, the project includes the implementation of the following components:

- Maintenance and Control Program for:
  - Drainage
  - Erosion
  - Final cover
  - Roads
  - Green areas
  - Facilities
- Emergency Response Plan
- Training for maintenance personnel
- Monitoring programs for:
  - Surface water
  - Ground water
  - Biogas
  - Leachates

## CHAPTER IV

### 4.1 Financial Feasibility and Project Management

#### 4.1.1 Financial Historical Information

In 1997, the public sanitation utility budget was \$9.4 million pesos, 49% of which was spent on payment of wages, and 35% was used to pay for fuel, materials, and services. Table 4.1 presents expenditures for the 1993-1997 period –current values--.

**TABLE 4.1. HISTORICAL EXPENDITURE LEVELS BY THE UTILITY (1993 – 1997)**

Line Item	1993	1994	1995	1996	1997
Wages	3 847 499	3 503 638	3 691 233	3 883 442	4 623 627
Repairs and maintenance	511 277	635 281	1 433 360	695 017	325 115
Fuel and oil	509 701	675 795	1 201 764	1 916 493	1 758 618
Materials and services	528 610	801 939	1 305 970	1 169 484	1 698 384

Machinery and equipment rental	140 360	136 125	346 225	315 010	912 193
Other	140 488	94 366	90 980	32 594	93 236
<b>Total</b>	<b>5 677 937</b>	<b>5 847 146</b>	<b>8 069 535</b>	<b>8 012 041</b>	<b>9 411 176</b>

For comparison purposes, the above table was updated using January 1998 prices. Numbers were modified using monthly averages and comparing the baseline year to January 1998. Data was obtained from the *Indice Nacional de Precios al Consumidor* [National Consumer Price Index] published by the Bank of Mexico. The following are annual inflation rates for each period: 1993:8.01%; 1994:7.05%; 1995:51.97%; 1996:27.7%; 1997:15.72%; January, 1998:2.17%.

As such, it can be determined that during the 1993-1997 period, Matamoros earmarked over 57 million pesos (historical number accumulated at constant values) from its budget for solid waste management. The last two years have seen a budget reduction (Table 4.2)

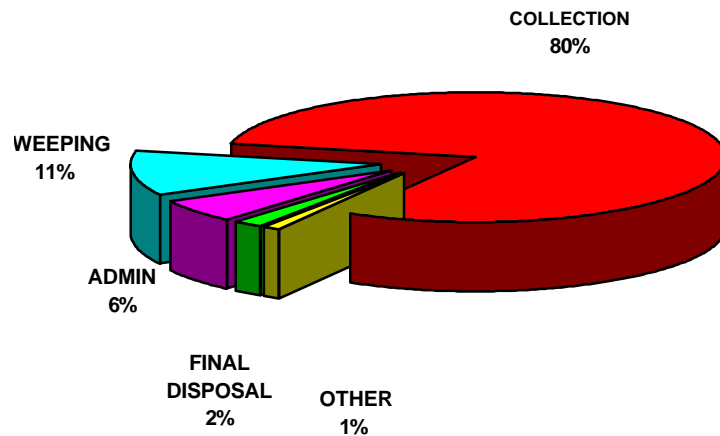
**TABLE 4.2. HISTORICAL EXPENDITURE LEVELS BY THE UTILITY (1993 – 1997)  
CONSTANT PESOS TO JANUARY 1998\***

Line Item	1993	1994	1995	1996	1997
Wages	8'029,959	7'055,761	6'124,614	5'065,825	4'887,271
Repairs and maintenance	1'067,066	1'279,353	2'378,277	906,627	343,653
Fuel and oil	1'063,776	1'360,942	1'994,006	2'500,003	1'858,896
Materials and services	1'103,241	1'614,976	2'166,908	1'525,554	1'795,227
Machinery and equipment rental	292,940	274,134	574,468	410,920	964,207
Other	293,207	190,038	150,957	42,518	98,552
<b>Total</b>	<b>11'850,188</b>	<b>11'775,203</b>	<b>13'389,230</b>	<b>10'451,448</b>	<b>9'947,807</b>

\* Numbers updated to January 1998, based on the National Consumer Price Index published by the Bank of Mexico,

The collection process takes up 80% of all the utility's income, while final disposal process expenditures are only 2% of the total income. This can be explained by the fact that an open dumpsite was used at the time (Figure 4.1).

**FIGURE 4.1. SERVICE PROCESS EXPENDITURES - 1997**



The city of Matamoros has undertaken various actions aimed at increasing the collection system's efficiency and disposing of waste in a sanitary manner. Proposed actions attempt to solve problems in a comprehensive manner. As such, investments need to be made in equipment, infrastructure and personnel training areas.

The total amount to be invested for the 4 project phases is \$142,798,700.00 pesos, at July 1998 prices, including Value Added Tax.

Based on studies developed, the project proposes a \$21,194,500.00 initial investment (1<sup>st</sup> Phase: 1998) –VAT not included--. The amount will be distributed as shown in Table 4.3.

**TABLE 4.3. INVESTMENTS REQUIRED AT YEAR ZERO OF THE PROJECT (Phase I, 1998).**

TASK	TYPE OF INVESTMENT	INV. IN PESOS
SWEEPING	Studies	500,000
	Equipment	52,500
	Subtotal	552,500
COLLECTION	Studies	500,000
	Equipment	3,274,000
	Equipment rehabilitation	450,000
	Subtotal	4,224,000
FINAL DISPOSAL	Studies	650,000
	Infrastructure	5,717,500
	Equipment	8,234,500
	Subtotal	14,602,000
GENERAL SERVICES	Studies	100,000
	Equipment	466,000
	Subtotal	566,000

DECENTRALIZATION OF THE UTILITY	Institutional Capacity Building Program	1,250,000
	Subtotal	1,250,000
	<b>T O T A L</b>	

Four 20 yd<sup>3</sup>, eleven 2.7 m<sup>3</sup>, two container washers and one lift truck will be purchased to enhance the collection service. Investments for general equipment relate to computers and radio communication equipment. The first will be used to support the utility's commercial operation, and the latter for supervision activities.

Studies for the project's first phase constitute 14% of the total amount. A breakdown of costs is presented in Table 4.4.

**TABLE 4.4. COST OF STUDIES REQUIRED AT YEAR ZERO OF THE PROJECT  
(Phase I, 1998).**

TASK	TYPE OF INVESTMENT	INV. IN PESOS
SWEEPING	Micro-routing	350,000
	Times and Movements	100,000
	Training	50,000
	Subtotal	500,000
COLLECTION	Micro-routing	350,000
	Training	150,000
	Subtotal	500,000
FINAL DISPOSAL	Final design	650,000
	Subtotal	650,000
GENERAL SERVICES	Awareness Campaigns	100,000
	Subtotal	100,000
	DECENTRALIZATION OF THE UTILITY	Institutional Capacity Building Program
Subtotal		1,250,000
<b>T O T A L</b>		3,000,000

The project proposes decentralizing the utility to create the necessary conditions to implement a marketing system and train personnel. A list of waste generating sources will be developed to achieve an efficient fee collection system. It has been estimated that this Organizational Development process will take 6 months, assuming the suggestion that the process be initiated at least 3 months before the project start-up date is observed.

Table 4.5 presents the Schedule of Events.

**TABLE 4.5. UTILITY'S DECENTRALIZATION  
SCHEDULE OF EVENTS**

ITEM	MONTH1	MONTH2	MONTH3	MONTH4	MONTH5	MONTH6
Procedure Manual						
Computer System						
Adjustments to regulations						
Decentralization process						
Basic Training						
Start-up						
Control Program						

Table 4.6 shows final disposal infrastructure and equipment investments required for Phase I.

**TABLE 4.6. FINAL DISPOSAL INVESTMENTS, PHASE I**

INFRASTRUCTURE	INV. IN PESOS
Purchase land	722,500
Form cells	1,130,000
Waterproofing	2,115,000
Leachate system	130,000
Monitoring and biogas wells	10,000
Peripheral roads and drain	470,000
Office, booth, shed	1,000,000
Scale	140,000
<b>T O T A L</b>	<b>5,717,500</b>

EQUIPMENT	INV. IN PESOS
Lift truck	1,284,000
Compactor	3,798,500
D7 Tractor	2,786,000
Tank truck	366,000
<b>T O T A L</b>	<b>8,234,500</b>

Studies, training, equipment and infrastructure are being considered for the project's planning period. These will be funded by internal cash flow. Table 4.7 shows a summary of investments for the project's last three phases (See Table c, Attachment 4).

**TABLE 4.7. SUMMARY OF INVESTMENTS FOR LAST 3 PHASES OF PROJECT  
(JULY 1998 PRICES)**

ITEM	INVESTMENT IN PESOS
<b>PHASE 2. Studies, equipment, and infrastructure. 1999-2001</b>	<b>17,616,500</b>
Sweeping and collection	10,651,500
Disposal and General Services	4,990,000
Studies	1,975,000
Contingency 0%	
<b>PHASE 3. Studies, equipment and infrastructure. 2002 - 2007</b>	<b>49,105,000</b>
Sweeping and collection	20,138,000
Disposal and General Services	24,017,000
Studies	4,950,000
Contingency 0%	
<b>PHASE 4. Studies, equipment and infrastructure. 2008 - 2013</b>	<b>41,901,000</b>
Sweeping and collection	24,011,000
Disposal and General Services	13,690,000
Studies	4,200,000
Contingency 0%	

The total amount to be invested for the 4 project phases is \$142,798,700.00 pesos, at July 1998 prices (Value Added Tax not included).

Funds for Phase I investments will be obtained from a \$8,954,500.00 pesos NADB loan (42% of investments), and assistance in the amount of \$2,350,000 (11%) from the Institutional Development Program (IDP). These numbers will be subject to NADB analysis, based on eligible activities. SEDESOL will contribute 3.6 million pesos –the total amount will be used for building the Sanitary Landfill--. The BECC provided the final design cost (\$650,000), and the remaining investment will be paid up by the City (Table 4.8).

**TABLE 4.8. PROJECT'S FINANCIAL STRUCTURE**

SOURCE	CONTRIBUTION IN THOUSAND PESOS	%

Grants (SEDESOL)	3,673.60	17.3
BECC	650.00	10
CITY	5,566.40	24
NADB - Loan	8,954.50	3
NADB - IDP	2,350.00	12
TOTAL	21,194,500	50

To date, construction of the sanitary landfill's Phase I has been funded as follows: The City provided \$1,135,722 pesos and land with an estimated \$722,500 pesos commercial value –40 he. Area-. In addition, \$1,703,600 in grants has been provided by SEDESOL. These line items are part of the project's financial structure shown in the above table.

As such, funds and funding sources for the project's Phase I are presented in Tables 4.9, 4.10, and 4.11, based on the importance of investment amounts:

**TABLE 4.9. EQUIPMENT FUNDING SOURCES**  
**(Phase I, 1998) NUMBERS IN MEXICAN PESOS**

EQUIPMENT	CITY	NADB	TOTAL
15 Sweeping carts	52,500		52,500
3 Truck rehabilitation	450,000		450,000
4 New trucks	1,800,000	600,000	2,400,000
11 Containers	154,000		154,000
2 Container-washer vehicles	600,000		600,000
1 Container lifting equipment		120,000	120,000
1 Charger on tires		1,284,000	1,284,000
1 Compactor		3,798,500	3,798,500
1 D7 Tractor		2,786,000	2,786,000
1 Tank truck		366,000	366,000
2 Pick-up trucks	210,000		210,000
30 Portable radios	21,000		21,000
9 Computers	225,000		225,000
1 Fixed radio communication unit	10,000		10,000
TOTAL	3,522,500	8,954,500	12,477,000

**TABLE 4.10. INFRASTRUCTURE FUNDING SOURCES**  
**(Phase I, 1998) NUMBERS IN MEXICAN PESOS**

INFRASTRUCTURE	CITY	SEDESOL	TOTAL
Land	722,500		722,500
Cell-formation	400,000	730,000	1,130,000
Impermeabilization	531,400	1,583,600	2,115,000
Leachate control		130,000	130,000

Biogas and monitoring wells		10,000	10,000
Peripheric road and drain		470,000	470,000
Office, booth and shed	250,000	750,000	1,000,000
Scale	140,000		140,000
<b>TOTAL</b>	<b>2,043,900</b>	<b>3,673,600</b>	<b>5,717,500</b>

**TABLE 4.11. FUNDING FOR STUDIES  
(Phase I, 1998) NUMBERS IN MEXICAN PESOS**

<b>STUDIES</b>	<b>NADB</b>	<b>BECC</b>	<b>TOTAL</b>
Sweeping	500,000		500,000
Collection	500,000		500,000
Final Disposal		650,000	650,000
General Services	100,000		100,000
Decentralization of the utility	1,250,000		1,250,000
<b>TOTAL</b>	<b>2,350,000</b>	<b>650,000</b>	<b>3,000,000</b>

The city has considered implementing a user fee system to recover the investment. Revenues resulting from the implementation of such policy will be used to cover operating expenses, training costs, equipment purchases, and infrastructure to meet growing service demands, as well as replacement of malfunctioning equipment. The utility will maintain reserve amounts for debt service coverage and operation and maintenance. In addition, revenues will help finance awareness campaigns and establish an environmental protection Trust Fund.

The purpose of awareness campaigns is to encourage payment of user fees, in addition to promoting environmental education. The result will be more participation by the community to solve solid waste related problems. The project considers spending an annual 5% from revenues during the first two years of operation. Later, the rate will be reduced annually by 1%, until it reaches a 2% rate. The rate will remain as such until the end of the planning period.

In addition, the environmental protection Trust Fund will be employed for remediation of the final disposal site, post-closure environmental monitoring, equipment, infrastructure, and operation viability improvements, whenever the utility has any financial problems. The Trust was determined to be 4% of operating costs, and remained constant during the planning period.

As such, investments at Phases 2, 3 and 4, will be funded by the utility's revenue, as shown in the cash flow (Table D, Attachment 4).

To service the debt, annual payments of \$ 2,896,453.00 will be made during the 10-year planning period. The upper part of Table B (Attachment 4) shows the proposed amortization of the loan. Calculations were made using a 30% interest rate that includes an actual 10% rate as suggested by NADB. The nominal rate was calculated by

estimating an 18% annual inflation rate, based on actual inflation rates for the first seven months in 1998 and projected values to December 1998. Then, the Fisher theorem was used to calculate the effective rate.

Revenue from collection of user fees is projected to be \$23,901,650.00 during the first year of operation. This amount will be distributed as follows:

**TABLE 4.12. ESTIMATED REVENUE FROM USER FEES DURING FIRST YEAR OF OPERATION (1999)**

SOURCE	FEE\$/MONTH	No. HOUSEHOLDS/ESTABLISHMENTS	INCOME \$/YEAR *
High income households	45	6,945	1,312,529
Medium income households	28	17,361	2,041,712
Low income households	17	45,140	3,222,988
Hotels	304	54	137,894
Restaurants	304	719	1,836,038
Stores	286	4,825	11,591,580
Markets	811	3	20,437
Industries	608	732	3,738,470
<b>Total</b>			<b>23,901,650</b>

Income projections for domestic sources were obtained by assuming that the billing/collection rate would be 35% during the first two years of operation. The assumption was that this rate will increase 5% annually until it reaches 60% in the year 2005. This level will be maintained until the end of the period. This consideration was based on the following major assumptions: 1) Residents are not used to paying for this type of service, and collection will face some resistance and, 2) since the utility does not have an updated generators list, billing and collection will be only partial.

For other sources, a 70% rate was defined for the first two years. As with the above consideration, the project assumes a 5% increase to reach 95%. This level will be maintained until the end of the planning period. This assumption was based on the fact that the city has established agreements for payment of user fees by Commerce and Industry Chambers and Associations. The response to this action has been positive.

For calculation of fees, the unit cost per ton was obtained and multiplied by the per capita income for the different levels. In addition, the fee was ranked using weight factors. The purpose was to obtain a crossed subsidy to assist the most economically challenged areas –see Table E, Attachment 4--. It must be noted that final fees will be defined when funding sources allocate funds to the project.

A transition fund has been proposed to ensure the utility’s proper operation and maintenance until it has sufficient capacity and strength to meet its obligations. For the first year, the fund will be \$9,411,176.00 pesos, which will be contributed by the city. This amount is equal to the 1997 budget (current values) earmarked to provide this service. It must also be noted that during the first seven years of operation, funds will be

constantly reduced by 15%, taking the last year's value as a baseline. This funding may be reduced, increased or extended later, based on the utility's operation and efficiency. Table 4.13 presents the direction of such funds.

**TABLE 4.13. TRANSITION FUNDS FOR THE PROJECT'S  
FIRST 7 YEARS**

ITEM	1999	2000	2001	2002	2003	2004	2005
Transition funds	9,411,176	7,999,500	6,799,575	5,779,638	4,912,693	4,175,789	3,549,420

Based on proposed fees and transition funds, it has been estimated that net revenues for the first year (1999) will be \$33,312,826.00. Table B (Attachment 4) presents revenue projections by waste-generating source. Fees must be updated at least once per year, based on the National Consumer Price Index by the Bank of Mexico.

The project's O&M cost analysis includes both historical costs and costs associated with the use of new infrastructure. As such, costs will be a total \$26,452,469.00 pesos, distributed as shown in Table 4.14. The proforma income statement (Table A, Attachment 4) includes a summary of income and operating cost projections for the duration of the planning period.

**TABLE 4.6. ESTIMATED EXPENDITURES DURING  
FIRST YEAR OF OPERATION**

TYPE OF EXPENDITURE	COST \$/YEAR
Personnel	6,775,448
Operation	4,780,423
Maintenance	1,551,433
Environmental supervision	250,000
Administrative	2,096,173
Debt Service	2,896,453
Reserve for equipment replacement and renewal	5,688,316
Awareness Campaigns	1,680,225
Trust Fund	733,999
<b>Total</b>	<b>\$26,452,469</b>

Additionally, the project proposes the creation of a debt service reserve equal to 25% of the debt service requirements. The project also proposes setting up an O&M reserve equal to 45 days/year of O&M costs, starting the second year. Considering these

reserves as part of the costs, total expenditures from the second year of operation will be \$29,691,286.00 pesos, distributed as shown in Table 4.15.

**TABLE 4.15. ESTIMATED EXPENDITURES, CONSIDERING RESERVES FROM THE SECOND YEAR OF OPERATION.**

TYPE OF COST	COST \$/YEAR
Cost of service with no reserve	27,078,682
Debt service reserve	724,113
Operation and maintenance reserve	1,888,491
<b>T o t a l with reserves</b>	<b>\$29,691,286</b>

Annual debt service coverage was calculated using the following procedure: a) total income minus operation and maintenance total costs, divided by b) the total amount resulting from the addition of all capital and interests. The result meets BECC and NADB requirements, as shown in the lower portion of Table A (Attachment 4).

The financial break-even point was determined by calculating the project's Net Present Value. For this purpose, a 12% annual discount rate recommended by the World Bank for this type of projects was applied. Profitability was evaluated by comparing initial investments against net operating flow for a 15-year period. As such, the NPV will be \$2,617,698.00, which is the total benefit resulting from the project.

Proposed fees are the lowest possible under the assumptions made. Adding a single peso to the lowest income level (most sensitive users) would result in a negative impact. Additionally, the project's Internal Return Rate was calculated at 16.3%, which reflects the project's overall profitability. Indicators show this profitability allows the project to meet debt obligations. Table D (Attachment 4) shows the cash flow.

For the evaluation, values remained constant along the project's planning period, with the exception of population growth rates (2.5% annual), waste generation (1% annual), households and businesses (1% annual), industries (2% annual), the reduction in the city's transition funding, collection factors, and awareness campaigns rates mentioned above.

Additionally, a fee sensitivity analysis was performed. Results show a +/- 10% variation in fees presented in this document. This analysis was based on the following variations: 1) NADB's loan interest rate, 2) operation and maintenance costs, and 3) the city's investment recovery rate. Results of the analysis are included in Attachment 4.

## **4.2. Economic and Demographic Information of the Proposed Service Area**

### **4.2.1 Population.**

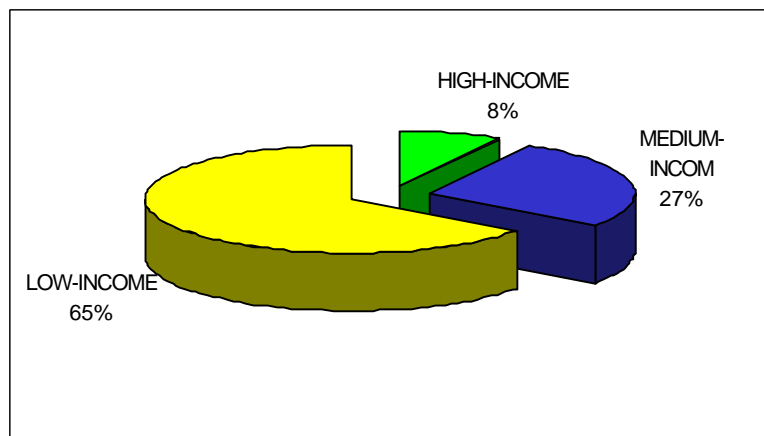
The *Resultados definitivos del conteo de población y vivienda 1995 del INEGI* [Final 1995 Population and Housing Census Results], report 363,236 residents in the municipality, which is 14.4% of the total population in the state. Of these, 49% are males (178,769) and the remainder are females (184,467). Population density was estimated at 108.37 res/km<sup>2</sup>.

Matamoros has the largest concentration (89.12%) in the municipality, with 323,749 residents.

#### 4.2.2 Income Levels

The high-income level represents the lowest percentage of the population. This level is easy to identify because of its geographic location. The other two levels commingle in most of the subdivisions. Low-income level areas can be clearly identified in the outskirts. These represent approximately 65% of the population (Figure 4.2)

**FIGURE 4.2. INCOME LEVEL DISTRIBUTION**



#### 4.2.3 Economically Active Population

According to the *Anuario Estadístico del Estado de Tamaulipas* [State of Tamaulipas Statistical Annual Report], the city's economically active population (EAP) represents 59.9% of the total population. Table 4.7 presents the corresponding distribution.

In addition, the employment rate is 96.1%. As such, the overall unemployment rate is 3.9%.

**TABLE 4.7. EAP DISTRIBUTION BY ACTIVITY**

Major Economic Activities in the Area		%
<b>Agriculture, cattle-raising, forestry, hunting, and fishing</b>		2.0
<b>Industry</b>	<b>Extraction and electrical</b>	0.4
	<b>Transformation</b>	31.9
<b>Construction</b>		6.8
<b>Trade</b>		17.5
<b>Services</b>		31.5
<b>Communication and transportation</b>		4.0
<b>Government</b>		2.8
<b>Employed in the United States</b>		3.1

Source: *Anuario Estadístico, INEGI, 1997*

With regard to income, a major part of the economically active population earns 2 to 5 times the minimum wage. Table 4.8 shows income levels as distributed in the urban area.

**TABLE 4.8. INCOME LEVELS IN THE URBAN AREA**

Minimum wage	Yearly average (%)
<b>Less than 1</b>	8.8
<b>1 to 2</b>	30.6
<b>More than 2, up to 5</b>	40.9
<b>More than 5</b>	16.7
<b>No income</b>	1.7
<b>Not specified</b>	1.3
<b>Total</b>	100

Source: *Anuario Estadístico, INEGI, 1997*

According to this information, 40.9% of the population earns 2 to 5 times the minimum wage. The World Bank's recommendation in the sense that user fees should not exceed 5% of each household's income has been considered; therefore, user fees comply with this suggestion. Table 4.8 shows that at least 60% of residents receive \$2,000.00 pesos/month. 2.5% of this amount is \$50.00 pesos, a figure that is higher than user fees proposed by the project (see Table 4.5).

#### 4.2.4 Marginality Rate

The city's marginality rate has been characterized as very low -1.666-, according to social and economic indexes published by the *Consejo Nacional de Población* (CONAPO, 1990) [National Population Council].

Due to its location and particular characteristics, Matamoros has become an industrial city, and as such, industries have become a major employment source. To date, the Municipal Development Plan includes two areas designated for *Industrial Use*, where construction of more infrastructures has been projected.

Population growth derived from industrial expansion –particularly maquiladoras—is due largely to the amount of immigrants who arrive from other Mexican states. However, the 1990 census estimated that over 73% of the residents were natives of Tamaulipas and the rest were from other states. The South and Southeast areas have shown the highest growth rate, in spite of the fact that a large part of these areas is subject to flooding.

### **4.3 Project Management**

#### **4.3.1 Institutional Capacity Building**

The project proposes the creation of a utility that can operate with its own capital. Administrative, operating and financial autonomy is sought through the implementation of an investment recovery system appropriate for Matamoros.

The main institutional capacity building goal is to immediately increase service quality and efficiency, develop a strategic plan for solid waste management, and continue mid-term and long-term plans and programs. The project proposes taking a more professional approach by providing permanent personnel training. This approach proposes to break the three-year municipal management scheme, and create and maintain learning curves in the long term. As such, this vision is expected to be an important point to support the establishment of a Civil Service Career that results in better quality service and work program continuity.

Additionally, the project intends to optimize operating costs, develop process specialization, and maintain preventive programs for equipment and infrastructure.

The project intends to promote public participation by involving citizens in decision-making processes and the solution of sanitation problems.

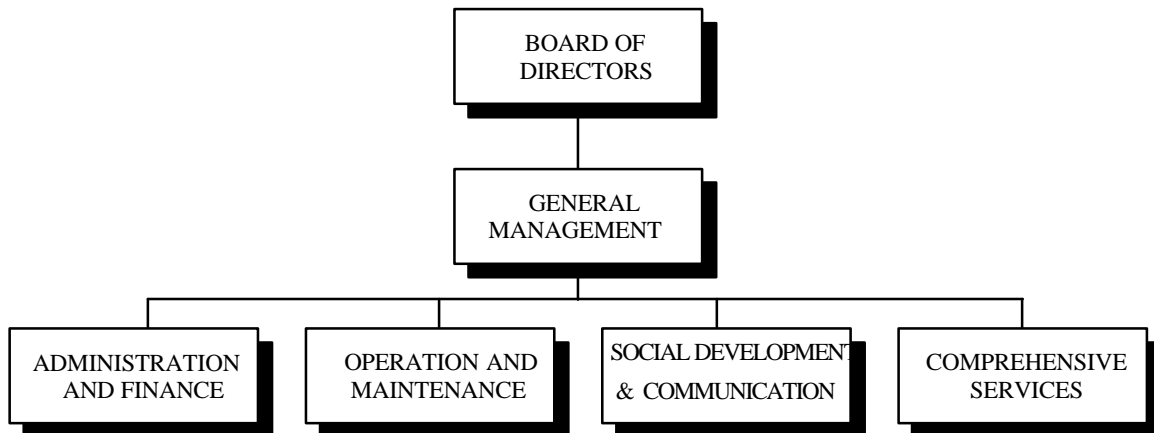
With this approach, the city seeks to enhance and upgrade its administrative structure to gain organizational and functional support. This implies strengthening the municipal institution.

To respond to this challenge, the city needs to assume the project's responsibility, with the sole purpose of enhancing the residents' quality of life.

#### **4.3.2 Organizational Structure**

The project proposes decentralizing the service by creating a utility with a structure that differs from the city management. The following figure presents the proposed organizational model.

**FIGURE 4.3 ORGANIZATIONAL STRUCTURE PROPOSED FOR THE UTILITY**



General duties of each of the areas are described in the following paragraphs:

#### BOARD OF DIRECTORS

- I. Develop the Municipal Solid Waste Strategic Plan in coordination with technicians in charge and considering residents' demands. The plan must agree with policies and criteria established by the corresponding by federal, state and municipal agencies.
- II. Establish the basis for the involvement of the social and private sectors in the analysis of city problems and solutions.

#### GENERAL MANAGEMENT

- I. Issue and follow up the Solid Waste Strategic Plan approved by the Board of Directors.
- II. Support the utility's balanced growth.
- III. Establish guidelines to appropriately manage material, financial, human and technological resources with the purpose of making all utility activities effective and efficient.
- IV. Coordinate the different departments to promote homogeneous procedures that respond to the utility's needs.

#### ADMINISTRATION AND FINANCE DEPARTMENT

- I. Plan and manage the utility's human, material and financial resources.

- II. Establish administrative policies and procedures needed to achieve the utility's goals.

#### OPERATION AND MAINTENANCE DEPARTMENT

- I. Oversee that waste sweeping, collection, transference and final disposal processes adhere to operation and maintenance procedures aimed at providing good quality service.
- II. Manage resources assigned to the department.
- III. Evaluate the department's managerial information system.

#### SOCIAL DEVELOPMENT AND COMMUNICATION DEPARTMENT

- I. Coordinate and implement a customer service system through the establishment of modern communication mechanisms.
- II. Coordinate and follow up programs developed for marginal groups related to the waste collection service.

#### COMPREHENSIVE SERVICES DEPARTMENT

- I. Improve and consolidate the sanitation service through adequate planning at the city level.
- II. Promote and implement an efficient supervision and surveillance system.

### **4.3.3 Legal Framework**

The Political Constitution of the United States of Mexico establishes that municipalities are responsible for providing sanitation services in coordination with the state. In the case of Matamoros, the State's Political Constitution ratifies such provision, which is upheld by the State Ecological Balance and Environmental Protection Law. General conditions for the provision of waste collection services are established in the *Bando de Policía y Buen Gobierno*, and specific conditions are contained in the *Reglamento de Limpia Municipal*.

However, these regulations omit some important aspects related to customer service, payment of user fees, inspection and surveillance, fiscal incentives, waste generation, and pollution prevention. As such, the city has proposed a revised set of rules that covers existing gaps and will be reviewed for approval by the City Council.

With regard to user fees, Budget Regulations do not allow the city to collect such fees, so a bill is being prepared to allow this activity.

Regulations that govern the municipal administration allow the decentralization of the public sanitation system, and provide for the creation of a Public Utility to manage solid waste.

The city is in the process of implementing these ideas by carrying out the following actions:

- Submit proposals to the City Council for consideration.
- Promote State Congress approval.
- Publication in the Mexican Official Register

Attachment 1 shows a complete analysis of applicable regulations reviewed.

#### **4.3.4 Legal Capacity to Undertake Financial Obligations**

The city is sponsoring the project, and has legal power and capital of its own. This puts the city in a position to undertake financial obligations and become a long-term debtor. In addition, the city has authority to use its capital as financial guarantee. For larger projects, the state and the federal level contribute to these obligations.

## **CHAPTER V**

### **5.1 COMMUNITY PARTICIPATION**

#### **5.1.1 Comprehensive Community Participation Plan**

For the development of this section, city officials used the **Guide for compliance with Public Participation Criteria Requirements** provided by the BECC, which describes the goals of the *public participation program*, discusses the Citizens' Committee and public meetings, and the communication and outreach programs. As such, the public will become involved in the development and implementation phases of the project.

The following is a summary of the **Minutes of the Committee's creation meeting**, which had participation from BECC staff members.

#### *Summary of Meetings to establish the Citizens' Committee*

On April 2, 1998, a meeting that had BECC staff members and the ETEISA director as speakers was held at the City Hall auditorium. The first commentary was from Gonzalo Bravo (Public Participation Coordinator at the BECC), who explained the benefits of the project by emphasizing the importance of having a sanitary landfill to advance the quality of life for residents of this community.

Later, names of potential Committee members were suggested, and the committee's final composition was decided:

President	Dr. Carlos de León Landeros
Co-President	Ma. de La Luz Jiménez Aguilar
Executive Secretary	Elsa Astudillo de Guerra
Technical Liason	Ing. Juan José Montelongo Hernández

Three hours later the meeting was adjourned.

Two **public meetings** were held on Thursday, May 28, and June 12. The goal was to make the public aware of the benefits of the Comprehensive Project, specially the sanitary landfill. Meetings were organized by the *Citizens' Committee (Attachment 5)*.

### *Summary of Public Meetings*

Invitations (see Attachment 5) were prepared and posted days before each of the meetings. Invitations were sent to unions, clubs, schools of all levels, etc. Events took place at the Casamata Museum.

The goal was “to demonstrate that the technical, financial and environmental aspects of the comprehensive solid waste project proposed for BECC certification are understood by most of the community, and the public accepts the project’s benefits, costs, risks, and impacts.”

The Citizens’ Committee intends to achieve this goal by:

- Communicating and divulging the project’s characteristics, benefits, and impacts
- Notifying the public at area and public review meetings of the characteristics and importance of project tasks
- Promoting project tasks in the community

BECC staff and members of the consulting company that developed the comprehensive project attended both meetings and were guest speakers at them. Comments focused on explaining the public the goals of tasks developed to date, and benefits of the *Comprehensive Solid Waste Management Improvement Plan for Matamoros, Tamaulipas*.

Questions raised by the audience were promptly addressed, and all doubts were clarified. The following were some of the most important commitments adopted:

- Commitment to divulge project information in the media
- Make the best use of existing resources to consolidate the project
- Commitment to hold as many public meetings as necessary

Notwithstanding that two meetings had been conducted as required by BECC criteria, two additional meetings were held for reinforcement: the first meeting, in coordination with the Borderplex Environmental Information Center, was held on September 2,

1998. The second was on October 1, 1998. Public support for the project was corroborated at these meetings. Additionally, since information provided to the public at the June 12 meeting changed as the final design was developed, the applicant deemed convenient holding one last meeting, which took place on October 15, 1998. As such, the project is in full compliance of all BECC Community Participation criteria.

### **5.1.2 Report Documenting Public Support**

Matamoros City officials called citizens to assist in establishing the *Comprehensive Community Participation Plan*, which has been successfully developed. For this purpose, the city created a committee whose goal is to promote the project and its implementation.

As a result of such actions, local meetings have been held with the community to discuss the project's objectives, scope and benefits in the environmental, social, health and financial areas. Results of the meetings reflect that the public understands and largely supports the project's execution.

At the present time, officials are preparing a report that discusses community participation issues.

## **CHAPTER VI**

### **6.1 SUSTAINABLE DEVELOPMENT**

#### **6.1.1 Definition and Principles**

The project will be instrumental to developing an efficient and comprehensive solid waste management approach in Matamoros. The project intends to provide 100% waste collection coverage and prevent environmental and health impacts inherent to waste exposed to the elements. In addition, the project proposes a strategy to implement treatment methods at the source.

Another important part of the project is the design of a facility with all engineering structures needed to safely dispose of waste, and a project to close and sanitize the existing dumpsite.

#### **6.1.2 Institutional and Human Capacity Building**

The decentralized utility that has been proposed to manage the city's waste collection system must effectively use administrative mechanisms available to collect user fees and guarantee the utility's self-sufficiency.

With regard to employee training, a training program has been considered for all phases of the project. Training will be provided by means of courses for operators, administrative and maintenance personnel.

### **6.1.3 Conformance with Applicable Local and Regional Conservation and Development Plans**

The goal of the 1996-1998 Municipal Development Plan for Matamoros is to implement actions at the different sections of the city's administrative structure. Its ultimate target is the **dignity of the human being and comprehensive development of the city and its residents** (see document in attached folder).

For public sanitation, the plan intends to “**upgrade the non-hazardous solid waste collection, management and confinement system.**” The *Comprehensive Solid Waste Management Improvement Plan* fits perfectly into this framework by taking a new approach to the collection system's operation, proposing equipment needed to address city needs, and introducing the design of a safe facility for the final disposal of solid waste.

The solid waste management system proposed by the project uses modern technological elements that are appropriate for the specific needs of the city and meet the goals of the public sanitation plan.

### **6.1.4 Natural Resource Conservation**

This project achieves natural resource conservation by implementing a *Waste Treatment* strategy contained in the *Social Communication Program*, and prevents waste generated by the community from polluting and limiting the use, reclamation and conservation of other natural resources.

The *Waste Treatment* approach will be directed to major sources that dispose of a large amount of material that may be incorporated to other processes, reused, or even reduced (minimization). To define lines of action, a specific Inventory of Waste is required for the city.

For Social Development, a *Social Communication Program* was developed. The program intends to increase public awareness through the use of different media. Public will be made aware of the importance of being involved in reducing, reusing, and recycling waste generated at their households, and in maintaining public areas clean.

In addition, actions to develop a public environmental culture have been proposed: signs in walls and corners; campaigns in radio, newspaper and other local media.

The development of this project will prevent air pollution resulting from wastes burned at dumpsites, generation of foul odors, and toxic gases. The project will also help reduce

the risk of polluting surface and ground water bodies. Additionally, the propagation of vectors that affect public health and alter the landscape will be controlled.

### **6.1.5 Community Development**

The project results in tangible benefits for the community, such as:

- Garbage will be periodically collected
- Streets will remain clean
- No foul odors, harmful fauna, etc. will be generated
- Illegal dumpsites will be eliminated
- Encroached land will recover its commercial value
- There will be no garbage burning or scavenging at the final disposal site
- The city's appearance will be greatly improved
- A single monthly fee will be paid, avoiding thus the payment of large tips to garbage collectors in some residential or business areas
- The collection service will be more efficient and of greater quality
- A facility for safe disposal of waste will be available

With regard to the impact that closure of the existing dumpsite will have on *pepenadores*, who will not be allowed to enter the sanitary landfill, the **Social Development** strategy proposes programs focused on seeking alternative income sources for *pepenadores* and integrating them to different work groups.

### **6.2 Plan to Improve *Pepeadores*' Living Conditions**

The following paragraphs summarize the 3 programs aimed at improving living conditions for *pepenadores* [garbage scavengers] and promote their integration to society in a dignified and productive fashion. Each program is detailed in Chapter 10 of the *Comprehensive Solid Waste Management Improvement Plan's* Final Report.

#### **6.2.1 Three-Stage Basic Socialization and Training Program:**

The program will create conditions for a social and cultural transition of workers from the scavenging phase to collective work. The program includes contents and methods needed to promote a socialization process based on the development of abilities and skills that will allow scavengers to consider other employment alternatives and promote their participation in various society groups.

#### **6.2.2 By-Product Recovery and Selective Collection Program**

This program considers modifying by-product selection conditions. The program proposes a selective collection scheme that will involve *pepenadores* and certain demographic areas. The program includes two sub-programs:

##### **6.2.2.1 By-Product Recovery Subprogram**

The following are its immediate goals: streamline the selection of by-products, establish a cooperative approach to work, and adequately integrate a 20-person work group.

- This program has been designed to work over a 9 month period divided in three stages: design and condition the area (30 days); organize work (20 days); direct marketing (7 months).

#### **6.2.2.2 Selective Collection Subprogram**

The following are goals of this program:

- Create appropriate conditions and develop cooperative work schemes
- Collect more than \$100.00 worth of by-products per person on a daily basis
- Develop coordination mechanisms with other groups involved
- Select the social area to be addressed and design a collection program

#### **6.3 Integration to Work Groups**

Finally, this program will help *pepenadores* develop new abilities and skills that will allow them to have access to jobs other than selection of by-products.

As a first activity, volunteers with sufficient capacity to become part of the job market will be selected. For this purpose, the program must notify industries about the program, and seek their support and participation.

#### ***Agreement with Pepenadores***

It must be noted that city officials signed an agreement with the group of *pepenadores* working at the municipal dumpsite to provide them benefits and access to other employment sources, free medical treatment for individuals 60 years of age or older, uniforms, and scholarships for children in elementary school. In exchange, *pepenadores* agreed not to oppose to the development of a sanitary landfill. Attachment 7 includes a copy of this document.