- The break-even analysis showed that the transfer and transport system (composed by a Transfer Station of 570 tons/day and tractor-trailers of 65 $m^3$ capacities) is financially feasible compared to the conventional transport system executed by 12.2 $m^3$ or 15.3 $m^3$ compactor trucks.

- Consequently, the Transfer and Transport system composed by a Transfer Station of 570 tons/day and tractor-trailers of 65 $m^3$ capacities is recommended to be implemented for the Eastern Sector formed by Tocumen, Pacora, and San Martin.

**North**

- The previous censuses conducted in 2000 showed that this sector has experienced high population growth. However, there are explicit policies to discourage additional settlements in the area, e.g., Law 21 and Decree 205. If these policies are implemented stringently, then the population growth can be expected to be lower than the projected growth derived from the previous censuses.

- The break-even analysis showed that the proposed Transfer and Transport system which is composed of Roll-off/Roll-on trucks and 22.9 $m^3$ containers is not feasible if it is compared to compactor trucks of 12.2 $m^3$ and compactor trucks of 15.3 $m^3$ which are currently used in Quebrada Ancha and Chilibre Centro. Moreover, the current collection amount in the routes mentioned previously is only 7 tons/day.

- Consequently, it is not recommendable at this moment to introduce a Transfer and Transport system to service the North. However, an evaluation of the variables that lead to the former conclusion (population growth, enforcement of urban development regulations, etc.) should be done in the future in order to determine if there has been any change in this regard and to define the necessity of introducing a Transfer and Transport system.

### b. Outline of the Project of Transfer and Transport System in the East

#### b.1. Target Areas

The project of Transfer and Transport System in the East covers the following corregimientos.

- Tocumen
- Pacora
- San Martin

#### b.2. Examination of Design Conditions

Conditions that are important on planning and designing of the transfer and transport system are population forecast and city planning in the target area. These issues were fully discussed in the previous section, a. Consideration of Necessity of Transfer and Transport System.

It should be noted that there is large difference between estimated required capacity of the transfer and transport system and actual waste collection amount. Based on the population forecast in year 2002, the estimated one is 240 ton/day, but the actual one is about 70 ton/day. In order to bridge the difference, it is supposed that the actual waste collection amount would meet with the estimated one in year 2007 where the amount is 350 ton/day. Consequently, waste collection amount for designing the transfer and transport system is set as shown in Table 11-36.

Table 11-36: Waste Collection Amount for Design of Transfer and Transport System in the East

Unit: ton/day

| Year | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Estimated required capacity | 240 | 250 | 270 | 300 | 320 | 350 | 370 | 390 | 420 | 450 | 480 | 510 | 540 | 570 |
| Amount for Design | 70 | 100 | 140 | 190 | 260 | 350 | 370 | 390 | 420 | 450 | 480 | 510 | 540 | 570 |

### b.3. Recommended Location and Scale of Transfer Station

#### b.3.1 Location

The ideal location of transfer station is a gravity center of waste collection amount generated from a target area. The gravity center at present is regarded as the area around the Tocumen Airport where is densely populated. It will be difficult to construct a large scale of transfer station in the area, which has been developed and is close to the international airport. Meanwhile, the area along the Pan American Highway (Carretera Panamericana) in the Pacora corregimiento is rapidly developing in recent years and further development is expected in the future. Then, it can be predicted that the gravity center moves to the area. Consequently, it is recommended to place the transfer station in the area along the Pan American Highway in Pacora corregimiento.

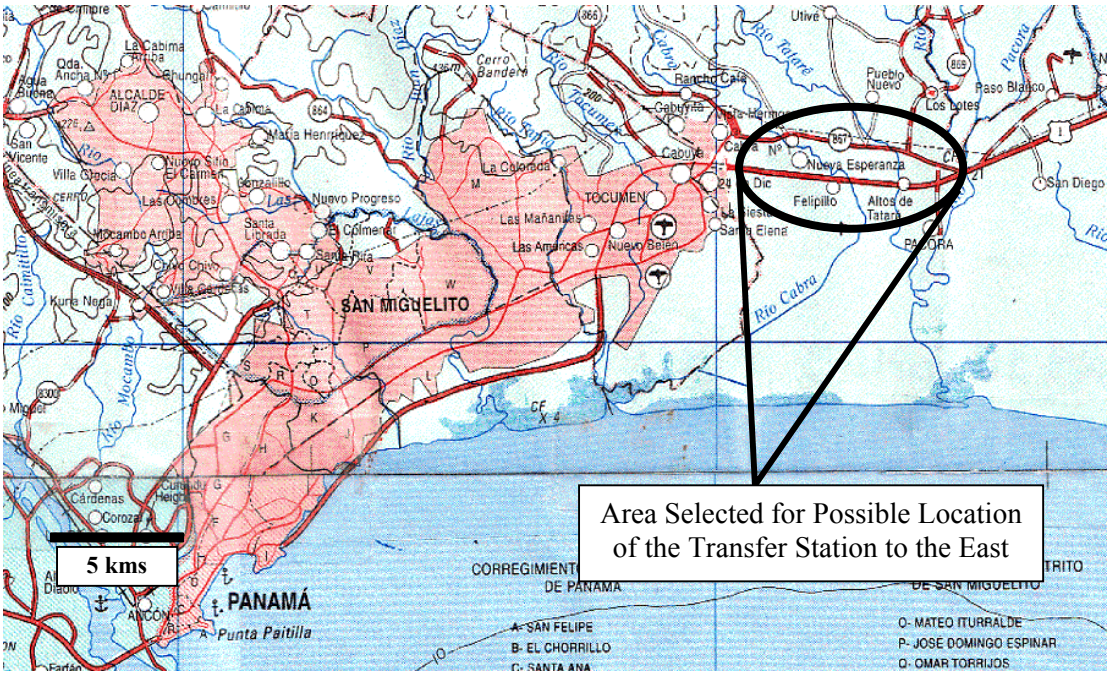


Figure 11-17: Recommended Location of Transfer Station in the East

### b.3.2 Scale

Required capacity of the transfer station for the area is 570 ton/day in 2015. Being on the safe side, 600 ton/day of facility capacity is recommendable. Meanwhile, it can be said that to construct such a large scale of facility at once is highly risky, as the current waste collection amount in the area is about 70 ton/day as well as the population forecast in more than 10 years contains large uncertainties. Consequently, it is recommendable to divide facility construction in two phases, i.e., 300 ton/day each, in order to reduce the risk.

## b.4. Examination of Technical Alternatives

There are several types of transfer stations to be considered for the transfer and transport system in the East. Those are:

- Direct dump station,
- Pit or platform non-compaction station,
- Hopper compaction station, and
- Push pit compaction station.

Table 11-37 discusses advantages and disadvantages of each type of transfer station.

As introduction of the transfer station is the first case in Panama District and it is expected to expand the facility, the system should be simple to operate and the facility be flexible to expand. Consequently, the “direct dump station” is recommendable as it suits to the needs.

Table 11-37: Advantage and Disadvantage of Transfer Station Type

| Type | Outline | Advantage | Disadvantage |
|---|---|---|---|
| Direct dump station | Waste is dumped directly from collection vehicle into waiting transfer trailers. | • Little hydraulic equipment is used, a shutdown is unlikely.<br>• Minimizes handling of waste<br>• Relatively inexpensive construction cost<br>• Drive-through arrangement of transfer vehicle can be easily provided | • Requires lager trailer than compaction station<br>• Dropping bulky item directly into trailers can damage trailers<br>• Minimizes opportunity to recover materials<br>• Number and availability of stalls may not be adequate to allow direct dumping peak period |
| Pit or platform non-compaction station | Waste is dumped into a pit or onto a platform and then loaded into trailers using waste handling equipment | • Convenient and efficient waste storage area is provided<br>• Un-compacted waste can be by bulldozer in pit or platform<br>• Top-loading trailers are less expensive than compaction trailers<br>• Peak loads can be handled easily<br>• Drive-through arrangement of transfer vehicles can be easily provided<br>• Simplicity of operation and equipment minimizes potential for station shutdown<br>• Can allow recovery of materials | • Higher capital cost, compared to other alternatives, for structure and equipment<br>• Increased floor area to maintain<br>• Requires larger trailers than compaction station |
| Hopper compaction station | Waste is unloaded from the collection truck, through a hopper, and loaded into an enclosed trailer through a compactor | • Use smaller trailers than non-compaction station<br>• Some compactors can be installed in manner that eliminates the need for a separate, lower level for trailers | • If compactor fails, there is no way to load waste on trailer<br>• Weight of ejection system and reinforce trailer reduces legal payload<br>• Capital costs are higher for compaction trailers<br>• Compactor capacity may not be adequate for peak inflow<br>• Cost to operation and maintain compactors may be high |
| Push compaction station | Waste is unloaded from the collection truck into a push pit, and then loaded into an enclosed trailer through a compactor | • Pit provides waste storage during peak period<br>• Increased opportunity for recovery of materials<br>• All advantage of hopper compaction station | • Capital costs for pit equipment are significant<br>• All other disadvantage of hopper compaction stations |

sources : Decision-Makers' Guide To Solid Waste Management, Volume II, 1995, US EPA

## b.5. Conceptual Design

### b.5.1 Outline of the Project

The project is outlined in Table 11-38.

Table 11-38: Outline of the Project

| Item | Specification |
|---|---|
| Transfer station | Type: Direct dump station<br>Capacity: 600 ton/day in total<br>First phase; 300 ton/day<br>Second phase; 300 ton/day |
| Transport equipment | Tractor: 300-350 Hp<br>Trailer: payload 20 ton, 65 $m^3$ (85 $yd^3$) with hydraulic ejector blade |
| Collection equipment | Compactor: 12.2 $m^3$ (16 $yd^3$) compactor truck |

### b.5.2 Design Parameters

Parameters for designing the transfer and transport system are set as shown in Table 11-39.

Table 11-39: Design Parameters for Transport and Transport System

| Item | Unit | Value |
|---|---|---|
| **Basic parameter** | | |
| Daily working hour | hr | 16 |
| Operating time | hr | 14 |
| Maintenance time | hr | 2 |
| Nos. of shift | nos. | 2 |
| Working days | day | 300 |

| Item | Unit | Value |
|---|---|---|
| **Tractor and trailer** | | |
| Payload | ton/trailer | 20 |
| Trip time of transport | hr/trip | 4 |
| Nos. of trip | nos./day | 3.5 |
| Waste amount transported | ton/trailer/day | 70 |
| Economic life | years | 7 |
| Distance per trip | km | 60 |
| Annual mileage | km | 63,000 |
| Fuel consumption | km/liter | 1.8 |
| Driver | person | 1 |
| Worker | person | 0 |

| Item | Unit | Value |
|---|---|---|
| **Compactor truck (16 $yd^3$ (12.2$m^3$))** | | |
| Payload | ton/truck | 5 |
| Trip time of collection | hr/trip | 3.5 |
| Nos. of trip | nos./day | 4.0 |
| waste amount collected | ton/truck/day | 20 |
| Economic life | years | 5 |
| Distance per trip | km | 20 |
| Annual mileage | km | 24,000 |
| Fuel consumption | km/liter | 2.2 |
| Driver | person | 1 |
| Worker | person | 3 |

### b.5.3 Conceptual Design of Transfer Station

Conceptual design of the transfer station is outlined in Table 11-40. Figure 11-18 and Figure 11-19 show a plan of the transfer station in Phase I, 300 ton/day of capacity, and one in Phase II, 600 ton/day of capacity in total respectively. It should be noted that a site for the transfer station was not presented by the Panamanian side, as this pre-feasibility study aimed at examining necessity of transfer and transport system in the area. Therefore, the facilities of

the transfer station were not designed based on actual information such as geological and environmental data. Then, construction of the facilities will require redesign based on such information of site in the future.

Table 11-40: Outline of Conceptual Design of Transfer Station

| Item | Details | unit | Phase I | Phase II | Total |
|---|---|---|---|---|---|
| | | | Quantify | Quantify | Quantify |
| **Land acquisition** | | m2 | 49,450 | 0 | 49,450 |
| | | | | | |
| **Transfer station construction** | | | | | |
| Platform | R/C | m2 | 1,250 | 1,250 | 2,500 |
| Roof on the platform | Slate covered | m2 | 1,250 | 1,250 | 2,500 |
| Office | | m2 | 270 | - | 270 |
| Workshop (Garage) | | m2 | 450 | - | 450 |
| Scale house | | m2 | 60 | - | 60 |
| Road pavement (access to platform) | Concrete pavement | m2 | 1,200 | 525 | 1,725 |
| Road pavement (road and reception) | Asphalt pavement | m2 | 7,070 | 2,480 | 9,550 |
| Road pavement (parking) | Asphalt pavement | m2 | 3,180 | 1,240 | 4,420 |
| Green area | Turf | m2 | 6,080 | 6,340 | 12,420 |
| Banking (access to platform) | | m3 | 6,728 | 4,532 | 11,260 |
| Retaining wall | | m2 | 1,096 | 1,040 | 2,136 |
| Fence | h=2.0m | m | 600 | 110 | 710 |
| Gate | W=10.0m | unit | 1 | - | 1 |
| | | | | | 0 |
| **Equipment** | | | | | 0 |
| Weighbridge | 60ton | unit | 1 | 1 | 2 |
| Hopper | Steel, 12m x 5m | unit | 2 | 2 | 4 |
| Hopper – Ventilation facilities | | unit | 2 | 2 | 4 |
| Generator | 230kW | unit | 1 | 1 | 2 |
| Car Washer | 20 liter/hour | unit | 1 | 1 | 2 |
| Electric facilities (Platform) | | unit | 1 | 1 | 2 |
| Electric facilities (Fan) | | unit | 1 | 1 | 2 |
| Electric facilities (Light) | | unit | 1 | 1 | 2 |
| Electric facilities (Others) | | unit | 1 | 1 | 2 |
| Wheel loader | 100kW | unit | 1 | - | 1 |
| Drainage facilities | | unit | 1 | 1 | 2 |
| Garage goods | | unit | 1 | - | 1 |

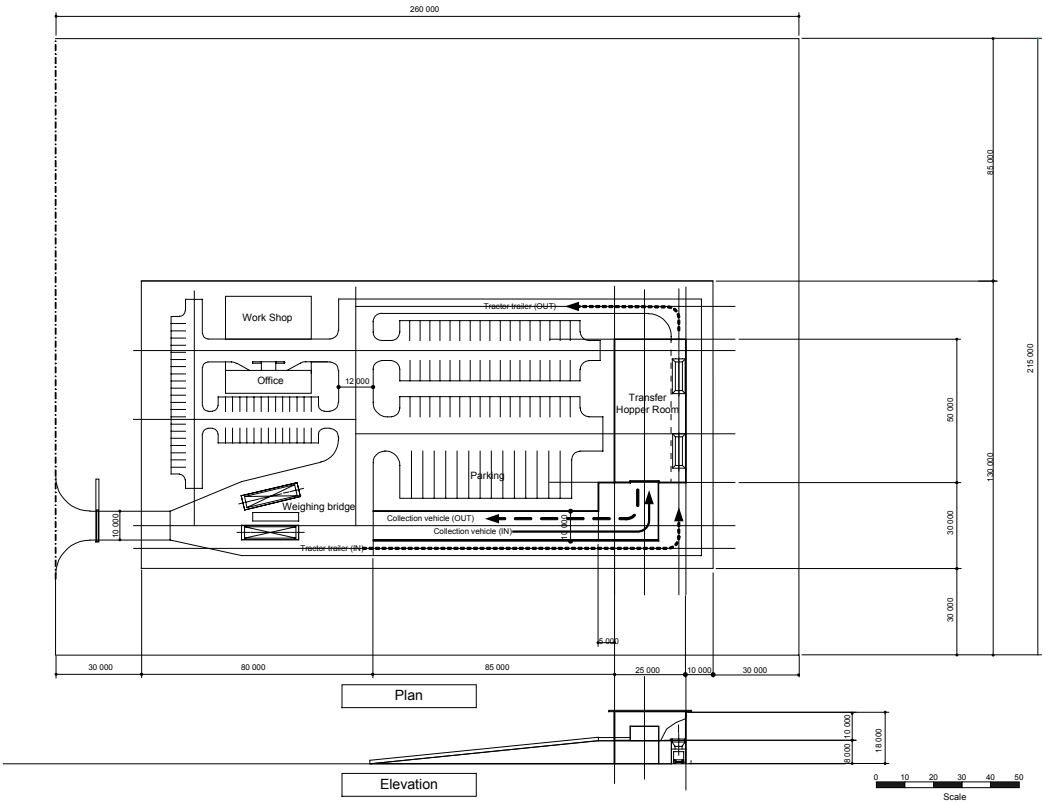


Figure 11-18: Plan of Transfer Station (Phase I, 300 ton/day)

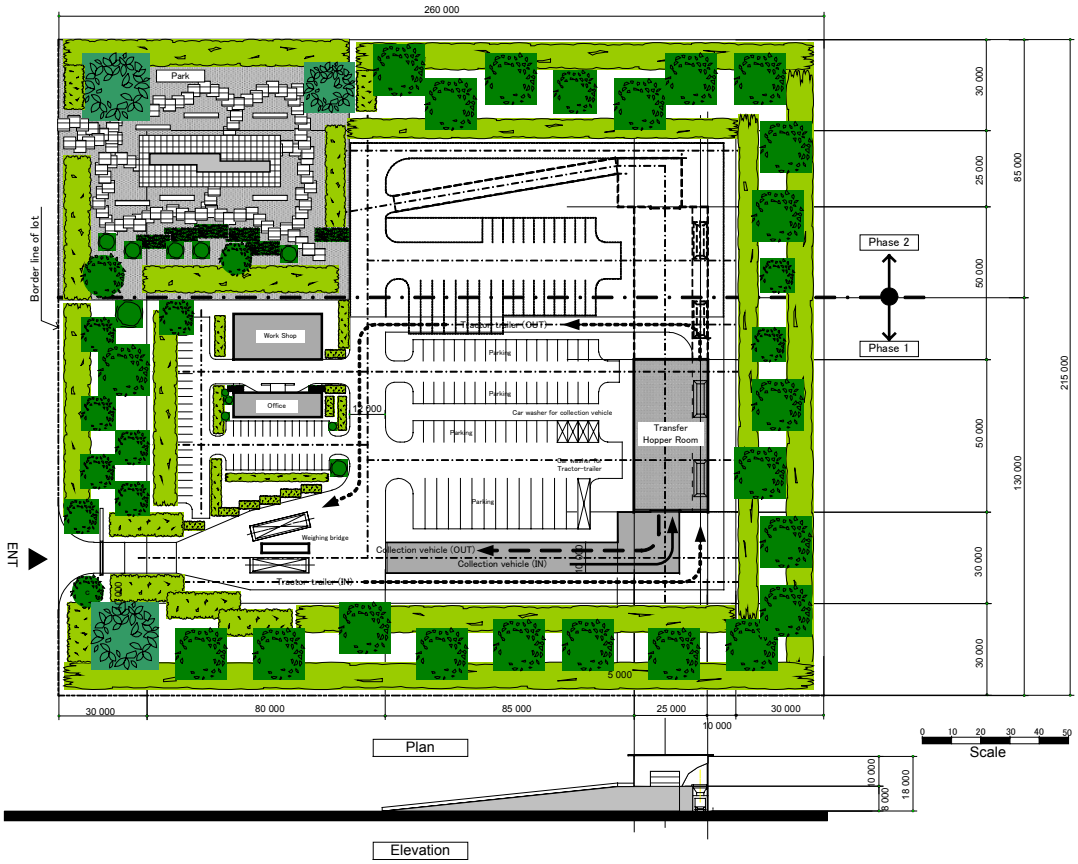


Figure 11-19: Plan of Transfer Station (Phase II, 600 ton/day)

### b.5.4 Required Number of Transport Equipment

Required number of transport equipment shown in Table 11-41 is calculated based on the waste collection amount presented in Table 11-36.

Table 11-41: Required Number of Transport Equipment

| Item | Year | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tractor (300-350hp)** | | | | | | | | | | | | | |
| Required | nos. | 3 | 4 | 5 | 6 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | - |
| Spare (10% of required) | nos. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| Total | nos. | 4 | 5 | 6 | 7 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | - |
| Purchase schedule | nos. | 4 | 1 | 1 | 1 | 0 | 0 | 1 | 4 | 2 | 1 | 2 | 17 |
| | | | | | | | | | | | | | |
| **Trailer (85 yd3, 20 ton)** | | | | | | | | | | | | | |
| Required | nos. | 3 | 4 | 5 | 6 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | - |
| For loading | nos. | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | - |
| Spare (10% of required) | nos. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| Total | nos. | 6 | 7 | 8 | 11 | 11 | 11 | 12 | 12 | 13 | 13 | 14 | - |
| Purchase schedule | nos. | 6 | 1 | 1 | 3 | 0 | 0 | 1 | 6 | 2 | 1 | 4 | 25 |

### b.5.5 Required Number of Collection Equipment

Required number of collection equipment shown in Table 11-42 is calculated based on the waste collection amount presented in Table 11-36.

Table 11-42: Required Number of Collection Equipment

| Item | Year | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Required | nos. | 10 | 16 | 18 | 19 | 20 | 21 | 23 | 24 | 26 | 27 | 29 | - |
| Spare (10% of required) | nos. | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | - |
| Total | nos. | 11 | 18 | 20 | 21 | 22 | 24 | 26 | 27 | 29 | 30 | 32 | - |
| Purchase schedule | nos. | 11 | 7 | 2 | 1 | 1 | 13 | 9 | 3 | 3 | 2 | 15 | 67 |

### b.6. Execution Scheme

Through consultation with the counterpart, construction of the first part of the transfer station is set in year 2004. Then, operation is planed to begin in year 2005. As for the remaining part, it is supposed that construction would be carried out in year 2007 and operation would start in year 2008. The schedule is schematized in Table 11-43.

Table 11-43: Execution Scheme

| Item | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Design and supervision | ⟷ | ⟷ | | | ⟷ | | | | | | | | |
| Phase I Construction | | ⟷ | | | | | | | | | | | |
| Operation | | | ⟷ | ⟷ | ⟷ | ⟷ | ⟷ | ⟷ | ⟷ | ⟷ | ⟷ | ⟷ | ⟷ |
| Phase II Construction | | | | | ⟷ | | | | | | | | |
| Operation | | | | | | ⟷ | ⟷ | ⟷ | ⟷ | ⟷ | ⟷ | ⟷ | ⟷ |

### b.7. Operation and Maintenance Scheme

#### b.7.1 Staff Assignment

Positions and numbers of staffs necessary to operate the transfer station are presented in Table 11-44. As for vehicles, one tractor needs one driver, and one collection vehicle is supposed to require one driver and three workers as shown in Table 11-39.

Table 11-44: Staff Assignment for Transfer Station

| Item | Phase I | Phase II |
|---|---|---|
| manager | 1 | 1 |
| engineer | 1 | 1 |
| supervisor | 2 | 2 |
| mechanic | 1 | 1 |
| mechanic assistant | 2 | 2 |
| worker | 8 | 12 |
| secretary (office & weighbridge) | 5 | 5 |
| Total | 20 | 24 |

#### b.7.2 Inspection and Maintenance

The direct dump station does not require high-tech inspection and maintenance, which is the principal advantage of this type of transfer station. Facilities that require periodical inspection and maintenance are mechanical equipment such as weighbridge, tractor, trailer and compactor truck. Inspection and maintenance shall follow instructions of suppliers.

Table 11-45: Inspection and Maintenance of Facilities

| Facility | Items to be inspected/maintained |
|---|---|
| Platform | Surface of the platform |
| Road/parking | Surface of road and parking |
| Weighbridge | Adjustment according to supplier's recommendations |
| Vehicles | Inspection and maintenance according to supplier's recommendations |
| Others | According to supplier's recommendation |

### b.8. Cost Estimation

Table 11-46 shows overall costs required for the transport ant transport system. Table 11-47 presents required costs per ton of waste collected, where the costs are divided by waste amount between 2005 and 2015. It should be noted that in year 2015 both the transfer station and vehicles will still have remaining economic life. If the remaining economic life period is taken into account, the cost per ton would be lower than the ones presented in Table 11-47.

Table 11-46: Overall Cost of the Transfer and Transport System in the East

| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Transfer station | | | | | | | | | | | | | | |
| Design and supervision | 67 | 67 | 0 | 0 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 189 |
| Capital | 0 | 3,039 | 0 | 0 | 1,821 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,860 |
| O&M | 0 | 0 | 211 | 211 | 211 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 2,793 |
| Total | 67 | 3,106 | 211 | 211 | 2,087 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 7,842 |
| | | | | | | | | | | | | | | |
| 2. Transport | | | | | | | | | | | | | | |
| Capital | | | 682 | 143 | 143 | 252 | 0 | 0 | 143 | 682 | 287 | 143 | 395 | 2,870 |
| O&M | | | 129 | 160 | 192 | 225 | 225 | 225 | 257 | 257 | 288 | 288 | 321 | 2,567 |
| Total | | | 811 | 303 | 335 | 477 | 225 | 225 | 400 | 939 | 575 | 431 | 716 | 5,437 |
| | | | | | | | | | | | | | | |
| 3.3 Collection | | | | | | | | | | | | | | |
| Capital | | | 978 | 623 | 178 | 89 | 89 | 1,156 | 800 | 267 | 267 | 178 | 1,334 | 5,959 |
| O&M | | | 604 | 989 | 1,099 | 1,153 | 1,208 | 1,319 | 1,428 | 1,484 | 1,593 | 1,648 | 1,759 | 14,284 |
| Total | | | 1,582 | 1,612 | 1,277 | 1,242 | 1,297 | 2,475 | 2,228 | 1,751 | 1,860 | 1,826 | 3,093 | 20,243 |
| | | | | | | | | | | | | | | |
| 3.4 Total Cost | 67 | 3,106 | 2,604 | 2,126 | 3,699 | 1,989 | 1,792 | 2,970 | 2,898 | 2,960 | 2,705 | 2,527 | 4,079 | 33,522 |

Table 11-47: Unit Cost of the Transfer and Transport System in the East

| Item | Cost (US$1,000) | Waste amount | Unit cost (US$/ton) |
|---|---|---|---|
| Transfer station | 7,842 | 1,359,000 ton (Waste collected between 2005 and 2015) | 5.77 |
| Transport | 5,437 | | 4.00 |
| Collection | 20,243 | | 14.90 |
| Total | 33,522 | | 24.67 |

## 11.3 Institutional Plan

The results of the financial evaluation of the M/P tell that it is appropriate to consign the project subject to the Feasibility Study and Pre-feasibility Study to the private sector under concession contract. Therefore, this institutional plan will examine conditions of the concession contract and provide a guideline to prepare a Terms of Reference (TOR).

### 11.3.1 Final Disposal Project

This section provides a guideline for preparing a TOR of Concession Contract of the Final Disposal Project.

**Process for Concession of Public Work (the Final Disposal Project)**

## 1. Legal Attributions

The legal foundation is originated by Law No. 41 of the 27 of August, which states that: "the Panama municipality will have the responsibility to manage Cerro Patacon which will also be use jointly by the San Miguelito Municipality."

Additionally, Article 8th establishes that "a Mayor who would manage a sanitary landfill could arrange contracts through a tender for private companies which are specialized in environmental sanitation; these companies should be accredited by a competent Panamanian authority. The company(ies) should satisfy the national environmental normative in the areas defined for these purposes..."

## 2. Terms of Reference (TOR)

Taking into account the PPS which is being proposed, the TOR should be precise and meticulous as much as possible. Bidders should have access to database available in the Panama Municipality on the issue at hand.

JICA study is providing a feasibility study which contains valuable information that should serve as base for the execution of an engineering project which should be developed by the contractor in advance to the initiation of operations.

The list of charges should contain the following minimal conditions:

a) Detail exposition of the service to be provided by the private operator

b) Details of the privileges, advantages, exclusivities or special conditions which will be given to the private operator to which has been awarded the contract; the time periods should also be defined.

c) Description of investment requirements and parameters of the fee policy which the private operator should abide to.

d) Description of the methodology and proceedings to calculate fee and prices.

e) Establishment of coverage goals and service levels

f) Establishment of special conditions related to ownership of goods which are subject to be incorporated in the active private participation

g) Manner and procedure to transfer the final disposal service of Cerro Patacon Sanitary landfill.

h) Regime and conditions to transfer the assets which are employed to provide the service after the contract has expired.

## 3. Manner of Participation of the Private Sector (PPS)

There are different manners of the PPS and its selection varies in accordance to the type of market, the particular characteristics of the system and objectives of Panama municipality.

The PPS in other areas, e.g., water supply, sewerage and treatment, etc. varies in accordance to concepts, scope, and applicability from the PPS in the area of solid wastes management.

It is important to analyze and review the models that have been implemented in both developing and developed countries and experiences should be learned from this implementation. The selection of the optimal model for the PPS should be defined by several factors such as:

- Size and type of market
- Objectives by the owner, such as equity vs. efficiency
- Long term objectives
- Activity level of rent-seeking of the system
- Existing levels of human resources
- Capacity of the entity to regulate
- Special conditions and characteristics of the property

In advance to the selection of the model that best suits the characteristics of Panama municipality, it is necessary to define the institutional structure, level of activities of opportunistic type (free-riding), monitoring system, legal sanctions system, information and control systems, level of personnel who has been trained for the regulation, public perception toward the private operation, among others.

A general summary is shown subsequently which present the most common manners of PPS in solid waste management.

Table 11-48: Options for the PPS in Solid Waste Management

| Types of PPS | Asset ownership | Investment | Operation / Management | Commercial Risk | Establishment of the price | Service quality |
|---|---|---|---|---|---|---|
| Service Contract | Private | Private | Private | Public | Auction | Regulated |
| Operation Contract | ------- | | | | | |
| Competitive prices (lump sum o unit prices) | Public | Public | Private | Public | Auction | Regulated |
| Cost-Plus | Public | Public | Private | Public | Verified | Regulated |
| Administration Contract | -------- | | | | | |
| Fixed payment (lump sum) | Public | Public | Private | Public | Auction | Self-regulated |
| Fixed payment plus incentives | Public | Public | Private | Public | Auction | Self-regulated |
| Franchise | -------- | | | | | |
| To competitive prices | Private | Private | Private | Private | Auction | Regulated |
| To regulated prices | Private | Private | Private | Private | Regulated | Regulated |
| Concession | --------- | | | | | |
| To competitive prices | Private | Private | Private | Private | Auction | Regulated |
| To regulated prices | Private | Private | Private | Private | Regulated | Regulated |

| Types of PPS | Asset ownership | Investment | Operation / Management | Commercial Risk | Establishment of the price | Service quality |
|---|---|---|---|---|---|---|
| Non-regulated franchise or license (exclusive or non-exclusive) | Private | Private | Private | Private | Free price | Regulated or non-regulated (as it is desired) |
| Open competition regulated (license is not paid) | Private | Private | Private | Private | Regulated | Regulated |
| Non-regulated open competition or informal market | Private | Private | Private | Private | Free price | Non- regulated |
| BOT BOOT BOO | Private or Public | Private or Public | Private or Public | Private or Public | Auction | Regulated |

Source: Madrid-Aris (1999)
Notes: BOT: Build-Operate-Transfer BOOT: Build-Operate-Own and Transfer BOO: Build-Operate and Own

In economic theory of regulation, the manner of PPS regulation through auction is considered as the "optimum regulation." The auction corresponds a competitive tender of closed envelope type. This type of regulation is optimal because if the auction process is competitive (there is not collusion and the participants´ number is high), then efficient prices are obtained easily and without great burden nor regulation cost.

Developing countries should tend to follow this type of regulation because there area important restrictions (lack of human resource, high level of rent-seeking activities, lack of resources to monitor and control prices, unstable regulation framework, deficient control and information systems, etc.) to regulate efficiently.

Normally, people tend to analyze based on the previous table and to correlate the property manner of assets and investment with the levels of risk for the different types of PPS. It should be noted that the privatization and/or regulation processes not only depend on the type of PPS (assets ownership, investment and operation), but also to the fact that the PPS should be directly linked to the "regulation and fee conceptual framework."

For example, if a concession is conducted under a fee framework which can allow an extraordinary revision of prices or fees previous to the regular revision period, i.e., the price regulation period is reduced which leads to what is defined as "regulatory lag", then the risk might not only bear by the concessionary as a totality because the risk could be transfer to the public sector; i.e., by the customers.

On the other side, a tariff regime normally has an indexing system or automatic readjustment of tariffs which can generally be of unique or polynomial type. It is common that if a polynomial index is used, it should contain endogenous variables related to the efficient cost of production. Consequently, the existence of exogenous variables as part of this index could transfer part of the risk to the consumers through a tariff readjustment.

In other occasions, the private part requests a warranty from the state for the investment, as a result, part of the risk (investment) is transferred to the public sector. Taking into account the foregoing, it can be shown that regarding the risk in the PPS, the regulation problem is very

complex and can not only be confined to the previous table as many suppose it should be done.

### 3.1 Recommendation on the type of PPS

The most important aspect to consider is related to the amount of investment which should be done because of this the time duration should be enough so that investment depreciate sufficiently and capital investors obtain reasonable profits.

Consequently, it is required that the private sector which finances the investments should have domain on the facilities for the time foreseen in the Master Plan, i.e., the years between 2004-2015.

The resulting fee derived from the calculations of investment, and operation and maintenance costs is defined as reasonable; even if it is also considered the remediation costs of Etapa I and the works of closure and post-closure; moreover, there is an strict observance of the environmental law for a change.

If it is considered that the land will continue to be state property (Municipal or Executive), then the option that better suits the reality is that the private sector should bear the investments, construction the facilities, acquire temporarily the facilities and when the contract expires, the private company should transfer the assets to the state. This type of system would correspond to BOT of PPS.

The system of contracts type BOT and variations are applied mainly to the construction of sanitary landfills and transfer stations.

Under a BOT regime and its variations, the private sector has the responsibility to elaborate the engineering design, construction, maintenance, management and initial investment and expansion of the services. Under this regime, it could also assume or decline the billing and charge for the services, as a result, in this case the private company is acquiring the commercial risk. The BOT projects area assigned through a competitive tender of closed envelope type (auction).

A BOT can be implemented under a regulatory system of return rate; although it can also be implemented under a system of pure top price (price – cap) or under a model of top prices in a model company.

BOT agreement requires defining meticulously specifications. The most important is that the agreements describe the requirement for a regular maintenance which should be provided by the private sector to the facilities; additionally, it should establish the final condition that the facilities should have when they are transferred back. Without these specifications, it can

easily be foreseen that the facility would have a planned obsolescence which would be adjusted to a transfer plan.

Additionally, the following is recommended:

- convocation for tender should be published internationally;
- a reference price should be attached in the tender document;
- a minimum of three economic offers should be presented during the opening of bids if the tender is to be considered competitive;
- if the price is higher than 25% of the referral price, the proposal would be considered invalid.

### 3.2 Limitations to the PPS in Cerro Patacon sanitary landfill

Previous to the preparation of the tender document, it is advisable to consider the following limitations which currently take place in Cerro Patacon:

a) Regarding the property and expansion of the zone which has been assigned as solid waste final disposal in the Panama District.

According to Law No. 41 of August, 1999, Panama Municipality has the responsibility to manage the sanitary landfill in Cerro Patacon.

In this regard, it is convenient to arrange with the competent authority (ARI) the cession of land which was assigned to the former DIMA for the disposal of solid wastes in the Metropolitan Area, taking into account that Panama municipality will take care of the required investments which are foreseen in the Master Plan or it will have to respond for these investments in the case of a contract with the private sector.

In parallel, the negotiations with ARI should be finished to obtain the property of the land to expand the operations and provide cover soil for the landfill site.

b) Regarding the discharge of solid wastes in San Miguelito District

San Miguelito Municipality subscribed a contract with the private sector where it is established that this Municipality guarantees to the company the right to use Cerro Patacon without any cost for such company.

Likewise, with respect to Cerro Patacon sanitary landfill, San Miguelito Municipality will have the responsibility to obtain from Panama Municipality the corresponding authorizations to exempt form any payment to this company. For the purpose of this clause (ClauseN°4) the wastes which are transported by the company will be considered as a service without cost in favor of San Miguelito Municipality in accordance to what is established in the third paragraph (3) of the fifth article of Law N°41 de 1999.

On the other hand: the right of San Miguelito Municipality to negotiate with the Panama Municipality 50 hectares located in Cerro Patacon site. In this property, the company will have the right to operate a Sanitary Landfill and a Treatment Plant and Recycling of wastes.

Under the assumption that Panama Municipality undertakes to contract the private sector; the contractor would be expected to bear the investments foreseen in the Master Plan and the operations costs and the clients of the system would be compelled to pay for the services provided to them and the investments done by the contractor. A valid question would be: Who would bear the costs of solid waste final disposal by San Miguelito Municipality?

The Panama Municipality should consider a final solution to this situation, taking into account that San Miguelito discharge currently, and does not pay for it, an average of 216.7 tons per day (daily average between August 2001 and July 2002) (this figure represents 17.9% of the total which is discharged daily in Cerro Patacon sanitary landfill).

c) Regarding the extraction of recyclable materials and others

There is a reasonable doubt about the possibility that the private sector bears the foreseen investment and reach the efficiency of the operations, if it is considered the presence of persons who extract materials which can be represented as a reduction of performance (30%) in machinery due to the potentiality of accidents which might occur.

Panama Municipality should conduct every effort and undertake any required negotiation to prohibit the extraction of materials which are circulating in the waste stream in order to eliminate the current extraction practices as part of the social considerations to be formulated.

d) Regarding the registration of specialized private companies

In the article 8th of Law 41 of August 27, 1999, which was quoted previously, it is established that private companies which take part in the tender process should be specialized in environmental sanitation and they should be credited by the competent authority.

The law acknowledges the jurisdiction of the Health Ministry on this matter and, consequently, the Panama Municipality should request to this ministry the opening of an accreditation register. It is important that the municipality warns the ministry about the minimum requirements that the companies should satisfy regarding their technical and financial capacity, taking into account the size of the investment and the volume of solid wastes to be disposed.

**4. Bidding and Hiring Process**

The participation of the private sector will be materialized through the free participation which would include the following main stages:

a) Production of a pre-qualification document

b) Convocation to the pre-qualification process

c) Pre-qualification of firms and consortium of firms which are interested

d) Production of lists of charges and tender documents

e) Approval of list of charges and tender documents

f) Invitation of pre-qualified firms or consortiums which should present their offers based on the documents provided.

g) Presentation of technical and financial offers.

h) Technical and financial-economical evaluation of the offers presented

i) Awarding the winning offer

j) Subscription of the contract

k) Endorsement by the General Controllership of the Republic

l) Provision of the Order to Proceed

m) Production and approval of the engineering design

With the purpose to conduct the whole process, an Evaluating Commission will be formed which is in charge to pre-qualify to those participating and to evaluate the proposals which are presented in public bid. This evaluating commission would be integrated by at least three (3) of five (5) members who are appointed by the Mayor with the approval of the Municipal Council.

**5. Provision of the final disposal service and supervision of the works executed**

The firm or consortium (Concessionaire) would begin immediately the elaboration of the engineering design after the Order to Proceed has been received, for this purpose a reasonable term should be considered.

Within this term, the Concessionaire should have a period of mobilization previous to initiate operations in the final disposal site. During this stage, the concessionaire would construct offices, warehouses, garages, dressing room and dining room, first aid, water supply services will be installed, sewerage. The land surveying works would also initiate by using the digital map provided by JICA.

Once the mobilization period has finished, the Concessionaire would begin works for final disposal by taking charge of the whole operation and receiving the income established by the

fee. All the foregoing would be done while the final engineering design are finished and the construction of structures is finalized.

DIMAUD should create an administrative unit to supervise the operations, oversee the strict satisfaction of the terms of reference and the corresponding technical specifications.

The supervision unit would be composed by a professional engineer with a experience of at least 5 years in sanitary landfills which receive more that 500 ton/day; a surveyor; and a civil engineer assistant with at least three years of professional experiment.

### 11.3.2 Transfer and Transport Project

This section provides a guideline for preparing a TOR of Concession Contract of the Transfer and Transport Project.

**Process for Concession of Public Work (the Transfer and Transport Project)**

**1. Legal Attributions**

Law No. 106 enacted on October 8th, 1973: this is the law for local governments and its article 138 states that "the concession of a public service should be decreed by the Council through an agreement which would be adopted as the result of a favorable vote by an absolute majority of its members. The contract should abide to the following norms (among others):

- The service is not possible to be provided or the financial burden unbearable on the Municipality side."

Law No. 41 enacted on August 1999 authorizes the Municipality to pursue every type of contracts and participation of the private sector to satisfy the provision of the solid waste management services.

Law No. 56 enacted on December 1995 regulates public contracts; it regulates everything related to contracts between the State and the private sector.

**2. Terms of Reference (TOR)**

It is advisable to continue with the preparation process of the feasibility study with the purpose to obtain sufficient and necessary information which can allow having a better understanding of the required investments and operation costs.

With this information the TOR can be prepared to ensure better advantages for the entity in a PPS process.

**3. Manner of Participation of the Private Sector (PPS)**

Refer to the different participation manners of the private sector in a PPS document for Cerro Patacon sanitary landfill.

### 3.1 Recommendation of PPS Manners

Sufficient time period should be considered to allow enough depreciation of the investments. At least, a time period similar to the time covered by the Master Plan (2003-2015) should be considered.

The conceptual design of the transfer station considers a capital investment of US$4,86 millions for the construction (including the cost of the land) and US$2,87 millions for the transport equipment. The total investment amount would reach US$7,73 millions.

Due to the characteristics of the project, where the most relevant issues are the capital assets, the Panama municipality would be interested to transfer this investment to the private sector.

The private sector would bear the investment: construction, equipment, transport vehicles, operation and maintenance. Additionally, at the end of the concession period, the totality of the capital assets would be transferred to the Panama Municipality. The investment for the purchase of the land would correspond to the Municipality.

This manner corresponds to the concession type BOT (Built-Operate-Transfer)

The Panama Municipality would establish a reasonable base to define the fees.

### 3.2 Limitations of the PPS for the Transfer Station in the East

The following limitations of the project can be considered and it should be paid attention to them:

a) Feasibility Study

Panama Municipality should consider upgrading the pre-feasibility study to a feasibility study.

b) Selection of the location of the site

Panama municipality should select the location of the site (approximately 5 hectares) by negotiating an option to buy. Initially, an engineering project should be prepared; additionally, negotiations with the competent authorities should be conducted and corresponding permits and authorizations should be obtained. Subsequently, the purchase of the land can be formalized. It is important to consider the existing limitations due to the operation of Tocumen airport.

If Panama Municipality considers convenient, the PPS could be defined for the collection service in Tocumen, Pacora and San Martin corregimientos as possible additional component of the transfer station. In the pre-feasibility study, the size of the collection fleet is defined, its investment, operation and maintenance cost and its total cost.

**4. Bidding and Hiring Process**

The stages suggested for the bidding and hiring are similar to those which are reflected in the PPS document prepared for Cerro Patacon sanitary landfill.

**5. Provision of the Transfer Service and the Supervision of Operations**

The concessionaire will have the responsibility to develop the final engineering design. After the signing of the contract and the reception of the order to proceed, the elaboration of the aforementioned document (final engineering design) will take place; additionally, the final negotiations for approval of permits from the competent authorities will also take place.

DIMAUD should create a unit to supervise and monitor the strict execution of the terms of reference and the respective technical specifications.

## 11.4 Financial Analysis

Financial analysis was conducted for the Sanitary Landfill, the subject of feasibility study, and for the Transfer & Transport, the subject of pre-feasibility study. The purpose of this analysis was to assess the financial viability of the said activities from the standpoint of a possible concessionaire. Accordingly, income from the concessionaire standpoint was assumed to be equivalent to the concession cost for DIMAUD. The cost under consideration included investment plus operation & maintenance costs.

**a. Sanitary Landfill**

Under conditions explained above, the resulting financial internal rate of return (FIRR) would be 5.2%. The sensitivity analysis showed that a 10% income reduction would lower FIRR to –1.0%, while a 10% cost increase would lower FIRR to –0.5%. A simultaneous 5% income drop and a 5% cost increase would change FIRR to –0.7%.

**b. Transfer & Transport**

Under conditions explained above, the resulting financial internal rate of return (FIRR) would be 3.5%. The sensitivity analysis showed that a 10% income reduction would make FIRR negative lowering it to -1.1%, while a 10% cost increase would lower FIRR to –0.6%. A simultaneous 5% income drop and a 5% cost increase would change FIRR to –0.8%.

**c. Sanitary Landfill plus Transfer & Transport**

When sanitary landfill plus transfer & transport were considered under joint concession, the resulting financial internal rate of return (FIRR) would be 4.9%. The sensitivity analysis showed that a 10% income reduction would lower FIRR to –1.0%, while a 10% cost increase

would lower FIRR to –0.5%. A simultaneous 5% income drop and a 5% cost increase would change FIRR to –0.7%.

Table 11-49: Financial Analysis of Feasibility Study

| Cases | FIRR Sanitary Landfill (%) | FIRR Transfer & Transport (%) | FIRR LF, T&T (%) |
|---|---|---|---|
| Base | 5.2 | 3.5 | 4.9 |
| Income reduction: -10% | -1.0 | -1.1 | -1.0 |
| Cost increase: +10% | -0.4 | -0.6 | -0.5 |
| Income: -5% & Cost: +5% | -0.7 | -0.8 | -0.7 |

## 11.5 Environmental Impact Assessment

This section describes results of Environmental Impact Assessment (EIA) of the priority projects, i.e., Final Disposal System and Transfer and Transport System.

### 11.5.1 Scope of EIA Work

**Contents of EIA**

Process of the EIA employed in the Study consists of Initial Environmental Examination (IEE) and detailed EIA. As for the Final Disposal System, both the IEE and the detailed EIA were conducted. Meanwhile, only the IEE was carried out for the Transport and Transfer System, as any specific site has not been proposed.

| Contents | Final Disposal System (Feasibility Study) | Transfer and Transport System (Pre-feasibility Study) |
|---|---|---|
| IEE | ○ | ○ |
| Detailed EIA | ○ | - |

**Scope of the detailed EIA Work**

A whole EIA process usually includes public participation in decision-making. Consultation with the public is responsibility to a project proposer, and also this is out of the scope of the Study. The Study will prepare technical information that is required for the EIA process. Then, it is sought that the Panamanian side will conduct a whole process of the EIA with the information, if such EIA is required to carry out the project.

### 11.5.2 Initial Environmental Examination

**a. IEE Outline and Objective**

IEE is a process aiming to determine (i) whether detailed EIA (Environmental Impact Assessment) is required and (ii) if so, what types of impacts should be further studied. The former is often called "screening" and the latter "scoping". Generally, screening is done by a competent authority according to relevant laws and regulations of the country. According to the EIA system of the country shown in the section of "Screening" below, projects dealing with solid waste would be subject to EIA. Therefore, supposing the priority projects to be required EIA, this IEE concentrates on "Scoping" in order to allot available resources to selected problematic issues and to make the Study as efficiently as possible.

**b. IEE Process**

IEE in the Study will be carried out as follows.

**Step 1:** Potential environmental impact will be checked as far as possible within information available.

**Step 2 (Screening):** Whether father EIA study should be carried out is considered.

**Step 3 (Scoping):** Environmental items, which are considered to might have serious impact, were picked up as subjects for further study in the second study work in Panama.

**c. Screening**

The country has a system of environmental impact assessment, which has been established in 2000 (Executive Decree 59). Projects that have a potential to generate an environmental risk needs to conduct an environmental impact study, EIS. Such projects are listed in the Executive Decree. Degree of EIS depends on a type of project. That is, the more serious environmental risks are expected, the more studies are required. In the system, projects will be categorized according to seriousness of environmental risk as follows.

**Category I:** Projects in the list that do not generate significant environmental impacts and do not pose environmental risks.

**Category II:** Projects in the list that can generate negative impacts that can be easily mitigated to comply with standards. These projects imply partial effects on the environment, with no indirect, cumulative or synergistic impacts.

**Category III:** Projects that require a more thorough analysis because of the potential negative impacts.

The list of projects and activities that might be subject to EIS includes those dealing with solid waste. Thus, environmental impact studies would be required for the Priority Projects below.

- Final Disposal System (for feasibility study)
- Transfer Transport System (for pre-feasibility study)

What important herewith is which category those priority projects fall into. The Study Team is not an agency to decide such matter. This will be subject to discussion among organizations concerned in the Panamanian side.

**d. Scoping**

It was carried out to pick up serious problems that might be caused by the implementation of the priority projects.

- As for the priority project of the Final Disposal System, concrete evaluation of environmental items was made, as the site has been clearly defined, i.e., Cerro Patacon Final Disposal Site. Therefore, Environmental Impact Assessment in the phase II of the study was carried out based on the results of this scoping.
- As for the priority project of the Transfer and Transport System, less concrete evaluation has been done compared with the Final Disposal System, as a site for the project has not been decided. Therefore, it is recommended to carry out EIA out of this study with taking into account the results of this scoping, once the site is defined.

Results of the scoping were shown in Table 11-50. It was carried out based on JICA Guideline, where words used in the table has the following meanings.

- Activities 'During Construction' include land acquisition, land occupation, use of construction equipment and traffic of construction tracks.
- Activities 'During Operation' include traffic of waste trailers and operations of the facility.
- Evaluation of possible environmental impact is expressed by ranks from A to D.
  - Rank A; Serious impacts might be caused.
  - Rank B; Some impacts might be caused.
  - Rank C; Extent of impact is unknown because information is lacking and/or it depends on project location.
  - Rank D; There is little or no impact.

Table 11-50: Results of Scoping

| Evaluation Items | Possible Cause and Effect | | Landfill Expansion (Cerro Patacon Final Disposal Site) | | Transfer Stations (unknown) | |
|---|---|---|---|---|---|---|
| | During Construction | During Operation | Rank | Reasons | Rank | Reasons |
| Social Environment | | | | | | |
| Resettlement | Resettlement of people living in the proposed site or on the access route | | D | There are no permanent dwellings in the site. | D | Sites have not been identified but required areas are small. |

| Evaluation Items | Possible Cause and Effect | | Landfill Expansion (Cerro Patacon Final Disposal Site) | | Transfer Stations (unknown) | |
|---|---|---|---|---|---|---|
| | During Construction | During Operation | Rank | Reasons | Rank | Reasons |
| Economic Activities | Disturbance of economic activities | | D | Area is already used for solid waste disposal. Further disturbance of economic activity is not expected. | D | Location of sites is flexible so economic impacts can be minimized. |
| Transport | Increase in traffic and accidents | Increase in traffic and accidents | D | Area is already used for landfill operations | B | Near the locations there will be a change in traffic pattern. |
| Public Facilities | Impacts on schools, hospitals, etc. by traffic and noise | Impacts on schools, hospitals, etc. by traffic and noise | D | Area is already used for landfill operations. | C | Although potential sites have not been identified, impacts may not be serious, as required areas are small. |
| Division of Community | Geographical separation of community or interruption of communication | | D | Area is already used for landfill operations. | D | Required areas are relatively small. |
| Historical Heritage/ Cultural properties | Loss and/or devaluation of heritage or cultural properties-- archeological remains, or historical assets | Devaluation of such properties by disposal trucks passing nearby | C | There is a potential that archeological remains would be found, because such discovery is common in the region. | D | Required areas are relatively small and increase in traffic should not be as significant |
| Water Rights/ Access Rights | Obstruction of water or common access rights | | D | Area is already used for landfill operation | D | Required areas are relatively small and should not cause obstructions. |
| Public Health | | Degradation of public health due to wastes fallen from trucks, existence of wastes in an area or proliferation of vermin | B | Although soil cover has been applied to avoid waste littering, the landfill operation is still associated with some littering. | B | Waste removal and cleansing of area should be done according to a strict schedule to avoid impacts. |
| Waste (from the project) | Generation of construction waste and debris | | D | Minimal waste to be generated and disposed of on site | D | Wastes should be transported to landfill |
| Accident/Risks | | Landfill gas explosion, refuse fires, landslides, lateral pressure on land, traffic accident | B | Hazardous wastes need to be controlled to avoid chemical reactions. Landfill design and practice, such as waste covering, should minimize risks. A due distance from physical structures should be kept. | B | Traffic of collection vehicles need to be controlled to avoid traffic accidents both in and out of the site. |
| Natural Environment | | | | | | |
| Topography and Geology | Change in valuable topography and geology due to excavation | Change in valuable topography due to operations | C | Excavation works are required to obtain soil for covering waste. | D | Required areas are relatively small and modifications to topography would not be significant |
| Soil Erosion | Increase in soil erosion due to land preparation and/or deforestation | Increase in soil erosion during operation | B | Torrential rains can cause erosion of exposed soil | C | Torrential rains can cause erosion of exposed soil, but required areas are relatively small. |
| Groundwater | | Change in quality and level of groundwater due to leachate | B | Groundwater hydrology should be understood and a monitoring program should be conducted. It should be noted that the former landfill area may cause groundwater pollution, because there is only a clay liner which might not prevent leachate from leaking into the ground.. | B | Control of liquids from wastes and washing areas need to be strictly followed. |
| Hydrological | Changes in river | Changes in river | B | Effluents might reach bigger | B | Control of liquids from |