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PRIVATE PROVISION OF SOCIAL SERVICES GABORONE, BOTSWANA

A PROPOSAL FOR THE IMPROVEMENT OF SOLID WASTE COLLECTION AND DISPOSAL FOR THE CITY GABORONE

PREPARED FOR:

GABORONE CITY COUNCIL

AND

U.S. AGENCY OF INTERNATIONAL DEVELOPMENT

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FINAL DRAFT REPORT

PRIVATE PROVISIONS OF SOCIAL SERVICES:

PROPOSAL FOR IMPROVEMENT TO THE SOLID WASTE COLLECTION AND DISPOSAL SYSTEM FOR THE CITY OF GABORONE

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The Consultant Team was composed of three members. A brief description the role of each member is provided below.

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CITY OF GABORONE

SOLID WASTE MANAGEMENT

PRIVATE PROVISION OF SOCIAL SERVICES

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LIST OF ACRONYMS/DEFINITIONS

GCC	-	Gaborone City Council
USAID	-	United States Agency of International Development
ICMA	-	International City Managers Association
SHHA	-	Self Help Housing Area
VDC	-	Village Development Committee
Tonne	-	Long Tonne, 1,016 kg, 2,204.6 pounds
TPD	-	Tonnes per day
TPY	-	Tonnes per year
P	-	Pula, Botswana National Currency Exchange rate used in this study: Pula = .50 US Dollars

1.0 EXECUTIVE SUMMARY

1.1 OBJECTIVES

The overall purpose of this project is to assist the Gaborone City Council (GCC) in developing a strategy for improvement to the solid waste collection and disposal services. A major component of this study is to assess the viability of transfering part or all of these services to the private sector.

1.2 BACKGROUND

The City of Gaborone, Botswana is undergoing rapid growth in both its population and general economy. This growth has placed great pressure on public facilities and services provided by the GCC. To effectively address the increased needs of its growing population, the GCC has been considering the privatization of several public services, including solid waste collection and disposal.

In 1989, the GCC discussed the potential of privatization of solid waste services with the United States Agency for International Development (USAID). Subsequently, funding was approved, and the Consultancy was engaged in April 1991 to provide technical assistance for Phase I of this project. Phase I consists of the development of privatization strategies for consideration by the GCC. If the GCC elects to proceed with privatization strategies outline herein, Phase II will be initiated. This phase would consist of technical assistance in implementation.

The Consultancy worked with the assistance of a Steering Committee composed of City Council and Central governmental representatives. A detailed review and assessment of existing conditions was conducted and provided to the Steering Committee members through a series of formal meetings and informal discussions. The Steering Committee provided feedback on the alternatives and recommendations were then developed for condideration by the GCC.

1.3 EXISTING CONDITIONS

The waste collection system was evaluated and found to be inefficient due an inadequate organizational structure, minimal supervisory training, low productivity, equipment downtime, and poor routing. Collection service was found to be erratic with some areas receiving twice per week service while others were serviced less than once every two weeks.

Disposal at the City's landfill was also found to be deficient resulting in environmental and health problems. Scavenging,

resulting in environmental and health problems. Scavenging, frequency fires and unauthorized waste oil dumping were noted as operational problems. The lack of qualified middle management and appropriate organizational structure contribute to a minimal accountability for landfill operations.

1.4 PRIVATIZATION PROGRAMME RECOMMENDATIONS

The underlying motivation for suggesting privatization options is the inability of existing governmental structures to respond quickly to changing conditions that are indemic in solid waste management. The privatization programme recommended to the GCC can be divided into collection alternatives and disposal alternatives. The collection programme is composed of three recommendations: incremental privatization of residential collection, privatization of commercial/industrial collection, and privatization of Old Naledi with a new collection strategy. In addition, it is recommended that operation of the landfill be privatized.

Incremental Privatization of Residential Collection - involves contracting collection of refuse in a portion of Gaborone to a private company. The contractor would be selected through appropriate tenders and assisted in organizing and operating the business of providing waste collection service to about one third of the residential plots of the City. Analysis indicated this would be the smallest segment that could be economically feasible considering the capital costs involved.

Privatization of Commercial/Industrial Collection - Under this scenario, the City Council would franchise through a tender process the collection of refuse from all commercial/industrial businesses in Gaborone at fixed unit prices defined in the agreement. The price would vary depending on the service provided. Since industry would be paying directly for refuse collection service, an annual costs savings of P600,000 is expected.

Privatization of Old Naledi with New Collection System - Due to current and previous failures to address the inadequate refuse collection in Old Naledi, collection and litter service would be contracted to a local private organization, such as the Village Development Committee, which is based in the area. In order to address the unique characteristics of the area a new collection system is recommended. The financial analysis indicates that this option could be implemented at current collection costs, while service would be improved.

Landfill - With the completion of the new landfill, consideration should be given to privatization of its operation. Effective and environmentally safe operation requires immediate responses to short term problems and accountability for performance. Therefore private operation is recommended.

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Since the new landfill will be a valued resource, the project team further recommends the construction of a sorting facility and composting plant in order to extend the life of the new landfill. These systems could become part of the landfill operations contract or could be operated under separate tenders.

1.5 PHASE II IMPLEMENTATION

What training programs? why?

Subject to review and approval by the GCC, the foll are recommended to be performed in Phase II of th

1. Prepare the appropriate documents and training programmes to privatize the collection of one-third (9,000 plots) of the current residential collection system.

2. Prepare the appropriate documents and training programmes for the privatization of all commercial and industrial waste generators in the City.

3. Prepare the appropriate documents and training programmes for the privatization of collection services in Old Naledi.

4. Prepare the appropriate documents and operating manual for the private operation of the new landfill.

5. Provide technical and management services to upgrade the remaining two-thirds of the current residential collection system, to include management and operations training.

6. Prepare preliminary engineering designs, cost estimates and material market studies for waste sorting and composting facilities, and a deposit/return system for beverage cans. Work should also include the design of a pilot composting system.

7. Evaluate potential of source separation of salvageable materials. Suggested steps include: detailed material market survey; pilot curbside collection program; and implementation of office paper recycling program.

8. Work with the appropriate City and Central Governments to evaluate existing laws and bye-laws, and propose changes where necessary to address solid and hazardous waste issues identified in this report.

It has been a major goal of the Consulting Team to objectively evaluate the existing systems and the economic and governmental framework in which they operate. This evaluation is reflected in the recommendations found in Chapter 6 and the methods of implementation of Chapter 7. The Team is confident of both the practicality of implementing these recommendations and of the

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financial and environmental benefits that will accrue to the City. We welcome the opportunity to have provided these services and to assure our continued interest in the City of Gaborone and its citizens.

2.0 INTRODUCTION

2.1 BACKGROUND

Botswana, a resource-rich country located in Southern Africa, is presently experiencing unprecedented growth in its economy, which is largely based on the mining and export of diamonds, copper, and nickel. Since Independence in 1966, Botswana has experienced rapid transformation from an almost entirely rural to a relatively urbanized country. The population of Gaborone, the nation's capital, has increased at an annual rate of over nine percent over the last ten years and currently stands at over 138,000. By the year 2001, population is projected to be 240,000, with some estimates as high as over 500,000. This rapid expansion has placed great pressure on public facilities and services provided by the Gaborone City Council (GCC).

To effectively address the increased infrastructure and service needs of its growing population, The GCC has been considering the privatization of several public services. In particular, the privatization of solid waste collection and disposal was identified as a priority area.

In 1989, the GCC discussed the potential of privatization of solid waste with the United States Agency for International Development (USAID). As a result, the USAID prepared a request for technical assistance under the Private Provision of Social Services. This funding was subsequently approved in March 1990 for a two phase project consisting of technical assistance for both the development and implementation of privatization strategies of solid waste services.

The Consultant Team was engaged in April 1991 to provide technical assistance for Phase I of the project. Phase I consists of the development of privatization strategies for consideration by the GCC. This report contains the findings of Phase I and outlines recommendations for improvements to the existing system and privatization.

If the GCC elects to proceed with privatization strategies outlined herein, Phase II will be initiated. This phase would consist of technical assistance in the implementation of these strategies.

2.2 GOALS AND OBJECTIVES

The overall project objective is to assist the GCC in developing a strategy for improvements to the solid waste management services.

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The major emphasis of this study includes evaluating options for privatization of these service.

Phase I consists of review and assessment of the existing solid waste management system in order to make recommendations to the GCC regarding the feasibility of privatization. A key objective of Phase I is to present the GCC with a detailed plan for privatization of solid waste management. As previously stated, the purpose of Phase II is to provide additional technical assistance to the GCC in the implementation of improvements to the solid waste management system and privatization strategies which are selected by the GCC. A major component of both phases is to identify areas of needed training for key GCC staff, and to assist in training development.

2.3 METHODOLOGY

The Consultancy worked under the direction of the Steering Committee composed of City Council and Central Government representatives. The Committee included representation from a variety of departmental offices to provide comprehensive input into the broad spectrum of issues evaluated by the Consultancy.

The methodology for Phase I, consists of three major tasks: review and assessment of existing conditions; development of alternatives for privatization; and recommendations for privatization and improvements to the existing solid waste system. Exhibit 2.1 presents a flow chart summarizing the relationship of these three major tasks.

The review and assessment of existing conditions evaluated the current collection and disposal system. Specific areas of investigation included: waste generation and composition; costs analysis; management structure; institutional structure; budget; and local bye-laws. A time and motion study was conducted to provide an accurate assessment of the current collection system efficiency and effectiveness. Waste generation rates were determined based on a weighing program conducted over a two week period during the months of April and May. Waste composition data was obtained from a previous waste sorting study conducted in 1985 by NZA.

To assess the management system for service delivery, interviews were conducted with public officials from both the Central government and GCC. This provided a framework for evaluating budgets, legal and institutional considerations, management policies, and regulatory statues. Interviews were also held with representatives from the private sector to ascertain the current level of private activity and potential for further private involvement in solid waste service delivery.

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Findings from the review and assessment were provided to the Steering Committee members through a series of formal meetings and informal discussions. This provided a mechanism for continuous feedback and communication between the Consultancy and the Steering Committee. A description and assessment of these findings are contained in Chapter 3.

Information derived from the review and assessment formed the basis for the development of privatization alternatives. Five privatization collection alternatives were developed. Each alternative was evaluated for costs impact and contractual and management issues. These are discussed in detail in Chapter 4 of this report.

In addition, six technical disposal options were developed and evaluated for costs and landfill diversion. These are also discussed in Chapter 4.

The alternatives were then presented to the Steering Committee for feedback. Based on the assessment of the alternatives and direction from the Steering Committee, recommendations were developed for consideration of the GCC. These recommendations are presented in Chapter 6 of this report. The decision of the GCC regarding the recommended alternatives will determine the timing and extent of Phase II.

3.0 DESCRIPTION OF CURRENT SYSTEM

3.1 INTRODUCTION

This chapter presents background information which was critical for the development of privatization options and improvements to the existing system. It provides a thorough overview of the current solid waste management system in Gaborone. This includes: waste generation and composition; collection; disposal; finance structure; budget; and regulatory legislation.

3.2 WASTE GENERATION AND COMPOSITION

3.2.1 Population

The project team reviewed many documents regarding existing population estimates of Gaborone, projected future population and estimated growth rates. In addition to documented information the Team received numerous verbal opinions regarding values both above and below the documented estimates and projections. The three most recent documented sources of published information are; 1) "Population Projections, 1981-2011", published in 1987, by the Ministry of Finance and Development Planning, which is based on the 1971 and 1981 census, 2) The current draft of the National Development Plan No.7. (NDP7), and 3) Euroconsult, February 1990, "Accelerated Urban Land Servicing Program, Needs Assessment Summary". The following table provides a summary of the information included in these two documents, for both population estimates and growth rates within each five year period. Annual growth rates are shown in parentheses.

Data Sources	1986	1991	1996	2001	2006
Population Projections	95,163	138,471	189,187	248,896	320,310
(% Annual Incr.)		(9.10%)	(7.32%)	(6.31%)	(5.74%)
NDP7	94,211	136,396	184,594	239,367	NA
(% Annual Incr.)		(8.96%)	(7.07%)	(5.93%)	(NA)
Euroconsult	NA	178,373	307,399	529,756	NA
(% Annual Incr.)		(NA)	(11.5%)	(11.5%)	(NA)

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3.2.2 Waste Generation and Composition

A waste generation and composition evaluation was performed to estimate the quantity, in both mass and volume, of the waste generated in the City of Gaborone. In addition to a computer calculation of theoretical waste generation and composition, a two week weighing programme was conducted to determine actual waste collected and disposed at the current landfill. The Waste Generation and Composition study plus the two-week weighing program are presented in Appendices B and C and are summarized in the following table:

Total Population Estimate (1991)	138,471
Total Waste Generation (TPD)*	84
Estimated Current Recycling (TPD)	10
Estimated On-Site Disposal (TPD)	14
Results of Weigh Program (TPD)	60

* TPD - Tonnes per Day

A significant problem in the Waste Generation Study was the estimate of on-site disposal and the effect of transient population on waste generation. On-site disposal, which includes littering, burning, and illegal dumping, was found to be extensive in the SHHA and low income areas. It was also noted that small waste incinerators were observed throughout the city and also within the National Government Enclave.

The fact that much of the City's residents return to their home villages and cattle posts on weekends and holidays also has an effect on waste generation. Waste generated by these Gaborone residents during the weekend and holiday periods will not enter the City's collection or disposal systems. This situation is likely to change in the future as Gaborone and the surrounding region continues the transition from a rural to an urban society.

The 84 TPD estimated calculation of waste generation in the City, using unit generation factors from the weighing program, is based on population estimates, full time residency and a 7 day week. Estimated on-site disposal values were based on observations of actual on-site disposal practices and comparison of the calculated generation value with the actual weighed value. Estimates of current recycling were based on data obtained from current recycling operations.

For the purpose of this report, the project team has based all assessments of existing systems and evaluation of alternatives on the existing measured disposal rate of 60 tonnes per day. Future projections of waste generation for long term planning objectives

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and long term capital expenditures were based on population information presented in Section 3.2.1, and will assume an overall waste generation growth of 7 percent. This includes both a general increase for population and economic growth estimated to vary from 7 percent to 5 percent and a factor for increased per capita generation as the city becomes more urbanized. An additional 5% growth has been assumed for the first 3 years of the planning period to account for anticipated improvement to the effectiveness of the collection system resulting in a reduction of on-site disposal and burning. Exhibit 3.1 shows the estimated growth in waste disposal during the 20 year planning period, assuming a 12% increase in years 1 through 3 and 7 percent thereafter. The reader is referred to Appendix B for a more detailed assessment of waste generation and composition.

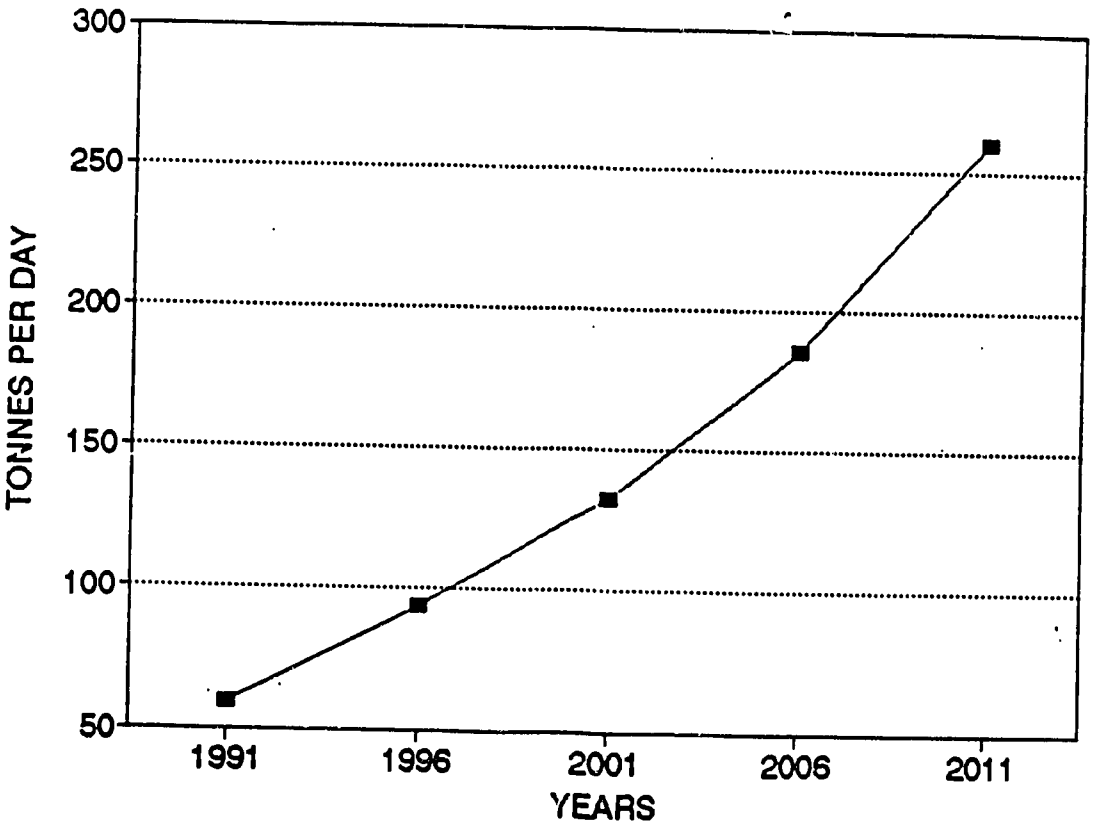

EXHIBIT 3.1
WASTE GENERATION

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3.3 COLLECTION

This section presents an overview of the existing refuse collection system in Gaborone. The team reviewed the management structure for refuse collection, routing of refuse vehicles, maintenance records, and the economics and efficiency of the operation as a whole. This was the basis for providing suggestions for improvements to the collection system.

This section is divided into the following subsections: background; efficiency of collection; waste collection rates; costs analysis of collection; containers; collection of salvageable materials; and conclusions.

Recommended strategies for improvements to the public collection program can be found in Section 6.2.

3.3.1 Background

The Health Department is responsible for providing collection of solid waste to the over 138,000 people, as well as the industrial and commercial enterprises located in Gaborone. It employs 150 people for refuse collection and another 214 people for litter pick-up and street sweepings.

The City offers two main types of collection service: door to door bin collection and a skip distribution and collection system. The bin system is the primary method for refuse collection in Gaborone. The Health Department engages a fleet of refuse vehicles including compactors, and standard, non-compactor vehicles (round bodies, and square bodies) to collect refuse streetside from residential and commercial plot owners. Based on a two week weighing program in April and May 1991, a total of 42.0 TPD of refuse is collected by this method.

The other method for public (GCC) collection refuse in Gaborone is the placement of skips in commercial areas. These containers, which have capacity for between four and five cubic meters of refuse, are transported to the landfill via tractor trailer. Between three and five TPD of refuse is collection by this manner.

The private sector delivers about thirteen TPD of refuse (excluding construction wastes) to the landfill. This waste is collected by either Skip Hire, a local private hauler, or by plot owners. Skip Hire operates a fleet of two skip vehicles, and collects an estimated six TPD from businesses (and another 8.7 TPD of construction waste). An estimated seven TPD of refuse is delivered by plot owners, mainly businesses.

A breakdown by source indicates that the commercial/industrial sector discards 19.7 TPD (34 percent) and the residential sector 37.9 TPD (66 percent). These figures were determined based on

loads of exclusively commercial waste delivered to the landfill. This included loads from either Skip Hire, self-haul loads by private industry, and public skips placed in commercial areas which are maintained by City Council. In addition, it was assumed that ten percent of the refuse collected by City Council via compactor, round body or square body vehicle is from commercial sources. A difficulty in determining specific breakdown of sources of waste is that the Health Department often collects residential and commercial wastes during the same route. The assumption of 10 percent is most likely a conservative estimate, and a more detailed study would be required to confirm these totals.

The Health Department operates three sanitation depots, one in each section of Gaborone: South, North, and West. They were established to enable closer management supervision and reduce vehicle travel time. Each sanitation depot is self-contained in terms of refuse collection vehicles and work force. Typically, the South Depot contains eight refuse vehicles, while the North and West Depots contain six and three vehicles, respectively.

There are fourteen routes in the collection system. Each vehicle is assigned a particular route each day, ranging from one to five extensions. Once a crew completes their assigned route, they are finished for the day. While performance based work allows rewards for efficient crews, the current routing system is not equitable in terms of crew assignment based either on plots picked-up or total tonnage. For example, one compactor vehicle typically collects between eight to ten TPD, while the other compactors collect less than four TPD.

Collection frequency varies from every day (including Sunday) for certain commercial establishments that produce large quantities of food waste, to twice per week for parts of the residential sector.

Each depot is managed by a supervisor who reports to the senior health inspector. In addition, one crew member in each refuse collection vehicle is assigned to be the charge-hand. This person is responsible for ensuring that the crew works efficiently and that service is satisfactory.

The Health Department operates a fleet of over two dozen vehicles. Vehicles are used for refuse collection, garden waste debris pick-up, collection of skips, and litter pick-up. The current refuse collection fleet includes: four compactor, nine round body, and four square body vehicles. The capacity of these vehicles are 10.7, 6.0, and 10.0 cubic meters, respectively. Other equipment includes: four tractors and about 40 skips (four to five cubic meters each). The City does not own any specialized vehicles for street sweeping. This is performed by manual methods.

The average age of the refuse vehicle fleet is 5.5 years, a relatively high age for such a fleet and higher than reported in

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the 1985 NZA study. An analysis of three months of operating records (January - March 1991) indicates that an average of 11.5 vehicles are actually operating each day, or one third of the vehicles are not operating. On certain days the number of operating vehicles can be as low as nine vehicles, significantly impairing service to the City.

Some steps have been conducted to replace older vehicles and downtime including the recent budget request of four new compactors with automatic transmissions. Apparently, a major maintenance problem with existing compactors is downtime due to the manual gearbox mechanism.

Average refuse densities achieved for compactor, round body, and square body were measured to be 289.6, 234.4, and 141.1 kilograms per cubic meter, respectively. These figures are based on a weighing sample of 139 vehicles during the months of April and May 1991 and are slightly biased in that they only include fully loaded vehicles.

Variation for the densities in the above figures can be attributed to the compaction capabilities of the compactor, and the specific areas served by each vehicle. The compactor provides a three to one compaction ratio, and thus would achieve a density of three times a non-compactor vehicle if they were both loaded with similar refuse. The high density for the round body can be partially attributed to collection in lower income areas (such as Old Naledi) where the waste has a much greater density due to the high percentage of fines and ash.

3.3.2 Efficiency of Collection

An evaluation of the efficiency of the current collection system is important for estimating service costs and for determining any deficiencies in the system. Efficiencies varied depending on the area served and the type of vehicle.

In order to provide a more detailed assessment of current collection efficiency, the Team conducted a time and motion study. This involved on-vehicle evaluation of the various vehicles, routes, and crews. Data gathering included recording time and distance traveled starting from leaving the depot in the mourning, through disposal at the landfill, to return in the afternoon. A total of 10 routes were evaluated over a three week period.

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The study evaluated efficiency by three categories which are defined below:

- On-route collection rate (kg/hour or plots/hour served) - is the efficiency during the actual collection period only. The period would begin when the crew arrived at the first stop and would end at the last pick-up.

- Overall collection rate (kg/hour or plots/hour served) - includes time for both the collection, unloading and all travel times.

- Daily labour productivity rate (kg/day/worker or plots/day/worker) - is based on total refuse (or stops) collected per day divided by total crew size. This is probably the most important indicator of efficiency.

All efficiency categories are based on a per vehicle basis.

The study indicated that on-route collection rate ranged from 1,180 to 1,900 kg per hour per vehicle, or 117 to 170 plots per hour. Overall collection rates, which include travel time to the route and landfill, ranged from 904 to 1,030 kg per hour, or 82 to 99 plots per hour. Daily labour productivity rate ranged from 400 to 1,000 kg per worker per day. Ranges for each category can be attributed to vehicle type and particular routing during the study.

Based on a review of the three rates identified above and compensation for variation in routing, the compactor vehicle was found to be the most efficient vehicle. A principle reason for their greater efficiency is increased holding capacity (up to 30 cubic meters of uncompacted refuse compared to ten cubic meters for the square body and only six cubic meters for the round body). This translates into reduced number of trips to the landfill per day, allowing greater collection time. Secondly, the compactors are much more ergonomically designed. Both the round and square body vehicles require the crew to lift containers to a height of two to three meters, while the compactor can be loaded from less than one meter from the ground.

It should be noted that rates obtained, particularly daily labour productivity, are lower than those found elsewhere in South Africa. South Africa rates were determined based on discussions with waste managers in that Country. A major reason for the low labour productivity in Gaborone can be attributed to the lack of management with training and experience in developing efficient routing systems. Unfortunately, current hiring practices do not address the need for managerial type personnel.

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3.3.3 Waste Collection Rates

By evaluating the various routes in conjunction with the weighing program (see Appendix C), the following waste disposal rates were calculated based on plot counts and net vehicle weights:

Income	Waste Disposal Rate (Kg/Plot/Day) a) Average	Range
Low-SHHA	1.93	1.04 - 2.48
Medium	3.08	2.31 - 4.45
High	3.55	2.45 - 4.76

a.) These figures were obtained from refuse generated from 2,707 plots.

The greater disposal rates of higher income areas coupled with lower housing densities result in more expensive collection costs for the higher income areas. This is supported by evaluating collection rates in two different areas. Vehicles serving more densely populated areas such as SHHA (Self Help Housing Agency) areas are able to collect over 150 plots per hour, while in higher income areas, such as Extension 9, maximum collection rates were 120 plots per hour.

A significant amount of the waste generated in the City is handled by on-site disposal. Businesses, for example, often burn their paper and other organic refuse outside in open, makeshift fire pits. On-site disposal by residents would include burning of refuse (i.e., paper, wood, plastic) for cooking or heating and the illegal dumping of refuse in vacant areas. The potential health impact of littering is obvious. These areas, where children are often found playing, provide an ideal breeding ground for rodents and insects, and can be a fire hazard.

Infrequent collection and lack of adequate containers for plot owners are major factors contributing to the illegal dumping of refuse, particularly in the lower income areas. Improvements to the collection system would be expected to decrease illegal dumping, and thus, increase disposal rates. Reduction of the use of refuse as a fuel for cooking or heating would be dependent on substitution for fossil fuels or solar ovens.

3.3.4 Cost Analysis

The costs of refuse collection was evaluated based on budget data provided by the Engineering Department, price quotes from equipment vendors in Southern Africa, and collection efficiency determined from the time and motion study. A summary of the cost analysis is presented in Exhibit 3.2. This table provides costs figures based on one day of operation.

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Exhibit 3.2 Summary of Refuse Collection Cost Analysis
Costs for One Vehicle with Crew a)

Cost Component (One Vehicle)	Compactor	Round-Body	Square Body
I. Collection Efficiency b)			
a. Plots/Day	415	224	244
b. Tonnes/Day	4.17	3.25	2.74
II. Capital Costs			
a. Vehicle	202,000	110,000	110,000
b. Containers	0	0	0
III. Annual Operation & Maintenance Costs (Pula/Year) c)			
a. Debt Service for Vehicle d)	50,600	27,600	27,600
b. Labor	35,900	35,900	35,900
c. Management/Supervision	14,300	14,300	14,300
d. Maintenance			
Material	4,000	4,000	4,000
Repair	2,000	2,000	2,000
e. Fuel	3,000	3,000	3,000
f. Insurance	250	250	250
IV. Summary			
a. Total Collection Costs			
Annual Costs (Pula/Year)	110,100	87,000	87,000
Daily Costs (Pula/Day)	353	279	279
b. Pula/Tonne	84.60	85.87	101.89
c. Pula/Plot/Week	1.70	2.49	2.28

a.) Based on operation of 312 days per year.
b.) Efficiencies based on on-vehicle evaluation study.
c.) Costs based on personnel communication with Mr. Pathmanathan, Chief, Engineering Department, May 3, 1991.
d.) Based on a Revenue Stabilization Fund (8.0% interest over 5 years).

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Exhibit 3.2 is divided into four segments: collection efficiency; capital costs; operation and maintenance costs; and summary. As shown, collection efficiency is indicated by number of plots served per day and tonnes per day collected for each vehicle. Capital costs were limited to refuse collection vehicle, and do not include the replacement of containers which would obviously impact costs.

As mentioned, the operation and maintenance costs are shown for one operating day. These costs include: the debt service for vehicles (financed with Revenue Stabilization Fund); labour (driver, six crew members, and charge-hand); management/supervision; vehicle maintenance; fuel; and insurance.

The overall collection costs for operating the round body and square body was calculated to be P279 per day, while the compactor was determined to be P353 per day. While the compactor was shown to be the most expensive to operate on a per day basis, it was the most economical on a per plot served. This is due to its greater collection efficiency which allows the crew to service a larger area.

Based on twice per week collection, the costs for the compactor was calculated to be P1.70 per plot, compared to P2.49 for the round body and P2.28 for the square body. As shown, costs ranged from P85 to P102 per tonne. Annual costs for each type of vehicle are presented in the proceeding tables (Exhibits 3.3, 3.4, and 3.5).

3.3.5 Containers

The type of containers used for refuse collection is extremely important because it effects collection efficiency and can promote the proper disposal of refuse. In Gaborone, a variety of containers are used for storage of refuse ranging in size from 40 litres to 240 litres. These bins are mainly metal, although a few commercial establishments are using plastic containers.

Several observations related to containers were made during the time and motion study. One of the major concerns noticed was the relative age of most of the containers. The last major purchase of containers by the City was over seven years ago. As a result, most of the containers used are damaged. Except for the SHHA areas, it is the policy of the City Council that individual plot owners replace their own containers.

The type of containers used and their old age has created several areas of concern for the City Council. Less than five percent of the containers were noticed to have lids. As a result, this contributes to the litter problem since many of the containers are tipped over by dogs, and provide a breeding ground for insects. During one route evaluation, the collection crew was attacked by

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Exhibit 3.3 Refuse Collection Costs Analysis - Compactor Vehicle Costs for One Vehicle with Crew

Cost Component for Operation of One Vehicle			Annual Costs (Pula/Year)	Daily Costs (Pula/Day) a)
I. Capital Costs				
a. Compactor Vehicle w/ automatic transmission. (Based on a capital costs of P202,000, amortized over 5 years at 8% interest.)			50,592	162.15
b. Containers			0	0.00
II. Operation and Maintenance Costs b.)				
a. Labor	# of Units	Salary (Pula/Day)		
Driver	1	23.41	7,304	23.41
Crew	6	12.84	24,036	77.04
Charge Hand	1	14.52	4,531	14.52
		Subtotal:	35,871	114.97
b. Management/Supervision (40 percent of labor)			14,349	45.99
c. Maintenance				
Material			4,000	12.82
Repair			2,000	6.41
d. Fuel c)			3,000	9.62
e. Insurance			250	0.80
III. Total Collection Costs (One Vehicle and Crew)			110,062	352.76

IV. Per Unit Costs	Average	Range
a. Pula/Tonne	84.60	30 - 200
b. Pula/Plot/Week	1.70	1.41 - 2.35

a.) Based on operations of six days per week (312 days per year).
b.) Costs based on personnel communication with Mr. Pathmanathan, Chief, Engineering Department, May 3, 1991.
c.) Fuel costs based on traveling 15,000 km per year. Calculated at 4.5 km per litre and P.90 per litre.

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Exhibit 3.4 Refuse Collection Costs Analysis - Round Body Costs for One Vehicle with Crew

Cost Component for Operation of One Vehicle			Annual Costs (Pula/Year)	Daily Costs (Pula/Day) a)
I. Capital Costs				
a. Square Body vehicle (Based on a capital costs of P110,000, amortized over 5 years at 8% interest.)			27,550	88.30
b. Containers			0	0.00
II. Operation and Maintenance Costs b)				
a. Labor	# of Units	Salary (Pula/Day)		
Driver	1	23.41	7,304	23.41
Crew	6	12.84	24,036	77.04
Charge Hand	1	14.52	4,531	14.52
		Subtotal:	35,871	114.97
b. Management/Supervision (40 percent of labor)			14,349	45.99
c. Maintenance				
Material			4,000	12.82
Repair			2,000	6.41
d. Fuel c)			3,000	9.62
e. Insurance			250	0.80
III. Total Collection Costs (One Vehicle and Crew)			87,020	278.91

IV. Per Unit Costs	Average	Range
a. Pula/Tonne	85.87	30 - 296
b. Pula/Plot/Week	2.49	1.30 - 5.06

a.) Based on operations of six days per week (312 days per year).

b.) Costs based on personnel communication with Mr. Pathmanathan, Chief, Engineering Department, May 3, 1991.

c.) Fuel costs based on traveling 15,000 km per year. Calculated at 4.5 km per litre and P.90 per litre.

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Exhibit 3.5 Refuse Collection Costs Analysis - Square Body
Costs for One Vehicle with Crew

Cost Component for Operation of One Vehicle			Annual Costs (Pula/Year)	Daily Costs (Pula/Day) a)
I. Capital Costs				
a. Square Body vehicle (Based on a capital costs of P11 amortized over 5 years at 8% interest.)			27,550	88.30
b. Containers			0	0.00
II. Operation and Maintenance Costs b)				
a. Labor	# of Units	Salary (Pula/Day)		
Driver	1	23.41	7,304	23.41
Crew	6	12.84	24,036	77.04
Charge Hand	1	14.52	4,531	14.52
		Subtotal:	35,871	114.97
b. Management/Supervision (40 percent of labor)			14,349	45.99
c. Maintenance				
Material			4,000	12.82
Repair			2,000	6.41
d. Fuel c)			3,000	9.62
e. Insurance			250	0.80
III. Total Collection Costs (One Vehicle and Crew)			87,020	278.91

IV. Per Unit Costs	Average	Range
a. Pula/Tonne	101.89	55 - 297
b. Pula/Plot/Week	2.28	1.23 - 6.65

a.) Based on operations of six days per week (312 days per year).
b.) Costs based on personnel communication with Mr. Pathmanathan, Chief, Engineering Department, May 3, 1991.
c.) Fuel costs based on traveling 15,000 km per year. Calculated at 4.5 km per litre and P.90 per litre.

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a swarm of bees which were attracted to open metal containers of food waste. Another issue is the usage of 220 or 240 litre metal drums. Because of their large size, these containers are extremely difficult to lift, often requiring two to three crew members to empty.

In the commercial areas, there appeared a shortage of receptacles for litter. This has greatly contributed to the litter problem.

3.3.6 Collection of Salvageable Materials

The major recycling activities in Gaborone is the collection of cardboard by Waste Paper Recovery, Ltd., and the collection of metal cans by Metal Box, Ltd. Both companies are actively exploring methods to increase material recovery, and have additional processing capabilities.

Waste Paper Recovery, with 60 employees, owns a fleet of four vehicles to collect cardboard from the various businesses in Gaborone. The company provides free collection service in return for the cardboard. For large generators of cardboard, Waste Paper Recovery may pay for the material. It is estimated that the company collects 150 tonnes of paper per month. Metal Box has sponsored the collection of bi-metal cans from two dozen schools in Gaborone. They reportly collect 70 tonnes of cans per month.

A preliminary market survey indicates viable markets for bimetal cans, glass, high density polyethylene (HDPE), and the various grades of paper (corrugated, high grade, and newspaper). Prices for these materials ranged from P60 per tonne to P245 per tonne. With these strong revenues, the economics of source separated collection of salvageable materials appears viable. A preliminary analysis, as discussed in further detail in Appendix D, indicates that source separation may be an economically viable solid waste management option. The costs analysis shows that source separation can be financially self-sufficient, while creating a minimum of three jobs for every TPD of material recycled.

3.3.7 Conclusions

Based on discussions with City Council Staff and the information assessed, there are four major areas of concern in the existing collection system. These are lack of expertise, lack of trained personnel, lack of financial resources, and lack of technical and financial controls. Improvements in these areas, which are managerial in nature, are essential in order to alleviate many of the technical and economical deficiencies discussed in this section. Thus, any changes to the collection system must address management issues in order for it to provide long-term improvement.

Identified below are more specific conclusions of the existing collection system.

- The cost of collection is relatively high in relation to the level of service provided.
- Worker productivity is low compared to other cities in Southern Africa.
- Collection service is extremely variable with some locations receiving twice per week collection while other areas receive only once per month collection. In addition, plot owners have complained about the erratic nature of collection.
- The compactor vehicle was found to be the most efficient and cost effective of the existing fleet.
- Collection crew workers morale is relatively low. This may be due to the lack of management and lack of personal recognition.
- Containers need to be replaced City-wide, with particular attention of providing containers with attached lids.
- The current hiring procedures for sanitation staff places minimal emphases on hiring needed personnel with management training.
- Increased receptacles are needed in commercial areas to reduce litter.

3.4 DISPOSAL

3.4.1 Landfill

Existing Landfill - Approximately 60 TPD of municipal waste is collected and transported to the existing landfill for disposal. The existing landfill is located approximately 250 meters south of Tlokweng Road near the sewage ponds and is less than 3 kilometers southeast of the City Centre. The location of the landfill is shown on Exhibit 3.6. Landfilling occurs in an uncontrolled manner, along the outer perimeter of the site, resulting in a flat shape which is not well suited for shedding rainwater. Waste is dumped, receives a minimum of compaction and is then pushed over the perimeter bank. The working face is actually the entire perimeter of the landfill which is expanding horizontally outward rather than vertically upward. Although the City owns a steel wheeled compactor and bulldozer, they are not being utilized in an efficient manner due to the large working face and absence of daily cell construction.

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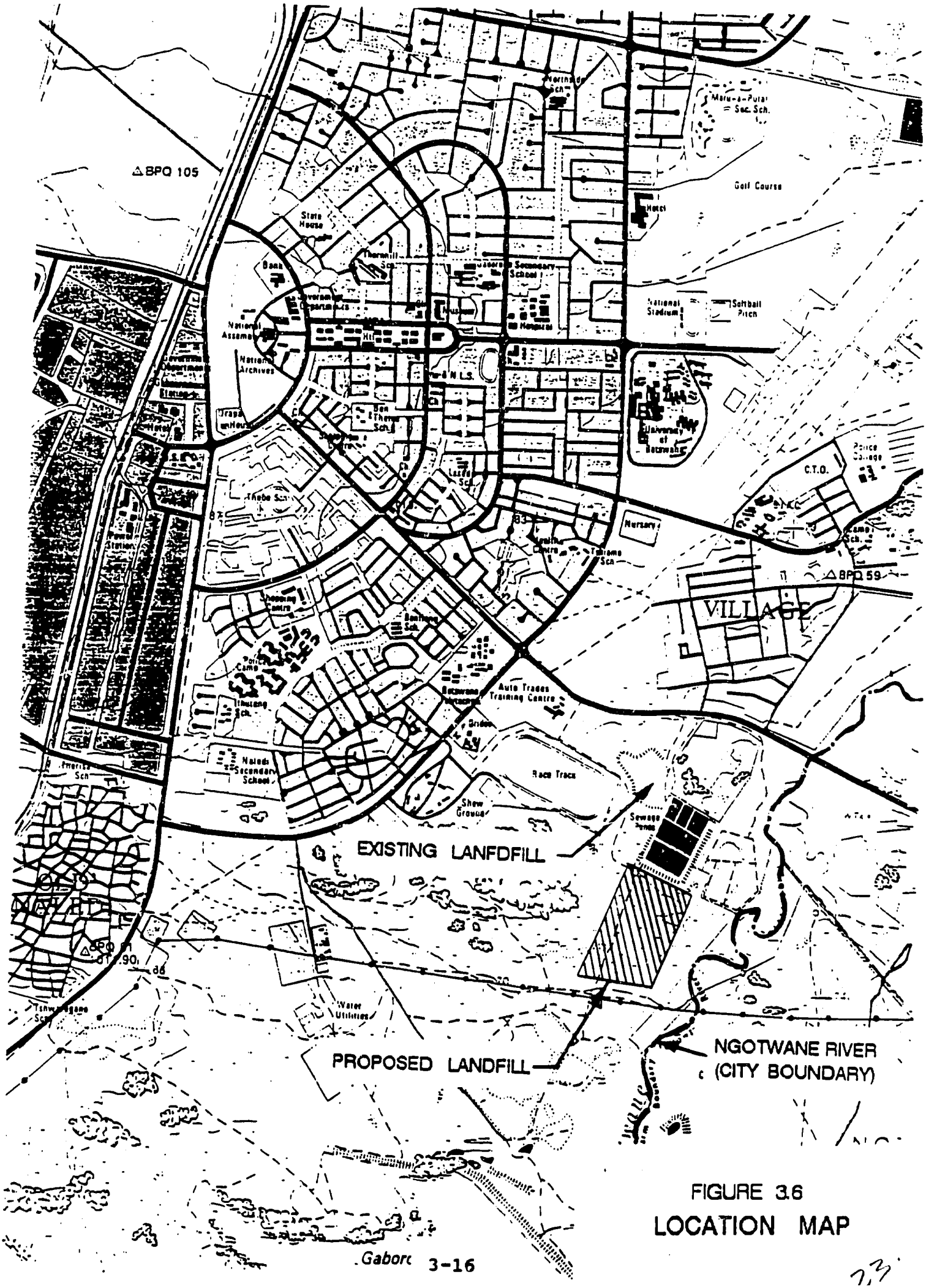

FIGURE 3.6
LOCATION MAP

Due to the current construction activity in the city, significant quantities of excavated earth material are being dumped at the landfill, which, if properly managed would be more than adequate for daily covering. Unfortunately, the material is usually dumped randomly along the landfill perimeter and mixed with the refuse. Although this process provides some minimum cover, daily cover is seriously deficient which has resulted in significant fly and rodent infestation, odours, and windblown debris. On 8 June 1991, the Team observed a fire that consumed nearly the entire working face of the landfill, estimated at 100 meters in length, demonstrating another problem associated with improper landfill operation. The odour of the burning refuse was easily identified in downtown Gaborone, 3 kilometers down wind of the landfill. These fires are reported to be a common occurrence.

Scavenging is legally banned but is a common practice at the landfill with an estimated 100 to 150 people searching through the refuse on a daily basis. Many of these people live in crude shelters surrounding the landfill. The scavengers are mainly searching for food and scrap metal. A previous commercial practice of reclaiming waste cardboard from the landfill was stopped last year due to worker health and safety issues.

Based on capital, labour and operating costs provided by the City, the existing costs of operating the landfill are summarized below.

Existing Landfill Costs

Item	Cost (Pula)
Capital Costs	
Compactor	P400,000
Bulldozer	300,000
Subtotal Capital Costs	700,000
Annual Capital Cost 5 yrs @ 8%	175,322
Recurrent Costs	
Labour	
Equipment operators (2)	14,600
Labourers (5)	20,000
Subtotal Labour	34,600
Cover Material	0
Maintenance & Supplies	12,000
Fuel	8,000
Administration @ 40% Labour	13,840
Subtotal Recurrent Costs	68,440
Total Annual Costs	243,762
Cost per tonne @ 21,900 TPY	P11.13

New Proposed Landfill - The Solid Waste Study prepared in 1985 by NZA Consultants, evaluated waste generation within the city and concluded that the existing landfill would be filled up in the near future and that a new site would be required. The study evaluated four potential sites, three of which were located outside the City limits in tribal land areas and the fourth located just southwest of the existing site as shown in Exhibit 3.6. Due to the difficulties encountered with locating the landfill in tribal lands, the City Council elected to pursue the development of the site as shown on Exhibit 3.6. Although the location and design of the proposed landfill are not within the scope of this study, observations were made during our work regarding the proposed site which are discussed below.

Very little data exists on the hydrogeological conditions of the proposed landfill. Although bedrock has been located by test pits

between 0 and 2 meters from the ground surface, more information regarding the groundwater flow should be obtained so that potential impacts from the proposed landfill can be assessed. Due to the close proximity of the Ngotwane River, significant environmental degradation could result from improper operation of the existing and proposed landfills. Underground seepage from the Gaborone Dam and reservoir should also be evaluated to determine actual groundwater flow directions.

Funding for the design and construction of the proposed landfill was approved in 1991 and the work is currently proceeding with field surveys and design. The approved funding was prioritized to complete the entrance road, weighbridge, fencing, utilities and site work first, with the remaining funds to be applied toward the construction of the first landfill phase.

3.4.2 Special Wastes

There are several special wastes that are being disposed of at the existing landfill that are causing specific problems or should be handled in a different manner.

Waste Oil - Improper disposal of waste oil is a major environmental problem in Gaborone. It is estimated that in excess of 800,000 litres of waste oil are generated annually in the City of Gaborone. Although some of this oil is being collected and sold for re-processing in South Africa, most of the oil is being dumped in sewer drains, dumped in the bush or tipped at the landfill. If this practice continues, the impact on ground and surface water resources could be environmentally devastating. A large pool of waste oil was observed at the former northern landfill near the Maru-A-Pula School and the Gaborone game reserve. This area is currently being filled in with clean fill in hopes of absorbing and immobilizing the oil.

Waste oil is also being tipped at the Tlokweng Road site, into a drainage ditch, near the south west corner of the sewage ponds. This activity has the potential of causing significant environmental damage to the nearby Ngotwane River when the rainy season returns this coming spring. Pools of oil that have collected in the ditch will be washed directly into the river during intense rainfall. Oil that has seeped into the sandy soil and bedrock could seep into the river over a longer period of time. This practice should be discontinued and corrective actions taken to remove the oil and contaminated soil. If collected and stored in drums, waste oil could be recycled through current markets in South Africa.

Abattoir and Brewery Waste - Approximately eight cubic meters per week of abattoir waste, consisting primarily of paunch contents and hoofs, are being tipped in a separate area of the landfill, adjacent to the sewage ponds. Odours and fly infestation are

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especially bad in this area due to the uncontrolled nature of the tipping and the lack of daily cover. This area is also used to tip waste grain mash from the brewery. Since these wastes are totally organic they could be composted very easily. Composting options will be evaluated in Section 4.3.

Medical Waste - The City's one hospital operates an incinerator that reportedly disposes of all surgical and patient care wastes. The Project Team was unable to gain access to the hospital facility to confirm this, but observations made of the black smoke coming from the incinerator stack would indicate that the facility is operating inefficiently. Ash from the incinerator is taken to the landfill. In addition to hospital wastes, other medical wastes which could be infectious are generated throughout the City by doctor's offices, clinics, dentists, and veterinary surgeons. Although procedures for proper handling and disposal of non-hospital medical waste have been established by the Health Department, there is minimal inspection or enforcement of these procedures.

3.4.3 Other Observations

Hazardous/Toxic Waste - The industrial and commercial sectors of Gaborone are growing at a very fast pace. Many of these industries are generating hazardous wastes which are currently being dumped in the City sewer systems or tipped at the landfill.

Open Burning of Rubbish - In addition to the frequent fires at the landfill, the Consultant Team observed many other instances of rubbish burning. Considering the composition of the waste, which includes many types of plastics, the open burning of rubbish produces toxic and noxious fumes that are a health concern. Although the majority of the plastics are polyethylene (HDPE & LDPE), including milk jugs and plastic bags, a considerable number of food containers are polyvinyl chloride (PVC) which can produce hydrochloric acid and dioxins when burned.

Beverage Containers - The vast majority of soft drinks and beer, sold in Gaborone, are produced in plastic containers or bi-metal cans with bottom and sides made of steel while the top is aluminum. The bi-metal beverage can, and plastic containers which currently have a relatively low recycle values, are major litter problems.

Proposed Landfill - Current plans call for the landfill to be lined with clay, with the installation of leachate collection and management systems. Clay liners have been shown to be less than totally effective as a lining material, especially where organic solvents have caused a breakdown in the clay soils resulting in leakage through the liner. Given the unknown nature of the industrial/commercial waste being generated in Gaborone and the close proximity of the Ngotwane River, consideration should be

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given to a more conservative liner material such as a plastic membrane. A liner made of high density polyethylene, properly manufactured and installed, would provide a much higher degree of environmental protection. If the current budget is not adequate to include the plastic liner, additional funds should be requested. It would be better to continue landfilling in the existing site than to begin the new site without adequate environmental protection.

3.5 INSTITUTIONAL STRUCTURE

There are two basic organizational systems that are used in managing the activities of either government or industry. The first is a hierarchical structure the emphasizes chain of command and has closely defined areas of responsibility and authority. This system is most identified with the military where it is essential that a field commander have the authority to make command decisions within his sector of operations instantaneously and perhaps without consultation. This system is usually preferred by those organizations that must respond to changing conditions that require more or less immediate action.

The second system is functionally based wherein the process is designed to make maximum use of professional and technical skills. The functional model emphasizes defused responsibility and authority causing the participants to utilize consensus building and participatory management. A town planning organization normally uses this structure to solicit professional input from architects, engineers, economic and social planners. A feature of this system is usually a high quality of decision after considerable consultation and frequent utilizations of ad hoc committees.

Government in Botswana is generally organized along functional lines that make use of the long history of consensus building manifest in the kgotla as a decision making system. It is characteristic of the system that it is highly responsive to the participants but is generally slow to respond to problems.

The primary institutional structure in which the solid waste collection and disposal system resides is the Health Department of the City Council of the City of Gaborone. The operating equipment used in collection and disposal however is assigned to the Transport section of the Engineering Department. The primary mission of the Health Department requires input from health professional at all levels of, city, district, and central government. Therefore a functional organizational structure is most appropriate to make use of the required talents and input from all levels of government.

However, the case currently under study, the collection of solid

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waste, is also the responsibility of the Health Department. This places an activity that needs to be reactive into a functionally organized structure.

Exhibit 3.7 is a representations of the organizational chart of the City of Gaborone. The lines of authority from the Councilors and the Mayor to the Chief Executive and in turn to the Department Heads infer a hierarchical flow of responsibility and authority that does not exist. Instead, the organization operates on a functional framework as a general rule. The City Councilors do have legislative authority to approve expenditures and the budget, Execution of the budget is in the hands of the Chief Executive. In a chart like this it is difficult to accurately portray the complex interrelationships that in fact exist. While the City Councilors have no command or executive authority, they do however, through a system of committees, and their significant political influence, profoundly effect not only daily operations but also overall policy direction.

In most hierarchal structures power to hire, promote,and dismiss is regularly vested in the line of supervision. In Gaborone city government this power is held by the Establishment Secretary for the Unified Local Government Service, an official of the central government. He generally exercises his authority in consultation with the effected department head and/or supervisor.

Generally, accepted practice in a function structure, as is represented in this organization at the departmental level, is the concentration of all resources necessary for completion of the mission for which it is responsible. Because our primary concern is the Health Department the example will be from this activity. The Health Department is recognized as having general responsibility for the public health. However two important elements are missing from the responsibility and control of the Chief Health Inspector, one the enforcement of health related Bye-laws. Enforcement authority resides in the Bye-laws Officer rather than in the person whose expertise is involved, and two, the vehicles used in waste management are under the control and budget of the Transport Department that is the responsibility of the City Engineer. Therefore the equipment operators are not accountable to same line of authority that has responsible for the equipment.

This is pointed out as an important characterization of the general tenor of government in Botswana. At the risk of over simplification we can make the observation that the government generally would use educational and persuasive inducement rather than punitive measures in their approach to the control of human behavior. If this observation is deemed valid then the implication for our current project is manifold. First, any recommendations should rely on participatory solutions if we expect to succeed.

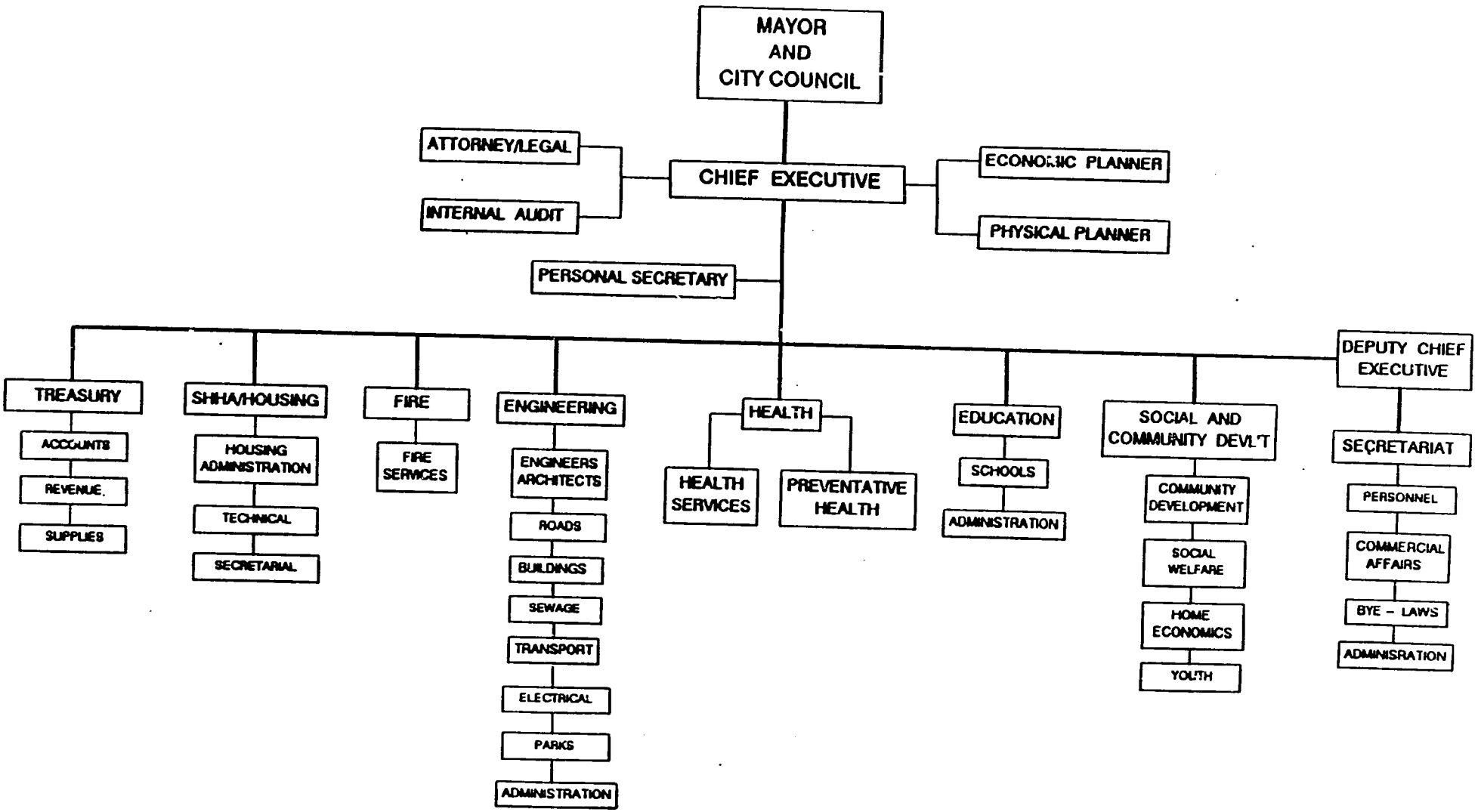

FIGURE 3.7
GABORONE CITY GOVERNMENT
ORGANIZATIONAL CHART

Second, any recommendation based on punitive enforcement will have a poor chance of being implemented or succeeding.

3.6 BUDGET

The Recurrent Budget for Gabarone provides a variety of numbers that can be used to evaluate the cost of solid waste collection and disposal. Depending on how one allocates management and administrative cost figures of up to P5.6 million for the current year can be estimated. Using the budget of Refuse Collection alone there has been an increase in cost of over fifty percent over the past two years while the population of Gabarone has grown by a maximum of twenty one percent during the same period.

The solid waste expenditures for the City of Gaborone are included in parts of several departmental or activity budgets. The table below is a chart of those parts of the budgets that are directly attributable to the collection and disposal of solid waste and an additional amount representing the annualized cost of equipment (see Appendix F). This method which excludes administrative and management cost was chosen because the numbers so derived most closely relate to actual savings the City might realize from the alternatives presented.

COMPOSITE BUDGET FOR SOLID WASTE FINANCIAL YEARS 90,91 92

		90	91	92
Transport 28% of total	P	444,220	625,570	717,746
Refuse Collection 35% of total		544,599	628,873	817,950
Annualized Equipment Replacement		268,256	268,256	268,256
		1,257,075	1,522,521	1,803,952
There are approximately 23,000 plots in Gabarone and they are picked up an average of once each week. The average cost per plot per week is;*		1.11	1.34	1.59

* This figure is based on 95% of the total of 23,000 plots being residential as reported in the 1985 solid Waste Study. This is particularly note worthy in that 5% commercial/industrial plots account for over 30% of the solid waste generated.

From information received from Mr. Kombe, Acting Chief Health Inspector, the solid waste collection portion of the Refuse Collection budget is about 35% of the total. In discussions with Mr. Pathmanaathan, City Engineer solid waste collection absorbs

about 28% of the Transport budget.

An annualized equipment replacement cost was determined by amortizing all equipment on an estimated purchase price for seven years as presented in Appendix F.

3.7 REGULATORY LEGISLATION

3.7.1 Township Act

The Township Act was enacted in 1966. It provides the basis for all responsibility and authority of local government. Chapter 40:02 of the constitution, Part V titled "Powers and Duties of Councils" Regulation 28.(2) provides,"Subject to the provisions of these Regulations , a council shall have power to do anything and enter into any transaction not unlawful which in its opinion is calculated to facilitate the proper discharge of any functions conferred or imposed upon it by or under these Regulations or any other law, or which is incidental or conducive thereto."

Regulation 29 is a little more specific in enumeration or the City's responsibilities, " It shall be the duty of a council to perform the functions it is required to perform and otherwise exercise its powers so as to secure and promote the health, order and good government of the area for which it has been established.

The contractual authority and procedure by which the City Councilors operate is specified in Regulation 38 as follows," If the liability of a council under any contract for the supply of any goods or materials or the execution of any works or the provision of any services, other than professional services, for or to the council is to exceed R 1 000 the contract shall be embodied in a formal document approved by the council and the council shall not enter into it without inviting tenders".

An important feature for privatization options that make it possible to consider unorthodox proposals that favor structures that impact Batswana owned new business is included in Regulation 45." (1) In considering quotations or tenders a council shall take into account the contractual reliability of the tenderers or the persons submitting quotations as well as the need to achieve economy,efficiency and the development of Botswana industries".

A further affirmation of this possibility is included in section (2) of the same regulation "A council is not obliged to accept the lowest or any tender or quotation but in any case where the lowest quotation is not accepted the reasons why it is not accepted shall be recorded in the council's minutes, and where the lowest tender is not accepted, the council shall report the reasons why it is not accepted to the Minister."

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Again in Chapter 40.02 the Township Act gives a specific delegation of responsibility for dealing with solid waste in the "FIRST SCHEDULE" (regulation 28)"FUNCTIONS WHICH MAY BE CONFERRED ON COUNCIL" as follows

> ..." 2. (1) To provide sanitary services for the removal and destruction of, or for otherwise dealing with, night soil and refuse.
> (2) To take steps in addition to those taken by any other authority to safeguard and promote public health and prevent the occurrence of or to deal with any outbreak or prevalence of any disease."

3.6.2 National Development Plan

The National Development Plan is not the law of the land but is a major policy statement. The NDP is rewritten every six years with a new focus and emphasis that reflects the changing political, economic and social conditions of Botswana. NDP 6 is the current plan in effect, however NDP 7 is expected to be released in the near future. Fortunately, the team was given the opportunity to review preliminary drafts of the appropriate sections to assure that no contradictions will be found in our use of the NDP 6.

It is well to show the governments support for some of the objectives of this project.

An initial commitment to the development of private enterprise in Botswana is found on page 54, paragraph 3.2 of NDP6 "Government is committed to careful planning to ensure that finance, manpower and natural resources are used effectively and in accordance with national priorities....The Government's commitment to planning is not intended to stifle private initiative but to create favorable conditions in which the private sector can contribute to national development." The commitment becomes more directed in the following statement from section 3.8 of NDP 6 "....Government must aim to create conditions in which private activities that are of national benefit can flourish."

Further,from the National Policy on Economic Opportunities page 64 of NDP 6 "...in general, the best way to stimulate the creation of opportunities is to provide incentives and support to the private sector..."

In this regard the central government made a commitment to local government as stated in section 4.2 "--Work towards encouraging greater decentralization in decision making, particularly of development related plans and projects and promote productive activities in order to generate more employment opportunities at local levels."

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3.7.3 Bye-Laws

The City Councilors and the Mayor derive their power to pass bye-laws to govern the city from the Township Act and other actions of the parliament related to specific responsibilities. In general Bye-laws track legislation from Chapter 40.02 and from regulation 28 FIRST SCHEDULE "Functions which maybe conferred on Council." Using Regulation 28 sec 2.(1)"To provide sanitary services for the removal and destructions of ...refuse, for its authority the city council developed a detailed bye-law on handling solid waste.

4.0 OPTIONS IN WASTE MANAGEMENT

4.1 INTRODUCTION

In order to provide alternatives for improvements to the current solid waste management system, the Consultancy developed a methodology for evaluating the current collection and disposal system and the legal and institutional considerations implicit in introducing privatization.

The methodology for assessing the current systems of service delivery varied significantly depending on the segment of the project under study. Initially, this consultancy examined the legal basis for delivery of Waste Management Services by reviewing the Township Act, the Bye-laws and the National Development Plan as they relate to the existing collection and disposal system.

Interviews were conducted with many public officials from both the central government and from the city council. Studies of waste management and of privatization in Botswana and other developing countries were reviewed for relevance to the current project. Representatives of the private sector were interviewed to ascertain perceptions of the current system and to solicit opinions on areas which require improvements.

At the same time, line supervisors were questioned to verify operations and policy. Job descriptions and files were reviewed and compared to actual observations. These assessments were shared with the Steering Committee as a basis for feedback and communication.

The team then divided the elements of the solid waste operations into management, organization, and administration for further study and problem identification. Problem identification lead directly to suggestions for remedial action which in turn were tested for legality, organizational acceptability, and consistency with other elements of the project.

4.2 DESIGN ISSUES FOR PRIVATIZATION

There are economic and social issues which need to be addressed in the decision to privatize solid waste management services. These issues relate to how privatization will impact efficiency, ownership of equipment, labour, cost recovery, recycling, and environmental concerns. These issues form a basis for comparing the privatization options presented in this chapter.

While issues presented may appear difficult to resolve, they have been successfully addressed in other privatization projects. Consideration of these issues in the early stages of project design

and development can help ensure that privatization options selected by the GCC will be viable and efficient. Design issues for privatization are summarized as follows:

- **Efficiency** - Privatization is designed to promote greater efficiency and cost effectiveness. Proposals will need to be evaluated in terms of their costs and level of service provided.

- **Ownership of Equipment** - If privatization occurs, a contractor may require appropriate equipment and some method for maintenance. Equipment could be either purchased directly by the contractor, or leased from the Engineering Department.

- **Labour** - The privatization of refuse collection will result in increased jobs in the private sector and job replacement within City Council. The public sector will require the addition of trained administrative staff for overseeing contracts.

- **Cost Recovery** - The privatization of solid waste management will result in costs impact to both the residential and commercial sector. These issues must be adaquately addressed in proposals under consideration.

- **Recycling** - Recycling activities in Gaborone have been limited to the private sector. As future landfill costs increase, recycling will become increasingly attractive and has social and environmental benefits.

- **Environmental Concerns** - Solid waste collection and disposal system impact both air, land, water quality. Litter and illegal dumping have been cited as major health concerns in the City of Gaborone. The selected options must consider these concerns.

4.3 COLLECTION OPTIONS

Described below are several privatization alternatives for consideration by the Steering Committee and Gaborone City Council. These alternatives are designed to improve collection efficiency and dependability for residents and businesses in Gaborone.

An important consideration in the decision to privatize any public service is the ability to meet three crucial criteria. These criteria: are ability to specify services required (i.e., to develop a clearly worded contract); developing safeguards to assure that satisfactory services are provided (i.e., developing

performance specifications); and developing competition so that a single entity does not dominate the market.

If each of these criteria are satisfied, privatization is an option that may be worth consideration. In the area of refuse collection, experience in other Countries has indicated that privatization can result in cost savings for the municipality.

The five privatization alternatives evaluated for collection service include:

A. Privatization of entire City (Gaborone West, South and North).

B. Incremental Privatization of Residential Collection.

C. Privatization of Commercial/Industrial Sector.

D. Privatization of Old Naledi with new collection strategy

E. Solid Waste Management by Parastatal

Based on the Consultant's analysis, and discussions with City Council staff, Alternative B, C,and D are the recommended privatization options. Thus, a more detailed description of these alternatives are provided in Chapter 6.

The remaining three alternatives which were not recommended for implementation are discussed in further detail below. Included is a synopsis, background, capital costs estimate, a review of equipment with capital cost estimates, contractual issues, and advantages and disadvantages for each alternative. In addition, the cost impact of each alternative is provided.

Cost impact is defined as the net effect on the unit cost (i.e., Pula per plot) compared to the existing costs. Cost impact is determined based on estimated efficiency of the various alternatives, capital costs, and management structure.

Alternative A. Privatization of entire City (Gaborone West, South and North)

Synopsis - This option would require that the consultants design a contract for all collection and disposal service. Under this option it is likely that a large experienced firm would bring in a management team and supplement it with local labor and drivers.
Background - Large international firms have a great deal of expertise that smaller firms must develop sometimes at great cost. A large firm will have the financial strength to overcome unexpected set backs and to provide almost certain backup service.

Description - The city would tender the entire system for bids on the basis of tonnes per day of handled waste. The successful bidder would be expected to use every available means to conserve landfill space by resource recovery systems and possibly composting. Other than normal service standards and preservation of landfill incentives most operating details would be left to the contractor.

Capital Cost - Not an issue in this alternative.

Cost Impact - The city would have to absorb a large number of displaced employees and possibly some equipment if the entire system were privatized in a single move.

Contractual Issues - There are no major difficulty in developing this kind of contract however because the volume of waste in Gaborone is so small at this time it may prove difficult to obtain bidders for any thing but a management contract at this time.

Assessment - This alternative addresses the desirable characteristics of: Promotes job in the private sector, probably effective and efficient initially, is responsive to growth, and would preserve or improve the environment.

Obviously local ownership and all local privatization issues are neglected. Additionally this option may lead to monopoly, high administrative and management costs and loss of local control.

Alternative B. Incremental Privatization of Residential Collection

Synopsis - A portion of Gaborone would be selected for contracting to a private company. Companies interested in tenders on the provision of solid waste collection would be pre-qualified and provided group training by BOCCIM or other appropriate agency in organizing and operating this kind of business. Bidders would not be helped on the tender itself however. Advertisement for tenders would be published and an award made under the laws of Botswana. The successful bidder would be trained under a Cohort system and prepared for all aspects of entrepreneurial waste collection if such training was requested or required.

Background - Two major thrusts of the government of Botswana are the development of private industry and training of management personnel. Additionally, there is significant interest in limiting the growth of local government expenses while aiding it to respond to the need of a rapidly expanding population. A service organization must respond quickly and decisively to constantly changing conditions therefore the entrepreneurial model of private enterprize is chosen as most appropriate to improve solid waste collection and to satisfy the above mentioned criteria.

Technical Description of Recommendation - Under this alternative a private company could be selected through appropriate tenders and assisted in organizing and operating the business of providing waste collection service to about one third of the residential plots of the city. Analysis indicates this would be about the smallest segment that could be economically feasible considering the capital cost involved.

The contractor would bid on a per plot price for providing an agreed standard of service. It is expected that the contractor would be assisted with intensive training and guidance through the first six months of operation by having a donor agency sponsored expert working as co-manager for this period if there is a need or interest on the part of the contractor or the City Councilors.

The use of the term Cohort is an adaption of the management system conceptually developed by Robert Goembiewski for training managers on the job. In this case, we propose the use of a donor provided expert in solid waste management to co-manage the organization and work hands-on in setting up financial and accounting systems, routing and management procedures. The Cohort would also be expected to assist the City Council in improvements to the public collection and disposal system.

Organizationally, it is anticipated that the contractor will utilize two crews with one backup vehicle. Each crew would service approximately 750 plots per day.

A more detailed description of this alternative is provided in Chapter 6.

Alternative C. Privatization of Commercial/Industrial Sector Only

Synopsis - Under this scenario, The City Council would inform all businesses that they must contract with a private franchised organization to provide disposal service within six months. In the mean while the city will advertize for tenders to enter a franchise agreement with the city wherein the successful tender would be allowed exclusive use of the city's streets and rights-of-way to collect solid waste from businesses in Gaborone at a price fixed in the franchise agreement, based on the service provided. The price would include escalation for fuel and general inflation.

Background - Business and Industry occupy a unique role in the waste system because production of waste is often directly related to their operations. Therefore disposal of this waste should be considered a cost of doing business. Under normal circumstances there is little justification for so directly subsidizing business without identifying a compelling public interest.
When faced with the possibility of a separate charge for solid waste disposal charge, businessmen sometimes argue that they pay

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rates to defray the cost of waste disposal. This approach fails to recognize the differences between various businesses. Some generate enormous amounts of waste compared to the rates they are assessed while others of great value add almost nothing to the waste stream. In addition, the separation will later provide a better basis for encouraging recycling and resource recovery. Separating the commercial collection from public service satisfies two of the governments basic objectives; 1, Increases jobs in the private sector, and 2, Reduces the cost of government.

From the information in Chapter 3, it is found that 34% of all solid waste that makes its way to the landfill is produced by the commercial sector. The production of solid waste bears no causal relationship to the rates paid by business, therefore rates are a poor method of assessing costs.

Technical Description of Recommendation - The city's part in this recommendation would include designing tenders for letting a franchise, drafting the necessary changes to the bye-laws, amending the business licensing bye-laws and training the Health Department personnel in enforcement. As a part of the franchise agreement the city would regulate the terms, conditions and prices of the franchisee and would receive five percent of gross receipts to pay for contract oversight and use of the streets. All companies would be expected to display their contract for the collection of refuse in their place of business and as a part of annual licensing. The Health Department would be given the responsibility to approve the level of service that each business should have. For example, a restaurant or food manufacturer would be expected to contract for daily collection, while a stationary store may only need one small container a week.

A more detailed description of this alternative is provided in Chapter 6.

Alternative D. Privatization of Old Naledi with New Collection Strategy

Synopsis - Collection of refuse in Old Naledi would be contracted to a local private organization, such as the Village Development Committee (VDC). In order to address the unique characteristics of the area, a new collection strategy is proposed.

Technical Description - This alternative would contract collection of refuse and part of litter pick-up in Old Naledi with a locally based organization. Management and financial training during the implementation of this alternative would be provided by a donor agency. Appropriate equipment would be procured by the City Council.

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Under the new collection strategy each plot would receive an amply supply of plastic bags. The plastic bags would be collected via farm type tractor with an attached five cubic meter trailer. Once the trailer is full, the tractor would deliver the bagged waste to a designated transfer area. This waste would then be delivered to the landfill by a City Council compactor vehicle.

To address the significant litter problems in Old Naledi, this option includes the placement of empty trailer containers in targeted areas.

A more detailed description of this alternative is provided in Chapter 6.

Alternative E. Formation of Parastatal

Synopsis - Solid Waste Management by Parastatal: Because parastatals have more flexibility in responding to changing conditions and they are able to recruit and retain skilled personnel more effectively a parastatal may be an acceptable alternative to the current system. The Electrical Power and the Water parastatals both have collection units and can enforce payment in many cases that the city could not by denying other service if there were a decision to institute a service charge in the future.

It is doubtful that the service would improve under this option and there is no reason to suggest that the cost of service would go down. However, management and responsiveness may be effected.

Description - The description of this alternative is generally parallel to that of the total privatization option.

Cost Impact - The cost of service would likely remain constant on a per plot basis initially. Cost may rise as the bureaucracy develops.

4.4 DISPOSAL OPTIONS

4.4.1 Issues

The assessment of the current disposal system, found in Section 3.4 concluded that the existing system (landfill) is uncontrolled and has resulted in significant, environmental, public health and social impacts, especially to those residents living near the landfill. Since the alternatives needed to mitigate these deficiencies are primarily technical in nature, this section on disposal options will first present the technical options for improvement of disposal operation, followed by a presentation on Privatization alternatives.

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In the context of this report, disposal will also include any processing of the waste that occurs after it has been collected. Processing methods include low tech alternatives like sorting and material separation as well as more complicated alternatives such as composting and incineration. All processing alternatives will serve to reduce the mass and volume of the waste requiring disposal, but they will not replace the need for a landfill. The processing of the waste, which includes removal of materials or reduction of waste volume through composting or incineration, will extend the life of the landfill.

In consideration of long-term disposal alternatives it is important to maintain flexibility in the presentation, selection and implementation of the selected plan. Economic, political and social changes will most likely occur during the planning period and while the plan must be firm enough to insure that the desired service is performed at a predictable cost and efficiency, it must also be flexible enough to respond to changes that may occur during the planning period. This is especially true of disposal alternatives in Gaborone since the new proposed landfill will have a limited life and the location and implementation of the next landfill will be far more difficult and costly. Therefore, the proposed landfill must be considered as a valuable resource and alternatives will be presented and evaluated in terms of their resultant effect on landfill life, as well as their economic and environmental impacts.

Cost estimates have been prepared for each disposal method and integrated into the presentation of alternatives. These estimates are based on conceptual design assumptions, similar reference systems, good engineering practice and in all cases adjusted for local labor conditions. Initial capital expenditures were annualized over twenty-five years at eight percent (8%) interest and an equipment reserve fund is included in recurrent costs to replace equipment throughout the life of the facility. These estimates are intended to serve only as a basis for comparison of alternatives and should not be assumed to reflect actual construction or operating costs. Upon selection of a disposal alternative, preliminary and final design phases should be completed to finalize cost estimates.

4.4.2 Disposal Methods

The following disposal methods are included in the presentation of disposal alternatives:

Landfill

The new landfill, currently under design, will be approximately thirty hectares in size and will be constructed in phases. The first phase, estimated to begin in late 1991 or early 1992 will

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include site work, access roads, fencing and administration facilities for the entire site plus construction of the first 100 x 150 meter cell. Although details are not yet finalized, the landfill will be lined with either a clay or synthetic liner and include leachate collection and management systems.

Based on information presented in the 1989 NZA report and the 1991 ARUP report, the capital and recurrent costs of the proposed landfill have been estimated and are included in Appendix E. Since the amount of waste material requiring landfilling will vary depending on the amount of processing, the initial cost estimate has been expanded to reflect annual costs at different capacities. These estimates are included in Appendix E and are included in Exhibit 4.4, Alternatives Cost Summary.

Materials Recovery

The waste in Gaborone contains many materials that have a post consumer value or should not be placed in the landfill for environmental or health reasons. A waste sorting facility has been recommended in past reports and the current site of the new landfill has a 50 x 50 meter area assigned for this facility. Based on the waste generation and composition study it is estimated that fifteen tonnes per day of materials could be removed from the waste, including three tonnes of glass, four tonnes of tin, six tonnes of paper and two tonnes of plastic. Actual amounts will depend on the amount of source separated recycling that occurs prior to the waste reaching the sorting facility. For the purposes of this report we have assumed that all mixed waste will be processed through the sorting facility while source separated organic material or other waste containing no recoverable material would proceed directly to the landfill or other processing component of the facility. A further description of the sorting facility and cost estimate is included in Appendix E. A summary of cost estimates is included in Exhibit 4.4.

Composting

Composting is defined as the natural biological decomposition of organic waste material under controlled conditions. The finished product of the process is a soil conditioner and erosion control material. In Botswana the compost will increase the native soil's ability to retain moisture and would have many market applications. For the purposes of this report we have assumed that all of the compost would be used for public works projects such as covering the closed landfills. If the compost component of the disposal system is privately operated, the City would have the option of taking the compost for its own usage or allowing the private operator to market the material to private and commercial users.

The Waste Generation Study and Weighing Program identified three to five tonnes per day of source separated organic material that could

be composted using low technology methods. These materials include vegetable waste, brush, feathers, manure and paunch contents. With a minimum investment these materials could be turned into a very high grade agricultural compost. Since these materials only represent six percent of the disposed waste, the composting of source separated organic material will have only a minor impact on landfill life. A more intensive composting system, following the sorting facility, will have a more dramatic effect on the landfill life, diverting an estimated twenty-seven TPD or forty-five percent of the disposed waste. A composting system designed to process an initial forty-five TPD is shown graphically in Exhibit 4.1 and described in more detail in Appendix E.

Incineration

Incineration produces the greatest volume reduction in the waste to be landfilled but also is the most expensive waste processing option. In addition to the high capital and recurrent costs, air pollution and ash handling problems can result if the incinerator is not operated properly. Waste incinerators that also produce energy in the form of steam or electricity are called Waste-To-Energy facilities. A further discussion and cost estimates of Waste-To-Energy are included in Appendix F and estimated costs are included in Exhibit 4.4.

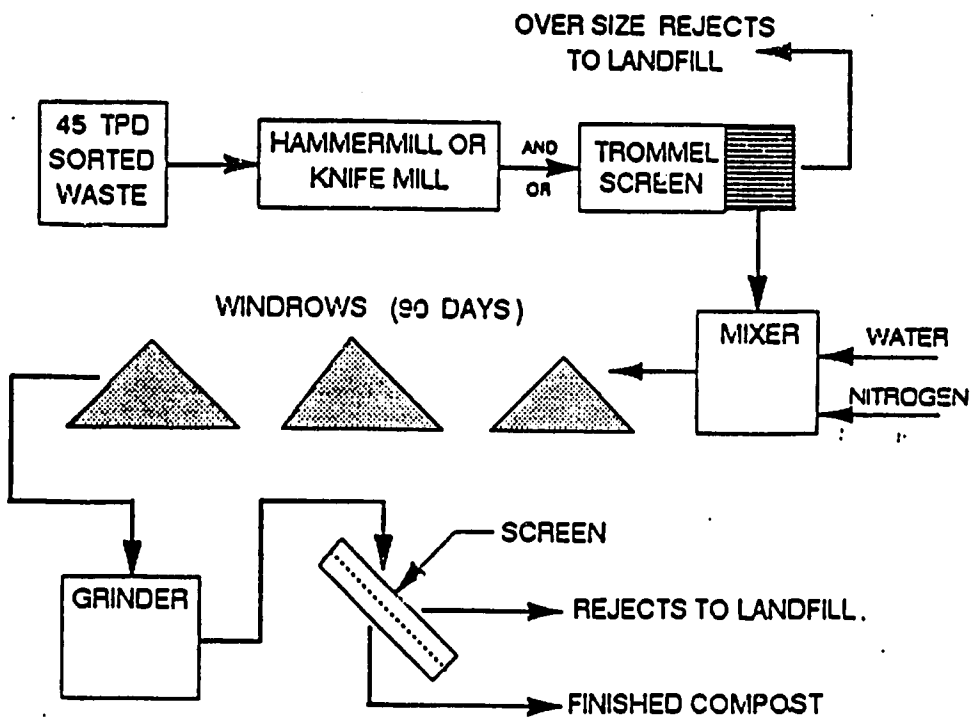

EXHIBIT 4.1 COMPOSTING SYSTEM

4.4.3 Privatization

The Issues - The current landfill is being poorly operated. In terms of pure economic efficiency (cost), the landfill operation rates high because the disposal is being accomplished with a minimum amount of manpower and resources. Unfortunately, the relatively low price being paid for this economic efficiency is more than overshadowed by the major environmental, health and social problems that are resulting from the improper operation. The key issue in considering public versus private operation is the improvement in operation in order to reduce or eliminate the current negative impacts. This improvement in operation, whether it remains public or is privatized, will most certainly result in significant cost increases.

Due to the potential for negative impacts from improper operation, accountability for operation is the biggest issue in evaluating Privatization of disposal alternatives. With public operation, accountability is often difficult if not impossible to maintain. Without well trained managers and operators, and frequent inspections, the current system has failed to operate a controlled landfill. Accountability through private operation will be much easier to define and enforce since the performance standards and conditions of operation can be enumerated in the contract agreement along with inspection provisions and penalty clauses if the performance standards are not maintained.

Ownership - Since the new landfill will be built on City owned land, ownership should reside with the City, with the option of privatizing operation. But the sorting and composting facilities would be totally new facilities and there are several privatization options that may include ownership as well as operation. Key issues in preparing an owner/operator agreement include risk sharing, payment formulas, performance standards and a contractual mechanism by which the City can assume ownership in the event of non-performance as defined in the agreement. Other options could include public ownership of the buildings and grounds, with private operation and ownership of equipment.

Design/Build/Operate - This is another privatization structure that may be suitable for the disposal alternatives. Although the landfill is already under design, the other potential components of the disposal system, the sorting facility, the composting facility and the incinerator could be privatized through a single contract that includes design, construction, and operation. The contract could be written to include either public or private ownership of the facility.

4.4.4 Alternatives

The disposal methods outlined above have been grouped into six (6) alternatives for further evaluation and consideration by the City

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Council. These alternatives are shown graphically on Exhibits 4.2 and 4.3 and described as follows:

Alternative 1 - This alternative basically continues the existing disposal procedures of landfilling wastes, as collected, under controlled conditions in the new landfill. Under this alternative the new landfill will have an estimated life of approximately twenty-seven (27) years. Operation could be either public or private.

Alternative 2 - A waste sorting facility would be added in Alternative 2 to remove those materials having a current recycling value or those materials that should not be landfilled. The sorting would be performed manually for glass, paper and plastic but a magnetic separator could be used to remove tin cans and other ferrous materials. Based on previous studies it is estimated that the sorting station could remove approximately fifteen tonnes per day of materials. The facility could be equipped with its own baler for processing materials or they could be transferred to an existing baler in West Gaborone for processing and marketing. The removal of the fifteen tonnes per day would extend the landfill life from 27 to 31 years.

Alternative 3 - This alternative would expand Alternative 2 by adding a waste processing facility after the sorting operation which would produce compost materials. Processing would include further handpicking to remove inert materials that will not compost, and also mechanical devices to separate materials by size and density. It is estimated that sixty percent (60%) of the 45 tonnes per day of sorted waste would be diverted, while 18 tonnes per day will be rejected material and sent to the landfill. Alternative 3 will extend the life of the landfill to an estimated 44 years.

Although the process itself is very basic, a composting plant must be operated and managed properly in order to ensure a high quality compost product and to control odours. For these reasons it is suggested that the compost facility be operated by the private sector.

Alternative 4 - Alternative 4 adds a waste incinerator to the system to reduce the volume of rejected waste that ultimately reaches the landfill. Since the waste will have been well separated by the time it reaches the incinerator, most of the inert materials will have been removed and ash percentages would be very low. Of the 18 TPD of sorted waste entering the incinerator, we estimate that only two tonnes per day of ash would require landfilling. With this fully integrated disposal system, we estimate that the life of the proposed landfill would be extended to 78 years.

Any alternative that employs waste incineration should be reviewed carefully for its environmental impacts and air pollution control equipment. Capital cost will be an important factor in evaluating waste incineration.

Alternative 5 - After having reached the fully integrated system, described in Alternative 4, there are three additional alternatives that could involve waste incineration. Alternative 5 combines a waste sorting facility, waste incinerator and landfill. Collected waste would be reduced from 60 TPD of mixed waste to an estimated four TPD of ash to be landfilled. Landfill life under Alternative 5 is estimated at 65 years.

Alternative 6 - This alternative assumes that collected waste is fed directly into a 60 TPD incinerator. Since the inert bottles and cans would remain in the waste, the volume of ash remaining from the incineration would be much greater than if the waste had been presorted. Under this alternative, it is estimated that 21 TPD of ash would still require landfilling, resulting in a landfill capacity of 46 year.

4.4.5 Evaluation of Alternatives

Economic Impacts - The estimated costs of the disposal alternatives are summarized in Figure 4.4. Each alternative is summarized in terms of total annual tonnes of waste disposed, tonnes of waste diverted from the landfill through sorting, composting or incineration and the resultant landfill life. Annual capital and recurrent costs are presented minus any revenues derived from the sale of materials or energy.

As stated earlier, the degree of processing directly affects the life span of the landfill. For each tonne of waste that is diverted, a cost saving will be realized by the City in terms of reduced landfill costs. Unfortunately, these cost savings will not be fully realized in the present and are actually costs that will be avoided at some point in the future by increasing the life of the landfill. For instance, a forty percent (40%) reduction in waste will not reduce current disposal costs by forty percent (40%) since many of the costs are fixed costs and will not be reduced by reductions in the amount of waste.

This economic concept is known as "avoided cost" and represents capital cost savings at some point in the future. Since these future costs are nearly impossible to predict we have selected a simplified method of applying the avoided cost concept to the comparison of alternatives. Alternative 1, Landfill without any waste diversion, will be considered the base case with annual

capital costs of P288,534 or P13.17 per tonne. Each subsequent alternative that diverts waste from the landfill through recycling, composting or incineration, will be given a P13.17 credit for each tonne of waste that is diverted. This credit is then subtracted from the net cost per tonne to obtain a "comparative" cost per tonne.

The application of avoided costs results in Alternate 3, Sort, Compost and Landfill as having similar comparative costs as the base case, landfill only. Although the alternatives that include incineration result in the greatest reduction of waste, and extension of landfill life, the high cost of building and operating these plants is significantly greater than the savings in landfill space and results in higher comparative costs.

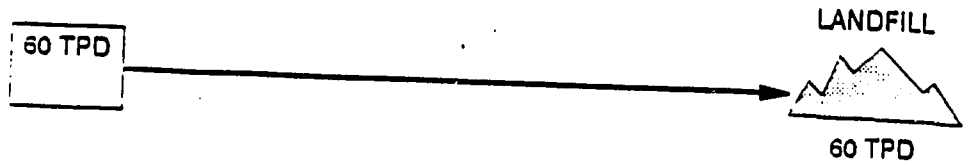
Environmental Impacts - Alternatives 2 through 6 all include processes that reduce or eliminate the amount of organic matter being landfilled and therefore reduce environmental impacts. Although the incineration process provides the greatest reduction in organic matter, creating a relatively inert ash, uncertainties regarding the incoming waste quality and the potential of improper operation could produce toxic ash and/or air emissions. This is especially true in Botswana where the industrial sector is rapidly expanding and a system for the identification and disposal of hazardous waste has not been implemented.

This same uncertainty over the quality of the incoming waste could also affect compost quality but to a lesser degree than incineration. If the waste is presorted prior to entering the compost system, there is less of a chance of hazardous waste getting into the system.

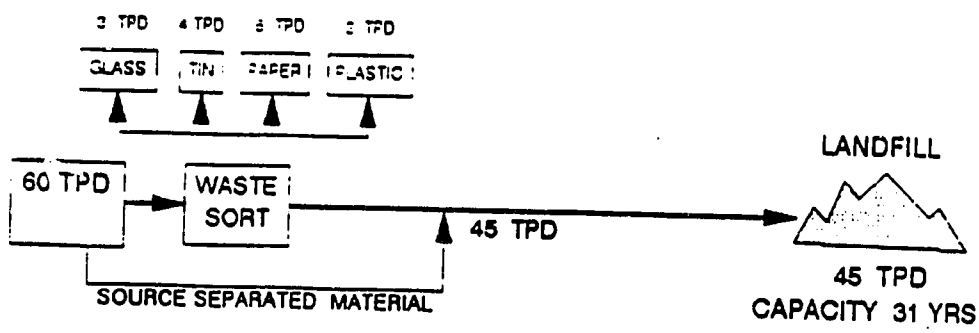
A more thorough discussion of environmental impacts will be presented in Section 5, Recommended Strategies.

4.4.6 Alternatives Summary

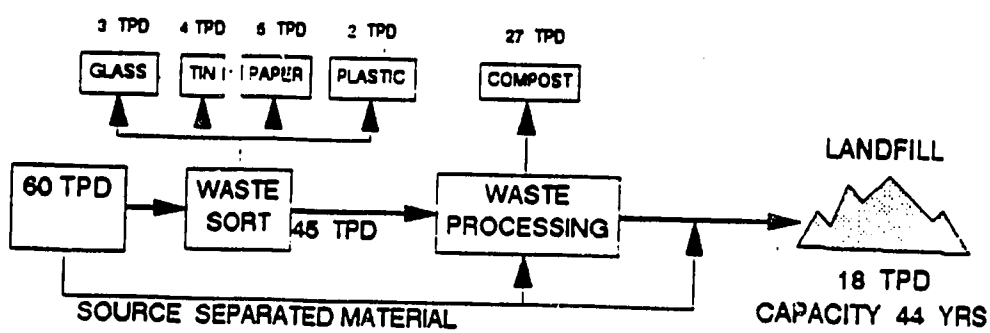
The current landfill is being operated at relatively low cost, but operation is uncontrolled and is causing significant environmental, public health and social impacts. In addition to the proposed new landfill, currently under design, additional processing and diversion of waste through sorting, composting and incineration will increase landfill life. Although disposal costs will increase dramatically as landfill operation is improved, and will increase still further with the addition of processing systems, the future cost savings in avoided landfill costs, will offset much of the additional processing costs. At this point in the report, it appears that Alternative 3, consisting of a sorting facility, composting facility and an 18 TPD landfill is the preferred technical alternative from both a comparative cost and environmental viewpoint. Privatization of all or a portion of the disposal components should be considered.



ALTERNATE 1
LANDFILL



ALTERNATE 2
LANDFILL WITH WASTE SORT



ALTERNATE 3
LANDFILL WITH WASTE SORT & COMPOSTING

EXHIBIT 4.2
DISPOSAL ALTERNATIVES 1, 2, & 3

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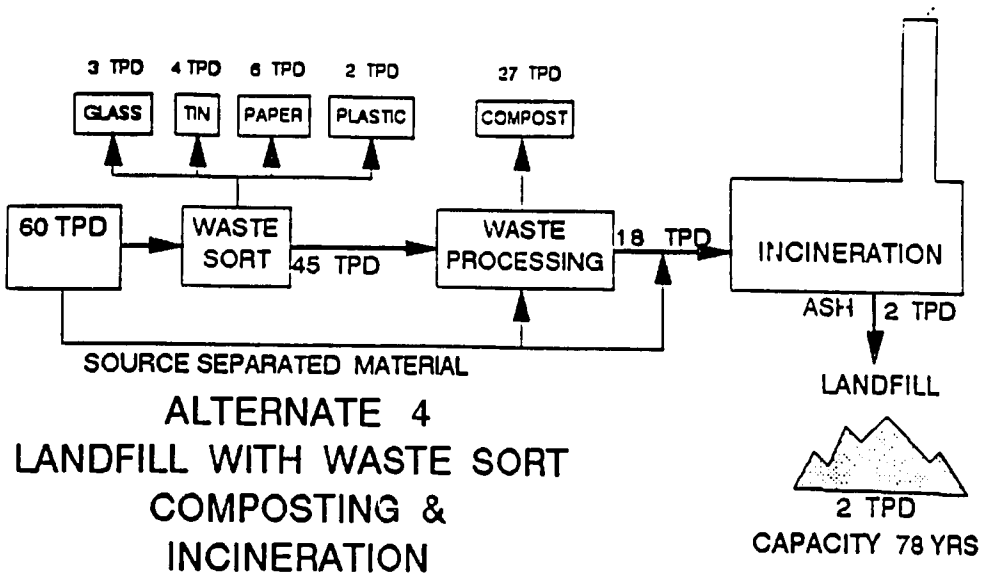
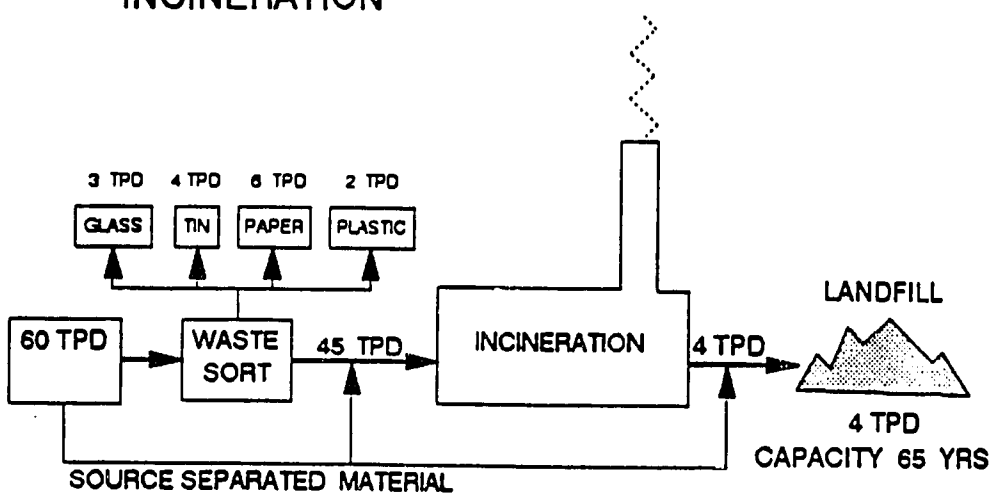
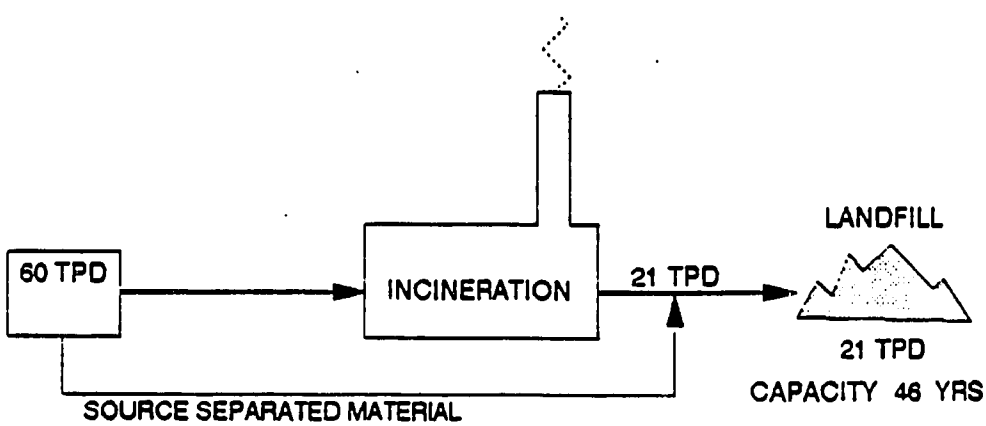


ALTERNATE 4
LANDFILL WITH WASTE SORT
COMPOSTING &
INCINERATION



ALTERNATE 5
LANDFILL WITH WASTE SORT
AND INCINERATION



ALTERNATE 6
LANDFILL WITH INCINERATION

EXHIBIT 4.3
DISPOSAL ALTERNATIVES 4, 5, & 6

EXHIBIT 4.4

ALERNATIVES COST SUMMARY

(Revised 11-6-91)

	ALT 1 LANDFILL	ALT 2 SORT LANDFILL	ALT 3 SORT COMPOST LANDFILL	ALT 4 SORT COMPOST INCINERATE LANDFILL	ALT 5 SORT INCINERATE LANDFILL	ALT 6 INCINERATE LANDFILL
GENERAL DATA						
TONNES DELIVERED	21,900	21,900	21,900	21,900	21,900	21,900
TONNES DIVERTED	0	5,475	15,330	21,170	20,440	14,235
TONNES LANDFILLED	21,900	16,425	6,570	730	1,460	7,665
LANDFILL LIFE (YEARS)	27	31	44	78	65	46
CAPITAL COSTS						
SORTING	0	1,590,000	1,590,000	1,590,000	1,590,000	0
PROCESSING	0	0	1,212,000	1,212,000	0	0
INCINERATION	0	0	0	5,425,000	8,925,000	10,425,000
LANDFILL	3,080,000	3,080,000	3,080,000	3,080,000	3,080,000	3,080,000
SUBTOTAL CAPITAL COSTS	3,080,000	4,670,000	5,882,000	11,307,000	13,595,000	13,505,000
ANNUALIZESD CAPITAL COSTS	288,534	437,486	551,026	1,059,240	1,273,580	1,265,148
RECURRENT COSTS						
SORTING	0	232,000	232,000	232,000	232,000	0
PROCESSING	0	0	163,000	163,000	0	0
INCINERATION	0	0	0	750,000	900,000	1,270,000
LANDFILL	418,500	374,000	247,500	166,500	166,500	226,500
SUBTOTAL RECURRENT COSTS	418,500	606,000	642,500	1,311,500	1,298,500	1,496,500
TOTAL ANNUAL COST	707,034	1,043,486	1,193,526	2,370,740	2,572,080	2,761,648
ANNUAL REVENUES	0	27,375	224,475	336,797	214,575	299,520
NET ANNUAL COST	707,034	1,016,111	969,051	2,033,943	2,357,505	2,462,128
NET COST PER TONNE	32.28	46.40	44.25	92.87	107.65	112.43
AVOIDED COST (PULA/YR)	0	72,106	201,896	278,809	269,195	187,475
COMPARATIVE COST PER TONNE	32.28	43.11	35.03	80.14	95.36	103.87

5.0 PRIVATE SECTOR ASSESSMENT

5.1 GENERAL CHARACTERISTICS

In meetings with the members of the Steering Committee and assessment of relevant public policy statements and the project Scope of Work, it was possible to identify several desirable characteristics of the firm or firms with which the City might contract all or part of the solid waste management system. First, there was general consensus that being locally based was a desirable if possible. It is hoped that this would increase the responsiveness of the contractor. Second, several thought that a small company would more closely satisfy the national goal of developing a managerial class in Botswana, and third, experience in the provision of public service would be an asset in the organization chosen.

5.2 LOCAL CONTRACTORS

Several local contractors were contacted who were interested in one part or another of managing the solid waste disposal system of Gaborone. In each case the interested party had either a narrow interest i.e., presorted compostable materials, were under capitalized for the size of the project, were lacking sufficient breadth of experience, or had no Matswana involvement in ownership. These contractors will be available for possible consideration of segments of the system if this is an alternative chosen by the Mayor and City Councilors.

In addition, representatives of the Botswana Conference of Commerce Industry and Manpower were contacted and expressed an interest in working with any new entrepreneurs who need business training or assistance. If an economically viable business plan were developed it was felt that there would be no difficulty in finding interested companies.

The Botswana Development Corporation also expressed a willingness to consider financial participation in a viable business venture of this type.

5.3 INTERNATIONAL CONTRACTOR

The general view of the international solid waste contractors that were contacted was that the limited volume of waste does not economically justify their interest. There was some interest in providing management services on a consultancy basis. At this point there seemed no advantage to consideration of an

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international firm in view of the criteria developed in the methodology section. A South Africa firm wishing to expand into Botswana may have an interest in the tenders and will have to be evaluated with other options.

5.3 CONTRACT ADMINISTRATION

Contract administration of the type under consideration would be expected to fall under the authority of the City Engineer. This is the office with production contract experience and has expertise in landfill operations and material handling. If there is a decision to utilize three or more contracts it would be reasonable to consider using a local engineering firm for contract administration. Each alternative for privatization includes the individual characteristics of the activity in consideration. The team will provide guidelines and training to persons selected by the City Engineer in contract monitoring and enforcement. In addition, the Cohort manager will be able to provide a great deal of training and assistance in contract management. As many empirical tests of contract compliance will be included as are useful for verification. For example, a weigh bridge will be installed at the new landfill during its construction so that activities and volumes can be monitored. cross-reference forms will be designed to minimize or identify contract violations and to assure that all waste is being properly handled.

6.0 RECOMMENDED STRATEGIES

This chapter presents the recommended options for collection and disposal of solid waste in Gaborone. Particular attention is focused on privatization schemes and the organizational and financial structures they would assume. In addition, a section is provided for improvements to the existing system, and observations and recommendations for future consideration.

6.1 PRIVATIZATION OPTIONS

6.1.1 COLLECTION

As described in Chapter 4, the consultancy evaluated five privatization options for the City of Gaborone. These options are identified below.

A. Privatization of entire City (Gaborone West, South, and North)

B. Privatization of Residential Sector in an area of Gaborone.

C. Privatization of Commercial/Industrial Sector

D. Privatization of Old Naledi with New Collection Strategy

E. Solid Waste Management by Parastatal

The two options that require privatization of the entire City, A and E, were not selected. Option A was not accepted due to the high risk of inadequate service, large number of displaced employees, and the system does not promote competition in the private sector. Option E was not considered because it did not appear to provide any cost savings, and it was uncertain whether service would improve.

The overall privatization programme recommended for Gaborone includes a combination of options B, C, and D. Privatization of these three alternatives has the potential to improve collection service in Gaborone, and reduce overall costs to the City Council.

For each of the recommendations, the following information is provided: synopsis; background; technical description; financial; and economic and social analysis. The financial analysis is divided into two sections, capital expenditure and recurrent costs. The economic and social analysis provides a brief description of any potential environmental, finance or health impact.

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Each of the collection recommendations are described below.

OPTIONS

B. Incremental Privatization of Residential Collection.

Synopsis - As outlined in Alternative B of Chapter 4, Section 4.1.1, an area of Gaborone consisting of approximately nine thousand residential plots can be isolated for a demonstration privatization project. Companies interested in tenders on the provision of solid waste collection would be pre-qualified and provided group training by BOCCIM or other appropriate agency in organizing and operating this kind of business. Bidders would not be helped on the tender itself however. Advertisement for tenders would be published and an award made under the laws of Botswana. The successful bidder would be trained under a Cohort system and prepared for all aspects of entrepreneurial waste collection if such training was requested or required.

Background - Two major thrusts of the government of Botswana are the development of private industry and training of management personnel. Additionally, there is significant interest in limiting the growth of local government expenses while aiding it to respond to the need of a rapidly expanding population. A service organization must respond quickly and decisively to constantly changing conditions therefore the entrepreneurial model of private enterprize is chosen as most appropriate to improve solid waste collection and to satisfy the above mentioned criteria.

Currently the standard by which waste collection service is evaluated is the performance of the public sector operation. This alternative proposes to add a private business service in a part of the city to form the basis for comparison. After an appropriate development period an informed decision can be considered to expand privatization or to return to the public system.

Technical Description of Recommendation - Under this alternative a private company could be selected through appropriate tenders and assisted in organizing and operating the business of providing waste collection service to about one third of the residential plots of the city. Analysis indicates this would be about the smallest segment that could be economically feasible considering the capital cost involved.

The contractor would bid on a per plot price for providing an agreed standard of service. It is expected that the contractor would be assisted with intensive training and guidance through the first six months of operation by having a donor agency sponsored

interest on the part of the contractor or the City Councilors.

The use of the term Cohort is an adaption of the management system conceptually developed by Robert Goembiewski for training managers on the job. In this case, we propose the use of a donor provided expert in solid waste management to co-manage the organization and work hands-on in setting up financial and accounting systems, routing and management procedures. The Cohort would also be expected to assist the City Council in improvements to the public collection and disposal system.

Organizationally, it is anticipated that the contractor will utilize two crews with one backup vehicle. Each crew would service approximately 750 plots per day.

Financial Analysis - Based on data produced in Chapter 3, the cost to the Gaborone City Council for solid waste collection in the 1991-92 financial year is P1.67 per plot and has grown at a rate of twenty-six percent from 1990 to 1991 and by twenty-three percent from 1991 to 1992. If the rate of increase continues unabated, the cost per plot per week will exceed P 1.90 by the next financial year in which this proposal could become effective.

Exhibit 6.1, presented below, is representative only and provides estimates by which the economic feasibility of the proposal can be judged and the private sector's performance may be compared.

Recurring Cost - According to the calculations the recurring cost to the City Council will be approximately P1.70 per plot per week or about P796,830 in the first year.

Capital Cost - This alternative requires no capital investment on the part of the City Council, however because the City Council can borrow money at much more favorable rates than industry it will save money if they provide the capital equipment and lease it to the contractor during the term of the contract. Substituting a lease cost, designed to pay the cost of the equipment and eight percent interest in seven years, there is a savings of P56,700 per year or a reduction of P.12 per plot per week to P1.58 per plot per week and a gross estimated cost of P740,130 per year.

Exhibit 6.1
Estimated Cost Calculations
for Private Solid Waste Collection

Capital Equipment:			
Compactor Trucks 3 @ P200,000	=	P600,000	
Pickup Truck 1 @ P30,000	=	30,000	
Containers 9,000 @ P110	=	990,000	
Total Capital Cost		P1,620,000	
at fifteen percent interest for seven years.....Annualized Capital Cost			P352,928
Manpower:			
2 drivers 2 @ P12,480	=	P24,960	
12 crewmen @ P9,300	=	112,320	
2 chargehands @ P10,920	=	21,840	
Clerk-sec'y @ P6,000	=	6,000	
Owner-Manager @ P50,000	=	50,000	
benefits @ forty percent employee	=	86,048	
Total Manpower Cost			P301,168
Operations and Maintenance:			
Material	=	P8,000	
Repair	=	4,000	
Fuel	=	8,000	
Insurance	=	15,000	
Rent	=	36,000	
Total O&M Cost			P71,000
Profit @ twenty percent of Manpower and O&M Costs			P71,734
Total annual cost including profit			P796,830
Divided by 9,000 plots per week = P1.70			

Economic and Social Analysis - This alternative will stabilize costs for solid waste collection, and avoid large periodic capital expenditures for containers and equipment. Service will improve and management will maintain better control over quality of service. This alternative will demonstrate the viability of privatization as an option for provision of social services. The Cohort will be able to supply significant support to the City Council in other solid waste operations during his term in Gaborone. It will be necessary to include an inflation rate factor if the contract is more than two years. Also, if Council wants a short term contract (two years or less) it will be necessary to include a buy out clause to cover capital debt. Many of the immediate monetary advantages to the Gaborone City Council depend on its ability to absorb extra personnel in other positions or placing them with the contractor. This selection satisfies all of the criteria suggested in the methodology section of this report.

C. Privatization of Commercial/Industrial Sector

Synopsis - Under this scenario, The City Council would inform all businesses that they must contract with a private franchised organization to provide disposal service within six months. In the mean while the city will advertize for tenders to enter a franchise agreement with the city wherein the successful tender would be allowed exclusive use of the city's streets and rights-of-way to collect solid waste from businesses in Gaborone at a price fixed in the franchise agreement, based on the service provided. The price would include escalation for fuel and general inflation.

Background - Business and Industry occupy a unique role in the waste system because production of waste is often directly related to their operations. Therefore disposal of this waste should be considered a cost of doing business. Under normal circumstances there is little justification for so directly subsidizing business without identifying a compelling public interest. When faced with the possibility of a separate charge for solid waste disposal charge, businessmen sometimes argue that they pay rates to defray the cost of waste disposal.

This approach fails to recognize the differences between various businesses. Some generate enormous amounts of waste compared to the rates they are assessed while others of great value add almost nothing to the waste stream. In addition, the separation will later provide a better basis for encouraging recycling and resource recovery.

In addition, there is no question that the City and the State provide much value for the rates received. Most important is a political and economic climate that is not only receptive but protective of enterprise. Additionally one may look at tax and investment laws, safety of the streets and the commitment of government to training workers, supervisors and managers for production.

Separating the commercial collection from public service satisfies two of the governments basic objectives; 1, Increases jobs in the private sector, and 2, Reduces the cost of government.

From the information in Chapter 3, it is found that 34% of all solid waste that makes its way to the landfill is produced by the commercial sector. The production of solid waste bears no causal relationship to the rates paid by business, therefore rates are a poor method of assessing costs.

Technical Description of Recommendation - The city's part in this recommendation would include designing tenders for letting a franchise, drafting the necessary changes to the bye-laws, amending the business licensing bye-laws and training the Health Department

personnel in enforcement. As a part of the franchise agreement the city would regulate the terms, conditions and prices of the franchisee and would receive five percent of gross receipts to pay for contract oversight and use of the streets. All companies would be expected to display their contract for the collection of refuse in their place of business and as a part of annual licensing. The Health Department would be given the responsibility to approve the level of service that each business should have. For example, a restaurant or food manufacturer would be expected to contract for daily collection, while a stationary store may only need one small container a week.

Exhibit 6.2 below is a representative budget/business plan for an operation necessary to handle the collection of solid waste of the Commercial/Industrial Sector. This plan assumes that current source separation and recycling is continued. It should also be remembered that these numbers reflect only the 1991 waste generation and that this volume is growing perhaps mort rapidly than the residential sector. Actual operations planning should be done during the period after the City Councilors give notice that they will no longer collect this sector's waste. Interested parties would make a survey of existing business, or the City Council could make the survey but caution the bidder that the information was not guaranteed by the City.

Financial Analysis - The City Council would save the costs of providing service to the business and industrial sector to the extent the personnel were absorbed into other public sector positions or into the private sector. The city would also collect about P23,000 per year in franchise fees. This estimate is based on five percent of the estimated gross receipts of the franchised collector (thirty percent of operating cost of City Council collection).

Recurring Cost - The only recurring cost would be for contract administration and training of Health Inspectors.

Capital Cost - This alternative has no capital cost to the City Council.

Economic and Social Analysis - This system provides more jobs in the private sector and reduces the subside of the City to businesses. It also encourages waste reduction, reuse and recycling.

Exhibit 6.2
Private Collection of Commercial/Industrial Refuse

Capital Equipment		
3 Compactor/loaders @ P232,000	P696,000	
30 5cu meter containers @P2,500	75,000	
1200 240 litre containers @P110	132,000	
1 pickup truck @P30,000	30,000	
Total Capital Cost	P933,000	
At fifteen percent for seven year replacement schedule....Annualized Capital Cost		P203,261
Operations and Maintenance		
Manpower: 3 drivers @P12,480	= 37,440	
12 crewmen @P9,300	= 112,320	
2 chargehands @P10,900	= 21,840	
Clerk/Sec'y @P12,000	= 12,000	
Owner-Manager @P50,000	= 50,000	
Benefits @ 40% of wages	= 93,440	
Total personnel cost	=P327,261	
Material and Supplies	= 8,000	
Repair and Maintenance	= 12,000	
Fuel	= 12,000	
Insurance	= 24,000	
Rent of space	= 48,000	
Total M & S	P104,000	
Total operations and maintenance cost		P431,040
Profit @ 25% of O & M		P107,760
Total Annual Operating expenses		P742,061

Privatization of Old Naledi with New Collection Strategy

Synopsis - Due to current and previous failures to address the inadequate refuse collection service provided in Old Naledi, it is recommended that this service be contracted to a local private organization, such as the Village Development Committee (VDC), which is based in the area. In order to address the unique characteristics of the area, a new collection and litter pick-up strategy is proposed.

Background - Naledi has been one of the most problematic areas for collection and litter control in Gaborone. This is due to the lack of priority by the City, compounded with the physical layout of the area. The lack of priority is evident in the level of collection service. While the majority of plots in other parts of Gaborone

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receive collection twice per week, residents in Old Naledi receive collection less than every two weeks. Some residents report collection once per month. Previous attempts to address this problem have not been successful.

The infrequent collection service encourages residents to dispose of their refuse in a nearby empty lot, greatly compounding the litter problem. The lack of service presents a serious health concern considering that the refuse contains decaying food waste and other organic matter which attract rodents and insects and could present a fire hazard during dry periods.

The physical layout of Old Naledi is not conducive for refuse collection using typical collection equipment. The roads are unpaved, very narrow, and difficult to maneuver, especially during the rainy season. In addition, the roads have yet to be identified with names (see Exhibit 6.3).

As indicated, waste management practices in other parts of the City have not been effective in Old Naledi. Thus, a new collection strategy is proposed. Because of the small size of the area (1,674 plots), it is uncertain whether it would be profitable for the private sector. Therefore, it is recommended that discussions be held with VDC to determine their interest in receiving a contract for providing refuse collection service. Simultaneously, the City Council should investigate whether any small businesses based in Old Naledi would be interested.

It should be noted that preliminary discussions have been held with VDC and they have expressed an interest in managing a contract for refuse collection. One strong advantage of VDC is their local presence and familiarity of Old Naledi. Previous efforts by the City Council to clean-up the area have failed, and thus, providing a community based approach may be the best solution for receiving the greatest cooperation from residents disposing of their waste properly and controlling litter.

Technical Description - This alternative would contract collection of refuse in Old Naledi with a small private business or organization such as the VDC. The contract would specify services to be provided and payments received. The contractor would be responsible for all economic aspects of the project, including employment hiring and payment of wages. Necessary equipment would be procured by the Engineering Department and leased to the selected contractor.

Under the new collection strategy each plot would be provided an ample supply of plastic bags. The plastic bags would be collected via farm type tractor with an attached five cubic meter trailer (see Exhibit 6.4). The use of a tractor to collect refuse in Naledi compared to the current collection vehicles is advantageous

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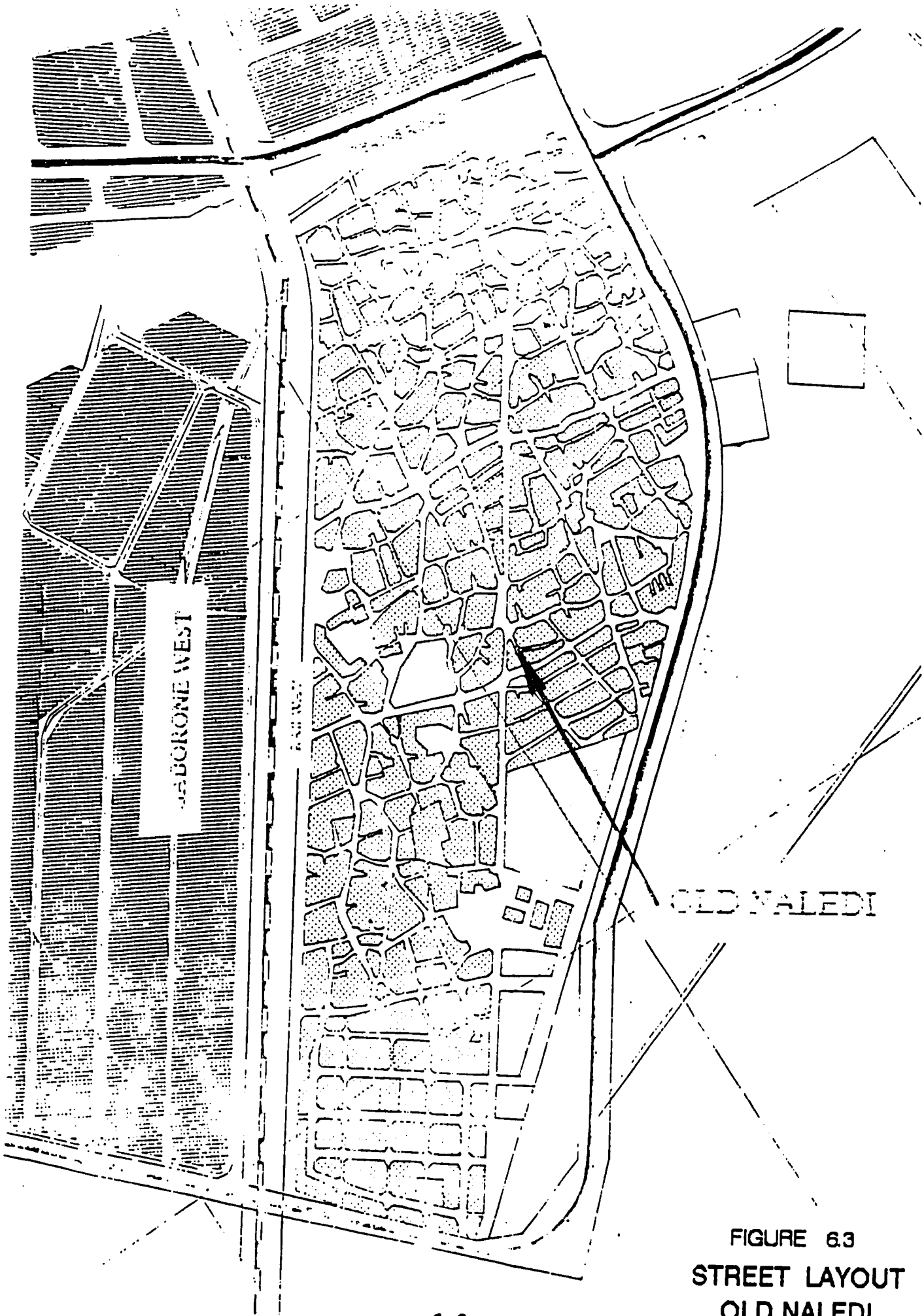
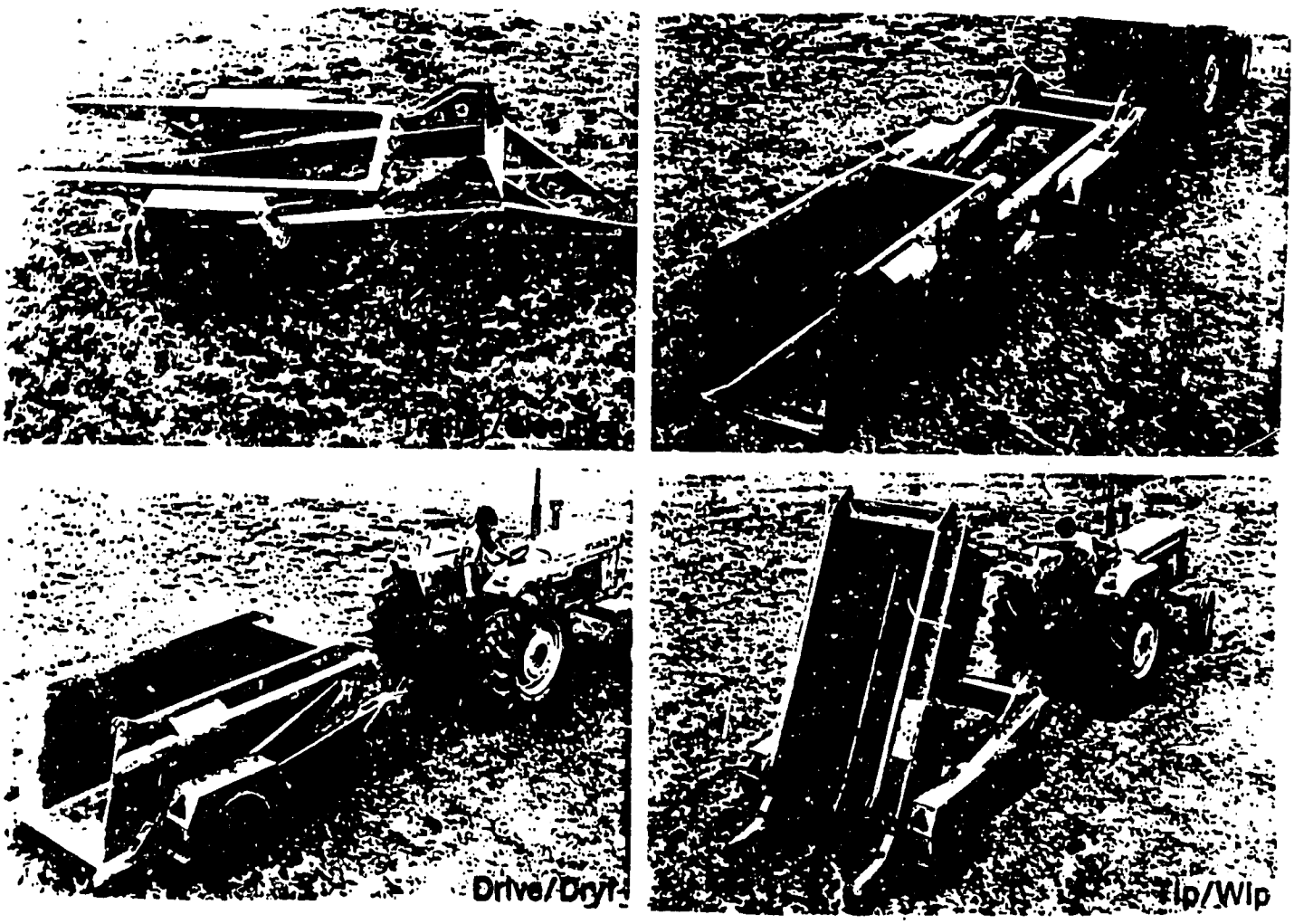


FIGURE 6.3
STREET LAYOUT
OLD NALEDI

Exhibit 6.4 Trailer Container System



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because of their improved handling on unpaved roads and flexibility maneuvering, especially during the rainy season. In addition, the tractors are considerably less expensive to operate.

Once the trailer is full, the tractor would deliver the bagged refuse to a designated transfer area located adjacent to a paved road. The crew would have the option of either: 1.) unloading directly into a compactor vehicle; 2.) switching to an empty trailer container; or 3.) unloading the bagged waste at the enclosed transfer area. One strong design criteria of this collection strategy would be that the transfer area be emptied at the end of each day. During contract negotiations it could be decided whether it is more cost effective for the City Council or the contractor to be responsible for final delivery of refuse to the landfill and final engineering design could be accomplished.

Residents will be instructed to place only ash that has cooled in their plastic bag. If ash is determined to be a problem, a separate collection system could readily be implemented.

To address the serious litter problem, additional trailer containers have been budgeted which would be placed in targeted commercial and residential areas.

Management and financial training would be a key element in ensuring that this project is successful. Training would include two components and would focus on both the hired manager and collection crew. The manager would initially work for one month with the South Depot to become familiar with current collection practices in the City. In addition, the donor agency would provide technical and financial training to the manager. The manager would be educated on routing, bookkeeping, personnel management, costs analysis, and equipment usage. In addition, the manager will be trained in complaint handling. The crew would also be assigned to work several weeks with the sanitation department and receive instructions on proper equipment usage. Existing public collection crew members residing in Old Naledi may be ideal candidates for employment.

The donor agency would provide assistance for developing an operating procedures manual. This would provide clear instructions on services to be provided, responsibilities of crew and manager, bookkeeping, costs analysis, routing, vehicle maintenance, health concerns, special waste handling, and complaint handling.

Financial Analysis

Capital Expenditures - Capital costs for this alternative includes: two tractors - P90,000 (P45,000 each); three trailers - P66,000 (P22,000 each) and ten trailer containers - P29,000 (P2,900 each). In addition, costs to retrofit a compactor vehicle with a top-winch have been allocated. Equipment would be purchased by

the Gaborone Engineering Department using a Revenue Stabilization Loan which would be repayable over five years at eight percent interest rate. The equipment would then be leased to the selected contractor.

Recurrent Costs - Annual costs for this scenario are estimated at P173,000. As shown in Exhibit 6.5, this costs compromises both loan payments (debt service) and operation and maintenance costs. Debt service figures include an annual costs of P48,800 for rolling stock (tractors, trailers, etc.) and containers, and P3,800 for the construction of drop-off sites in the area.

It is expected that the contractor would hire eleven personnel. This would include: two drivers, eight crew members, and one manager. Annual labor costs are estimated at P63,800 for salary and P12,800 for benefits and overhead. Other operation and maintenance costs include: P7,500 for maintenance of vehicles, P2,500 for fuel and oil, and P400 for insurance, and a twenty percent surplus was included. In addition, P11,000 was allocated for the use of a compactor to transport waste from the transfer area to the landfill.

Exhibit 6.5 presents costs on an annual basis and a daily basis. As shown, the annual costs for collection of 1,674 plots with twice per week service was calculated to be P173,000, or P830 per day of operation. On a per unit basis, it averages to be P1.99 per plot per week. Based on the assumed efficiency, collection service could be accomplished on a four day week, allowing one day for litter control and the pick-up and disposal of the trailers located in commercial areas. With this additional service, average costs was determined to be P2.25 per plot per week.

Economic and Social Analysis - The overall economic and social impacts are expected to be extremely positive. The programme would hire eleven local Batswana from Old Naledi with job classifications including both labour and management. These workers would receive extensive training and education. The collection system proposed is labour intensive, and would require three additional jobs compared to the current collection practice in the City.

This alternative is also expected to have a net positive impact on the environment. Since collection would increase from less than once every two weeks to twice per week, littering is expected to decrease dramatically. In addition, the new strategy would include additional placement of five cubic meter containers in targeted areas where littering is a serious problem. These containers would be transported either to the landfill or drop-off area by the contractor. The additional costs for litter pick-up and disposal was calculated to be less than P.30 per plot per week.

Exhibit 6.5 Private Collection Cost Analysis - Old Naledi

Cost Component for Operation of Entire System			Annual Costs (Pula/Year)	Daily Costs (Pula/Day) a)
I. Number of Plots Served Per Day (Two Vehicles)				837
II. Capital Costs b)				
a. 2 - Tractors (@ P45,000 each), 3 - Trailers (@ P22,000 each), and 10 - Containers (@ P2,900 each), and Top Winch system (P9,700) b)			48,764	233.80
b. Drop-Off Site Development (Capital costs of of P 15,000)			3,757	18.01
Total Capital Costs:			52,521	251.81
III. Operation and Maintenance Costs				
a. Labour	# of Units	Salary (Pula/Day)		
Driver	2	35.00	14,600	70.00
Crew	8	22.00	36,709	176.00
Manager	1	60.00	12,514	60.00
		Subtotal:	63,823	306.00
b. Overhead (20 percent of Labour)			12,765	61.20
c. Plastic Bags			4,352	20.87
d. Maintenance				
Material			4,200	20.14
Repair			3,300	15.82
e. Fuel			2,500	11.99
f. Insurance			400	1.92
g. Surplus (20% of operating costs)			18,268	87.59
h. Compactor Usage			11,006	52.77
IV. Total Collection Costs (Entire Fleet)			173,135	830.10
V. Per Unit Costs - Pula/Plot/Week				Average
Twice per Week Collection a)				1.99
Collection w/ Litter Pick-up c)				2.25

a.) Based on four days of operation per week.
b.) Capital costs financed through Revenue Stabilization Fund (8 percent interest, 5 years).
c.) Based on five days of operation per week.

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The program should have a positive sociological effect on the community since they would be responsible for providing refuse collection. In addition, a twenty percent surplus has been allocated to allow contributions to other social programs in Old Naledi. This may include hiring another health inspector, or developing other entrepreneur type businesses such as a material recycling programme.

The overall programme costs are similar to existing average costs for collection in Gaborone, with services expected to improve greatly.

SUMMARY

The following tables are intended to graphically display and to summarize the effect of the privatization options on the City of Gaborone. Actual effects are subject to individual action by the City Councilors.

As shown below, the privatization programme is expected to result in a net savings of P616,260 per year for the GCC. This is due to a savings of P2,916 for the residential option, and P613,344 for the commercial option. No savings are expected for Old Naledi, although services are expected to greatly improve.

SUMMARY TABLE OF COLLECTION PRIVATIZATION

Table of Net Cost Change

ALTERNATIVE (OPTIONS)	NET COST WITH THIS OPTION	NET SAVINGS THIS OPTION
Current Collection System	P1,803,952	-0-
Privatization Of Residential	P1,801,036	P2,916
Privatization Of Commercial	P1,190,608	P613,344
Privatization Of Old Naledi	P1,803,952	-0-
Total Savings All Alternatives	N/A	P616,260*

*This savings assumes immediate implomentation of all money saving features of alternatives.

The table below indicates net employment changes as a result of privatization. Privatization is expected to displace 80 collection crew members, while increasing private sector employment by 43 job positions. The net result is a lose of 32 jobs. It should be noted that job lose is mainly due to increased efficiency of collection. Crew sizes are not expected to be decreased.

Table of Net Employee Change

Alternative	Displaced from Collection*	Added to Private Sector	Net Job Impact
Residential Pvt	40	18	(22)
Commercial Pvt	32	19	(13)
Old Naledi	8	11	3
Total	80	43	(32)*

*Does not include effects due to growth or added service

6.1.2 DISPOSAL

Section 4.3.3 presented five alternatives for disposal in the City, which include various combinations of landfill, material sorting, composting and incineration. Alternatives 4, 5, and 6 included the utilization of an incinerator to obtain large reductions in the volume of waste requiring landfilling. These alternatives are not recommended due to their high costs, which are capital intensive, as compared to other processing methods, sorting and composting which are labour intensive. Alternative 3, which includes waste sorting, composting and landfill is the recommended disposal alternative. Although Alternative 1 represents the lowest estimated operating cost, the future savings in avoided landfill costs and the difficulty in locating a suitable future landfill appear to favour Alternate 3.

In a technical sense, the future disposal method has already been selected as a lined landfill with improved operation and management. The design and construction of that new landfill has been authorized by the City Council and is currently underway. In addition to supporting that conclusion, this report has recommended that diversion of waste through an on-site sorting facility and a composting plant will extend the life of the landfill which will result in long-term economic benefits to the City by avoiding future landfill costs.

In addition to recommending Alternative 3, the Project Team recommends the private operation of all disposal facilities. The key words in the preceding paragraph are "improved operation and

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management". The project team's evaluation of the current system has shown that accountability for operating and managing the landfill is difficult to achieve and maintain within the current system. Other sections of this report have documented the hierarchy of public decision making and the difficulties that are encountered in managing a facility which will need the flexibility to respond to changing conditions. The privatization of the landfill operation, through a carefully written contract will provide the accountability mechanism to insure proper operation and management and can also be written in such a way to allow flexibility of operation within defined boundaries. If a situation arises outside of those boundaries, a process can be defined in the contract that permits a decision to be made by a lower level of public management than under the current system. For the above reasons we are recommending private operation of the landfill which should be the City's initial priority after completion of the new landfill.

Depending upon the City's decision on implementing the other two components of recommended Alternative 3, the sorting and composting facilities, these could be combined with the landfill operation, issued as a supplement to the landfill operation contract or be issued as separate contracts. In order to maintain a coordinated disposal system it would be better to have a coordinated effort with operation of all disposal facilities by a single contractor. Chapter 7, Implementation Plan, will present a recommended schedule for implementing the recommended disposal system over a specific time period which will include preliminary designs of the sorting facilities in addition to privatizing the operation of the landfill.

6.2 IMPROVEMENTS TO THE EXISTING SYSTEM

Improvements are presented for both the collection and disposal system. If the City Council proceeds with Phase II, the consultant could provide assistance in implementing recommendations for improvements to the existing system. Obviously, the privatization options approved by the City Council would impact the extent of implementing the improvements described below.

6.2.1 COLLECTION

Eight recommended improvements are provided which have the potential to improve collection service. Since none of the recommendations presented are exclusive of each other, the City Council may select any combination of these improvements which are provided below.

For each recommended improvement, a description, estimated capital costs and labour requirements are provided.

Routing System - A comprehensive routing system such that equipment is fully utilized and efficiency increased should be developed. As mentioned in Section 3.3, current routing is very inefficient in that some vehicles are collection over ten tonnes per day, while other vehicles are collecting only one to two tonnes per day. This obviously affects the economics of collection and worker morale.

Routes should be based on collection crews working a seven hour day. While individual performance based work is an excellent motivation technique, crews need to work cooperatively together to ensure the job for the day has been accomplished. Ideally, three to four trucks should work as a team in a coordinated fashion. (Costs - 40 hours of consultant's time and 20 hours of staff time.)

Communication System - Each collection vehicle should be provided with a radio unit that can communicate with both the depot and other collection vehicles. This would enable the important transition of different crews to work as a team, as discussed above. (Costs: Radio system with base station - P23,000)

Equipment Replacement and Additions - All equipment used in solid waste management should be on a replacement schedule. This will allow planning and budgeting to occur well in advance of need.

Containers - Most of the containers used in Gaborone were purchased over seven years ago and are seriously damaged. The City needs to consider replacing these containers for both the residential and commercial sector within the next year.

Prior to a large purchase, it is recommended that the City evaluate the use of a standardized 120 or 240-liter plastic container. Exhibit 6.6 illustrates an example of a 240-litre container with wheels for easy maneuvering. (It should be noted that this illustration is not an endorsement of this brand, but to indicate the type of bins available.) These containers are advantageous because: 1.) they are less expensive on a per volume basis than larger containers; 2.) they are difficult for dogs to tip over; 3.) have lids which are attached to the container (thus, reducing problems with rodents and insects); and, 4.) they have a longer life than metal containers which are readily damaged. In addition, if the collection vehicles are equipped with mechanical lifting devises, plastic containers would be more suitable for woman workers.

For the commercial sector, plastic containers are less expensive to use than a skip system and provides greater flexibility for storage areas. For companies that produce large quantities of construction wastes, ash, or other high density material, a skip system would be more appropriate.

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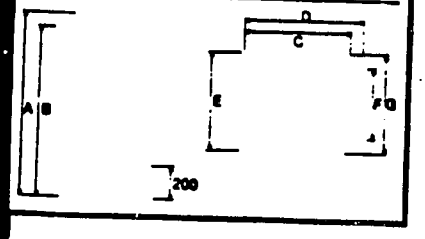
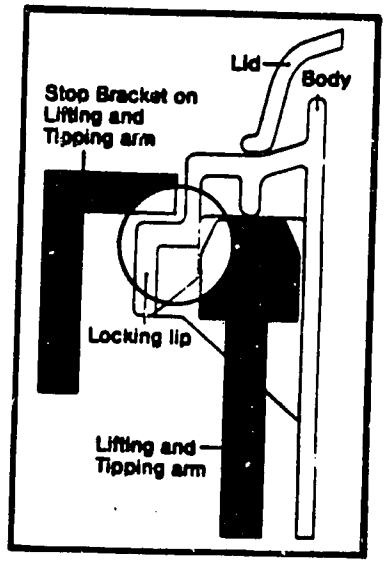
Exhibit 6.6 Example of Plastic Containers

	MGB 120	MGB 240
A	935 mm	1080 mm
B	870 mm	1000 mm
C	475 mm	640 mm
D	553 mm	730 mm
E	480 mm	580 mm
F	350 mm	410 mm
G	490 mm	575 mm
Weight approx.	11,3 kgs	15,5 kgs
Volume	120 l	240 l





Plastic containers for the residential sector are advantageous because they can reduce collection to once per week, thus reducing collection costs. The main problem with using plastic containers is the possibility of residents disposing of hot ash. Thus, any transition to a plastic container system will require an extensive education programme. It is suggested that plastic containers initially be used for one route in a high income areas where fossil fuel use is minimal. If the experience is satisfactory, the system could be expanded to other high and medium income areas.

Reorganization of Collection Structure - Consideration should be given to reorganizing the refuse collection in the Health Department to utilize a management structure more suited to the mission of the activity. A more hierarchical system is suggested. Also making the truck and equipment operators answerable to the organization responsible for the equipment should be considered.

Refuse Vehicles - Older refuse collection vehicles should be replaced with compactor vehicles. In addition, the purchase of additional refuse collection vehicles needs to be correlated with future construction development in Gaborone. It is recommended that for each 2-3,000 new plots, one additional vehicle will be required. (Costs: Compactor vehicles - P202,000 each.)

Uniforms Specific to Refuse Collectors - To improve morale and recognition from the public, it may be valuable to provide workers with a set of uniforms specific for refuse collectors. Uniforms of a different colour from the typical blue may be useful. In addition, a printed logo representing say "protection of the environment" may improve the public's perception to the refuse crew. If the uniforms are attractive and comfortable, workers would be more inclined to wear them, and take proper care of them. (Costs for new uniforms estimated between P10,000 and P20,000)

Procedures Manual - A good procedures manual is the cornerstone of an effective organization. It provides workers at every level with a guide to what is expected of them and their responsibilities. Employees seem to respond better to instruction if they know it is supported by written policy rather than arbitrary orders. A manual must not be considered a substitute for good supervisors and managers, but it certainly can supplement their knowledge and authority. (This will require about 40 hours of Consultant's time and about 10 hours from each of the line supervisors.)

Pilot Salvage Program - To investigate the potential to save the City Council money and provide additional job opportunities in Gaborone, a pilot source separation program in Extension 9 should be considered. A preliminary material market survey indicates that strong markets are available for corrugated, newspaper, high grade paper, glass and HDPE. As discussed further in Section 3.2, every

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tonne per day of material recovered, has the potential to create between three and four jobs.

The program would require residents to source separate valuable materials in their refuse into a particular container. These materials would be collected and delivered to a local salvage operator. Upon completion of the pilot program estimates will be made of volume of material diverted from the landfill, and any cost savings for the City Council. (This will require 32 hours Consultant's time and 20 hours of city staff time. In addition, a vehicle will be needed for about eight hours.)

Portable Chipper - The current system for collecting brush is very inefficient, resulting in unnecessarily high costs. Brush is collected loose and loaded on to a truck for delivery to the landfill. Because of the material's low density, the truck can only handle several hundred kilograms of brush.

A portable chipper which has the capacity to size reduce brush into chips less than eight centimeters would greatly increase the amount of brush loaded onto a vehicle, and thus reduce the number of trips to the landfill by at least seventy-five percent. One vehicle with a chipper could potentially replace three existing vehicles. Other benefits to the purchase of a chipper is that the chipped brush is a valuable mulch. (Capital costs - P45,000).

+ compost material

Litter Receptacles - The number of litter receptacles in commercial areas is inadequate. It is recommended that an additional 300 receptacles be purchased city-wide. (Capital costs - P27,000).

6.2.2 DISPOSAL

Revise Filling Procedures - The current procedure is to tip at the outside edges of the dump and push the waste over the edge, thus increasing the land area of the fill. By doing this the City is creating a dish when it should be creating a mound. The desired shape at closure, which is anticipated in 1 to 2 years, is a mound with slopes between 5 and 25 percent. This will permit rainwater to runoff during the rainy season rather than soak into the waste which creates leachate. Once the landfill is closed and covered with the proper amount of soil and grass has been planted, very little rain water will seep into the waste.

If the City continues building a flat dish, the rainwater will flow toward the middle and concentrate in pools, eventually seeping into the waste below, producing more leachate.

This revised process should begin by tipping in the middle of the site, building a long berm or cell of waste. Additional tipping should be controlled to as small an area as possible to control scavengers and reduce the amount of daily cover that is to be

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applied at the conclusion of each day. The compactor should be used to compact the refuse and push it into daily cells that are approximately 2 meters thick. Clean construction material should be stockpiled for daily cover or trucked in from a borrow pit. Each daily cell should be built against the previous day's, until the entire landfill has been raised 2 meters. The side slopes should be graded to a slope of 4:1. Although this process is normally begun at the edge of the landfill, it is recommended to begin at the center due to the current site conditions. These procedures have been described in more detail in an earlier report. (22 March 1991, page 10 ff)

Training sessions for proper landfill operation are periodically offered through the Institute of Waste Management of Southern Africa. The City should consider joining the Institute and taking advantage of these training opportunities. Other operator training is available through existing local consultants and equipment manufacturers.

As part of the revised filling operations, scavenging at the landfill should be prohibited and strictly enforced.

Apply Daily Cover - The compaction of waste and the application of daily cover are necessary for proper operation of the landfill. Daily cover serves many purposes, including odor control, pest control (flies, rats and birds) and control of windblown debris. Compaction and daily cover will also discourage scavengers which are a constant problem at the landfill.

Access Control - It is strongly recommended that a gate and fencing be constructed as soon as possible to limit vehicle access to the dump site to those times when supervisory personnel are present. A gate keeper should be located at the gate in a suitable structure to record the day's traffic flows, inspect the waste for the presence of hazardous materials and to direct the driver to the appropriate dumping location. Since a scale, gate house and full fencing will be a part of the new landfill, currently under design, these facilities could be temporary in nature. All other vehicle access to the dump should be blocked with piles of earth or demolition material.

The gate keeper should maintain a log of all vehicles entering the site, their registration number, origin of the waste and type of waste. The capacity of the truck should be recorded and an estimate made of how full the truck is. If the truck has come from the public weighbridge, the weight of the vehicle should be recorded.

The gate keeper should be trained to recognize hazardous or special materials that may require special handling. Any closed drum of any

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size should be opened and inspected. If the contents of the drum can not be identified by either the driver or the gate keeper, the material should be returned to the driver on his way out of the landfill. In general, oil based paints, solvents, drain oil, and cleaning fluids should not be permitted in the landfill. During high traffic times, additional inspectors may be required.

Waste Oil - Waste oil generation and disposal is a major environmental problem in Gaborone and should be dealt with as soon as possible. Although the current economics appear to exist for collection and recycling of waste oil through markets in South Africa, waste oil continues to be tipped at the landfill and other locations throughout the City. The City should consider a specific prohibition on tipping waste oil anywhere but in approved locations such as licensed collection stations. An evaluation of collection and transportation costs should be performed and compared with current market prices. If costs exceed revenues, consideration should be given to subsidizing the system to insure that recycling occurs. The potential for major environmental damage from the current practice will justify the subsidy if required. The collection and processing of waste oil could be privatized as a single franchise for the entire City or smaller district franchise areas. It is important to emphasize that the system will work only if the prohibition on tipping waste oil is enforced.

Separate Disposal Areas - Many materials brought to the landfill are inert and should not take up limited landfill space or they have properties that require special handling.

a. Construction rubble should be placed in a separate location, perhaps a low area that needs fill or borrow pits that require reclamation.

b. Clean earth should be stockpiled in one location so that it can be used for daily cover.

c. Asbestos construction waste should be placed in a separate area and covered immediately. Since asbestos is only a problem in an airborne state, the waste should not be crushed or compacted. If asbestos arrives at the landfill in a loose form, it should be wetted and placed in a heavy plastic bag before being landfilled. Extreme care should be taken not to inhale any loose fibers.

d. Grass clippings, yard waste and brush could also be placed in a separate area, away from the active landfill. The City may wish to consider the purchase of a chipper to chip brush and produce a mulch for use in the many public gardens in Gaborone.

e. Abattoir wastes are already being placed in a separate location but are not receiving any cover, which has the

potential of significant health problems. This area should also be covered on a daily basis.

Traffic Control - Current tipping occurs in an uncontrolled manner and vehicles of all types seem to tip wherever they please. One or more attendants should be provided to direct tipping at the active cell and separate areas should be provided for manual unloading of waste and compactors which eject waste mechanically. Traffic cones and signs should be placed to assist in the direction traffic to the appropriate tipping area. Confining the traffic flows to specific routing will also assist in dust control.

Dust Control - The landfill is a very dusty place. Studies have found that prolonged inhalation of dust can produce numerous respiratory ailments. Considering the high traffic flows, proximity to adjacent residences and worker safety, the city should begin wetting the access roads to the landfill to control dust.

Medical Waste - Although all surgical wastes and wastes from patient care areas in the hospital are being incinerated on-site, other potentially infectious wastes from doctor's offices, clinics, dentists etc., are being collected through the public collection system. The Health Department has established procedures for the handling of these wastes but enforcement and monitoring appear to be non-existent. Even if sterilization procedures are followed, some medical waste, such as syringes and broken glassware, could be hazardous to collection workers and scavengers. It is recommended in the short term that a specific coloured plastic bag with a warning printed on it be manufactured and distributed to all potential generators of infectious wastes.

Research and Development - There are many aspects of Gaborone's waste disposal system that could benefit from research and development carried on by Botswana's universities and schools. Composting of food and other organic wastes is a good example of where R & D programs could be of benefit. Abattoir wastes could also contain commercially valuable materials that could be put to better use than burying them in a landfill. Paunch contents are an excellent base for composting since they are nearly 100 % organic matter and include many of the bacteria and enzymes necessary for composting. In other countries, paunch contents and blood are collected and turned into compost and fertilizer and other wastes such as horns and hoofs can be used in the manufacture of glue.

6.3 OBSERVATIONS AND RECOMMENDATIONS FOR FUTURE CONSIDERATION

In the process of our evaluation the Team has made observations regarding aspects of the solid waste management system which are outside the specific scope of our project but are worthy of mention as potential long term improvements to the system. Although the following items are independent of the above recommendations on

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privatization of collection and disposal systems we urge the City to give them careful consideration.

Education - Littering, on-site disposal and illegal dumping are major problems in Gaborone. It has been the Team's observation that these behaviors are due in part to a lack of environmental awareness on behalf of the general public. Our first long term recommendation is that the City consider the development of educational programs aimed at specific age groups and or occupational sectors of the public to inform them of the environmental as well as aesthetic impacts of their actions in dealing with waste disposal. In addition to developing curriculum for primary and secondary schools, business leaders and civic organizations should be consulted to develop anti-littering advertising. An existing proposal to supply litter containers in public places, paid for by business advertising is a good example of an effective advertising campaign.

Enforcement - Although educational programs will improve environmental awareness, particularly among children, the current generation of adults will most likely not be affected. Therefore, in order to reverse the current trend toward increased littering, and illegal dumping it is also recommended that the City consider revisions to current laws in order to increase the effectiveness of bye-law enforcement and provide more flexibility in dealing with changing conditions. The current bye-laws are general in defining violations and depend on the definition of a public nuisance to establish whether a violation has occurred. At the present time, the system is "functional" in that the bye-law enforcement officer is the only person who can enforce bye-laws but he is unlikely to be the person observing the violation. A revision to a hierarchial system that would give the health inspectors the authority to enforce bye-laws, would create a more flexible and effective enforcement system.

Hazardous and Toxic Waste - New industries are required to list their waste products when they apply for a site permit through the Central Government but the City lacks the capacity to ensure that these wastes are disposed of properly. This is another area where health inspectors should be given the authority to enforce bye-laws to insure that these waste are being properly disposed.

Beverage Containers - Beverage containers are one of Gaborone's biggest litter problems. These containers, bi-metal cans (steel and aluminum) and plastic containers, have a low post consumer value and even though there are some recycling programs sponsored through the school system, the amount paid for the collected containers is relatively low and they continue to accumulate along Gaborone's streets and in public areas.

The problem of beverage container littering is not unique to Gaborone and has been approached in many different ways with

various degrees of success. Most of these systems either legislate the use of refillable bottles or artificially inflate the post consumer value of the container through a deposit system or subsidies of the material markets. The market subsidies are usually provided by the manufacturer of the container or through a governmental unit.

The evaluation of an appropriate system to be used in Gaborone would require additional evaluation which is beyond the scope of Phase I of the project but could be expanded in Phase II. This work would include evaluation of the current wholesale and retail market systems, types and quantities of the containers produced and current materials markets. The work would also review current and proposed enabling legislation, required to implement a deposit or subsidy system.

7.0 IMPLEMENTATION PLAN

7.1 INTRODUCTION

This chapter describes the necessary steps to implement the recommendations presented in Chapter 6. The implementation of the privatization programme is dependent upon adaptation by GCC. As stated previously, the privatization programme offers significant cost savings for the GCC, and improvement of service for the entire City.

Implementation in the sense that it is used here implies a description of a detail action plan whereby the Mayor and City Councilors can set into motion their decisions relating to privatization of solid waste management. In addition, the implementation plan could act as the scope of work for Phase II.

If the GCC selects privatization, it is recommended that an Implementation Committee be appointed to take the lead role in overseeing the implementation, and coordination of this project. GCC members of the existing Steering Committee would be ideal candidates for the committee. In addition, it would be vital to have legal expertise on the committee, as well as executive representation. Once the Steering Committee has been formed, they should meet with the donor agency to revise proposed time frame and schedule for implementation, and timing of consultancy.

An implementation plan is presented for each recommendation presented in Chapter 6. Although each programme will differ slightly in its implementation, there is a commonality of structure and procedure for the transition from public to private provision of solid waste management services. Exhibit 7.1 provides the structure and steps for the implementation of the various elements involved. The major steps include: contract preparation and negotiation; training; and, equipment procurement.

Exhibit 7.2 shows the time based relationships of the various tasks within each component of the implementation plan and also indicates the time relationships between components. For convenience, both exhibits are located at the end of this chapter.

7.2 IMPLEMENTATION OF PRIVATIZATION OPTIONS

PRIVATIZATION OF RESIDENTIAL COLLECTION

The following is a suggested sequence of events for the implementation of the privatization of the Project Team's recommendation for selection of approximately 9,000 residential plots for a demonstration project.

1. Councilors select privatization option and appoint an Implementation Committee. This committee will work with the Donor Agency to set the wheels in motion to begin the implementation Phase of the Project. Estimated time - two weeks.

2. Implementation Committee places advertizement requests for qualifications and financial statements in the Gazette and other appropriate media. A sample advertizement is included as Appendix G of this report. Estimated time - two to three weeks.

3. Elementary entrepreneurial training arranged by donor Agency. During this time those parties who express an interest in the provision of refuse collection will be given group training in the basics of submitting a proposal for service to the City Councilors. During this time the donor agency would arrange for the Project Implementation Team to be brought in. Estimated time - simultaneous with step one and two.

4. Project Implementation Team arrives to assist the Donor Agency and The Implementation Committee. Tender for private solid waste collection for designated 9000 residential plots is designed with the committee and the City Council legal staff. Estimated time - three to four weeks

5. After review by the City Council Implementation Committee, the Donor Agency and the Team, and position description and scope of work will be prepared for the position of "Cohort". Final selection of Cohort will be by donor agency with City Council Approval. Estimated time - six weeks.

6. Review of Tenders, contract negotiations and discussion of start-up procedures. This would be the responsibility of the City Council with the assistance as requested of the Implementation Team. Estimated time - two weeks.

7. Award of tender for private solid waste collection for

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designated area. Recommendation will be made by the City Staff for consideration by the Mayor and City Councilors. Estimated time one week.

8. Arrival of Cohort, training for contractor and contract administrators begins. Equipment recommendations presented to the City Council. Estimated time - six months.

9. Operations and management systems established, equipment delivery, routes designed and Start-up of Operations. Training continues. Estimated time - three months.

10. Review of system by Cohort. Report to Donor agency and to City Council on recommendations for further improvement by privatization or public sector. Estimated time - eight to ten months from decision of City Council.

PRIVATIZATION OF INDUSTRIAL/COMMERCIAL SECTOR

The suggested sequence of events for the privatization of the Industrial/Commercial Sector is as follows:

1. Councilors select Commercial /Industrial privatization option and appoint an Implementation Committee. Estimated time - Two weeks.

2. This committee will give notice to the affected businesses in Gaborone and will work with the Donor Agency to begin the implementation Phase of the Project (see notice sample in appendix H). Request for qualifications is published(see RFQ sample appendix G). Estimated time - four weeks.

3. Implementation Team arrives and begins work with Implementation Committee on provisions of franchise agreement, performance standards, changes to Bye-Laws and contract administration procedures. Estimated time - two to four weeks from council decision.

4. City Council requests tenders for the provision of solid waste collection service to Commercial/Industrial sector. Estimated time - four weeks

5. City Council and Implementation Team hold pre-award negotiation with apparent best tender. Estimated time - two weeks.

6. City Councilors award tender for the private provision of solid waste collection service to the Commercial /Industrial

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sector. Estimated time - four weeks.

7. Donor Agency coordinates training for contract administration simultaneous with other activities.

PRIVATIZATION OF OLD NALEDI

Identified below are the principle steps for implementation of privatization of solid waste collection services for Old Naledi. These steps are to serve as a guide for the GCC and the Implementation Committee. Full implementation of this option is expected to take between four and five months. Approximate time requirements for each step is provided, although many of the steps can occur simultaneously.

1. GCC selects privatization option and appoints Implementation Committee members. Committee informs donor agency of GCC decision and meets to revise proposed time frame and schedule for implementation. Estimated time - two weeks.

2. Committee begins discussions with the Village Development Committee (VDC) to determine interest in receiving contract for providing collection service. Simultaneously, the Committee investigates any legal issues related to providing a contract with VDC. Estimated time - one to three weeks.

3. Committee investigates whether other parties are interested in providing collection service in Old Naledi. Expected time frame - two to four weeks.

4. Committee decides whether to proceed with VDC or open the contract to all interested parties. (If the Committee elects to contract directly with the VDC, skip to step 7.)

5. RFP is designed, finalized, and released to the public. This step would require the assistance from the consultancy, and GCC legal staff. Estimated time - four to six weeks.

6. Review proposals and select contractor. The consultancy would provide assistance in this analysis. Estimated time - one week.

7. Collection program design finalized. In particular, finalize engineering plan for drop-off facility. The consultancy would provide technical assistance. Estimated time - two - three weeks.

8. Develop contract between GCC and the contractor for services. Negotiate contract and finalize (award). Input provided by the consultancy. Estimated time - two to three weeks.

9. GCC begins procurement of necessary equipment.

10. Consultancy organizes operation and management training for the contractor. Training element would include: costs analysis, routing, complaint handling, supervision, equipment usage and maintenance, and bookkeeping. Estimated time - two weeks.

11. Develop procedures manual which clearly identifies management system (personnel policy, hiring, etc...), collection and disposal system, and complaint handling. These tasks would be the responsibility of the consultancy. Estimated time - two weeks.

12. Operation and management system established and equipment delivered, and start-up of operation.

13. Continues monitoring and revision of procedures manual after two months of operation.

PRIVATIZATION OF LANDFILL OPERATION

Although the development of privatized landfill operations will follow the general sequence of the Implementation Flow Chart, the time frames for completing individual tasks will depend in part on the schedule for completing the design and construction of the proposed landfill. Specific portions of the operations contract will also depend on designed components such as the liner material and physical parameters of the leachate collection and treatment systems. If the landfill proceeds without a liner, which we would discourage, then the operations contract would not include leachate handling procedures.

After establishing the Implementation Programme, and defining Phase II of the Donor Consultancy, the landfill privatization would proceed as follows:

1. Issue a Request For Qualifications - This step will determine the degree of interest in the private sector to operate the landfill including, number of interested firms, their capabilities and resources to perform the work, and the nationalities of the interested firms. This step could be completed prior to the arrival of the Phase II Consultant Team. Estimated time - 2 to 3 weeks.

2. The next two steps could proceed simultaneously, depending on the GCC's input regarding Botswana firms versus expatriate firms.

   Entrepreneurial Training - If the responses to the Request For Qualifications indicates a need for Entrepreneurial

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training for Botswana firms, A training programme could be organized and implemented by the Phase II Consultant Team or other local consultant. Due to the time periods for other implementation tasks it is recommended that this task not be performed by the Phase II Consultant Team. Estimated Time - 3 to 4 weeks.

3. Contract Preparation - In cooperation with the designers of the new landfill, the Phase II Consultant team will prepare contract documents to be issued for cost proposals through public advertisements. The contract will include all operating parameters, management requirements, optional lease purchase of equipment through the City and cost bid forms. Bid cost will be a lump sum per month or year, based on 60 TPD with adjustments should waste volume increase through the contract period. Estimated time - 3 to 4 weeks.

4. Request for Proposals - Upon completion, review and approval of the contract tender documents they will be issued through an advertisement. Although some firms will have been prequalified, Botswana law will require a general advertisement for tenders. Estimated Time - 4 weeks.

5. Select Contractor - After receipt of proposals, the Committee and Phase II Consultants will review all submitted information, perform follow-up investigation of bidder qualifications, if required and prepare a proposal evaluation report to the committee for final contractor selection by the City. Estimated time - 2 weeks.

6. Contract Negotiations - After the contractor is selected there will be a period of time reserved for contract negotiations which will culminate with the final execution of the contract. Estimated time - 2 weeks.

7. Public Relations - Simultaneous with contractor selection and negotiations, the City and Consultant Team will initiate a Publicity Programme aimed at educating and informing the general public regarding new procedures to be implemented when the new landfill begins operation. Estimated Time 3 weeks.

8. System Start-up - At the agreed upon contract date, the new landfill will begin operations under a private operator.

9. Programme Monitoring - The Contract will include a framework for monitoring the landfill operation and ensuring that the waste is being properly landfill. During the initial 6 weeks of operation, it is recommended that daily inspections be performed by the City or their representative. Subsequent inspections should be performed on an as-needed basis.

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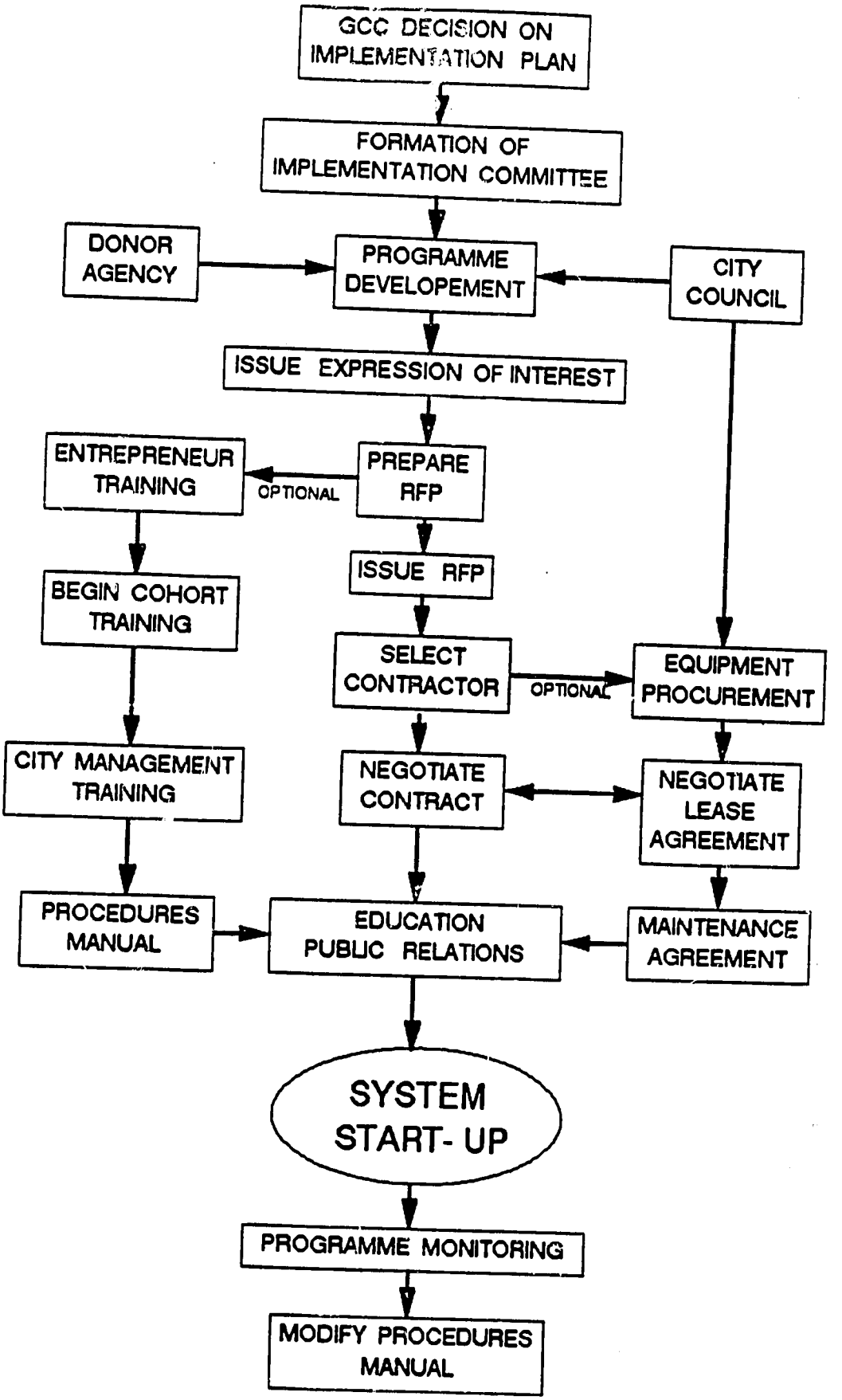
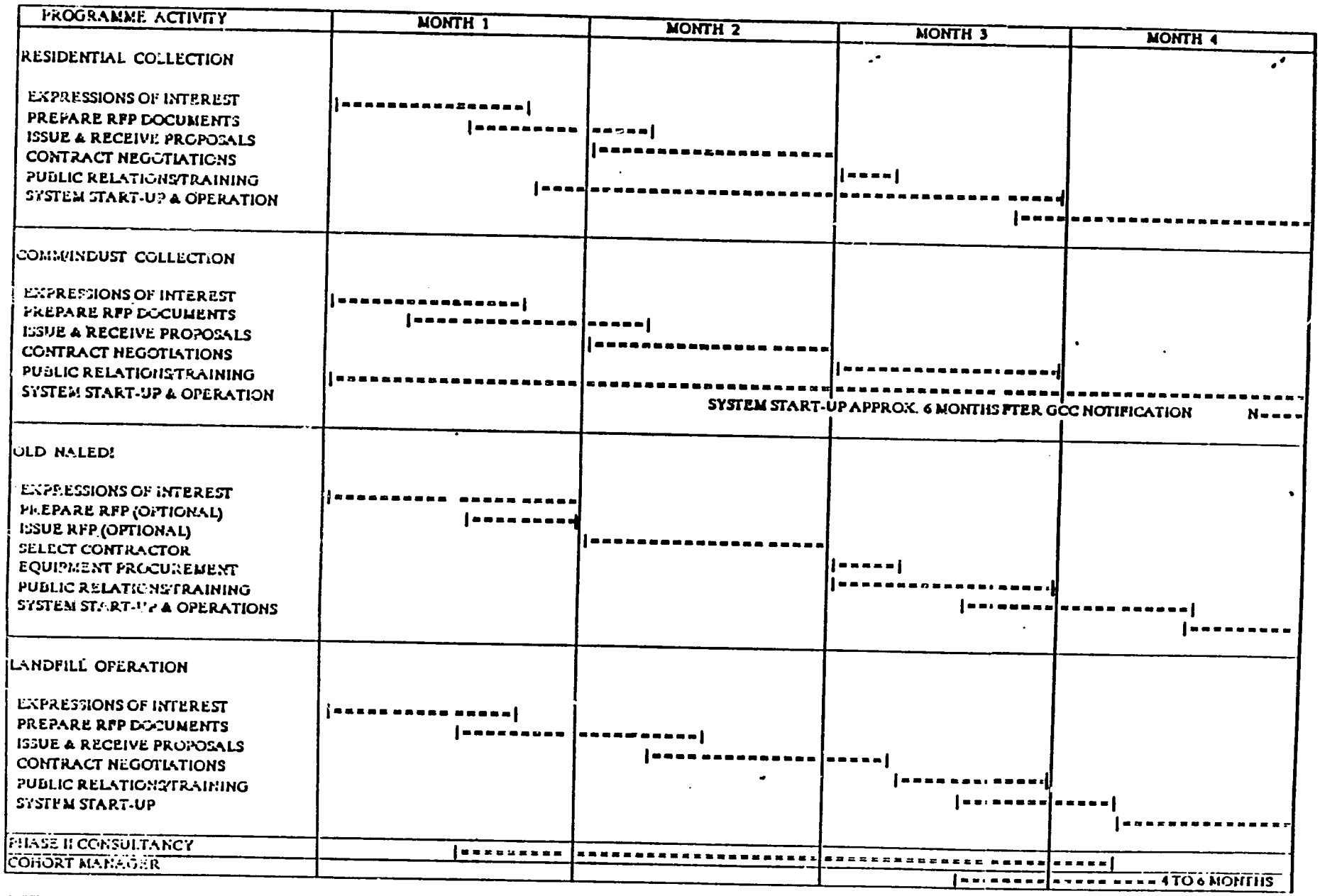


FIGURE 7.1

IMPLEMENTATION FLOW CHART



NOTES: 1. COLLECTION ACTIVITY TIME BEGINS WITH GCC DECISION TO IMPLEMENT PROVATIZATION PROGRAMMES AND FORMATION OF THE GCC IMPLEMENTATION COMMITTEE.

2. TIME SCHEDULE FOR PRIVATIZATION OF LANDFILL OPERATIONS WILL BE BASED ON COMPLETION OF THE DESIGN AND CONSTRUCTION OF THE NEW LANDFILL AND MAY NOT PROCEED SIMULTANEOUSLY WITH THE COLLECTION ACTIVITIES.

FIGURE 7.2

IMPLEMENTATION TIME SCHEDULE

APPENDICES

APPENDIX A - WORK PLAN

APPENDIX B - WASTE GENERATION & COMPOSITION

APPENDIX C - WEIGHING PROGRAM

APPENDIX D - RECYCLING

APPENDIX E - DISPOSAL METHODS

APPENDIX F - EQUIPMENT AMORTIZATION SCHEDULE

APPENDIX G - ADVERTISEMENT FOR INTERESTED PARTIES

APPENDIX H - NOTICE OF INTENT TO FRANCHISE

APPENDIX A - WORK PLAN

Statement of Work

SECTION I: Objective

This assistance is being provided as part of the Private Provision of Social Services Project. The overall project purpose is to assist the Gaborone City Council in its efforts to privatize solid waste collection, treatment, and disposal services and to initiate a favorable climate for privatization of other social services. The specific purpose of this Cooperative Agreement buy-in is to provide phased technical assistance and training services to the Gaborone City Council required for implementation of this project over a two-year period.

SECTION II: Background

Botswana, a resource-rich country located in Southern Africa, is presently experiencing unprecedented growth in its economy, which is largely based on the extraction and export of diamonds, copper, and nickel. Because of its mineral exports, Botswana currently holds approximately US$ 3 billion in foreign exchange reserves.

Since Independence in 1966, Botswana has experienced rapid transformation from an almost entirely rural to a relatively urbanized country. This urbanization process has accelerated since the early 1980s, and 30 percent of the country's 1.2 million residents now live in urban areas. The population of Gaborone, the nation's capital and largest city, has increased at an annual rate of over 10 percent in the past decade and currently stands at 120,000 persons. Gaborone's extremely high rate of population growth has placed great pressure on roads, housing, serviced land, and public services. Expansion of industrial activity within the city is also rapidly increasing demands on public infrastructure and services provided by the Gaborone City Council (GCC).

The GCC has been considering strategies to allow it to more effectively address the infrastructure and service needs of its rapidly growing population and business sector. One such strategy involves privatization of certain public services -- including municipal abattoirs, health services, public transit, and solid waste collection and disposal. In particular, the City Clerk has identified privatization of solid waste collection and disposal services as a priority area for action.

Solid waste collected within the City is presently dumped at a Council refuse site, located about three kilometers from the city center. The GCC maintains a fleet of 17 refuse trucks, 2

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tractors, 2 front-end loaders, 2 tipper trucks, and one bulldozer. Refuse is collected twice per week from residential areas. Industries directly deliver their refuse to the Council site.

Landfilling at the site is carried out through uncontrolled tipping operations which have produced environmentally hazardous effects. Frequent spontaneous fires occur at the present site, and resultant air pollution has been noted in regard to impaired visibility, smoke nuisance, and increased suspended dust particles in the surrounding area. Gross violations of air quality standards have been attributed to the site by the Air Pollution Department.

As the present site is nearly filled up, the GCC recently commissioned a consulting firm to identify a new site and design a new solid waste scheme. The consultant has completed his design and identified a 60 acre plot located to the northeast of the city near the present refuse site. The consultant has recommended controlled tipping, with adequate measures to minimize environmental degradation, and continued manual sorting of paper, glass, metal, cardboard, and plastics to optimize employment generation. The consultant has also recommended a weighbridge to provide a basis for levying of tariff charges and record keeping regarding the quantity of refuse being disposed of. Although the proposed site is located in an arid zone and the possibility of generating leach is minimal, two monitoring boreholes are proposed. The cost of developing this new site is estimated to be about Pula 2.8 million (approximately US$ 2 million), including ancillary works, plants, vehicles, and landscaping.

In 1989, the GCC discussed with USAID its intention to privatize the entire scheme of solid waste collection, treatment, and disposal. As a result of these discussions, USAID prepared a request to AID/W for partial funding under the Private Provision of Social Services program to provide technical and commodity assistance required for the privatization scheme and explore possibilities for privatization of other GCC services. This funding was subsequently approved in March of 1990 and provides the basis for the technical assistance activities described hereunder.

SECTION III: Scope of Work

To achieve the objectives of this consultancy, as described in Section I above, the Contractor shall provide to the GCC technical assistance in two phases, as follows:

A. Phase I Assistance

1. Objective: To assist the GCC develop a strategy for the improvement and, in full or in part, the privatization of

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the solid waste collection and disposal services now performed by the GCC. The Contractor will also assist in the identification of solid waste management training required by key GCC staff.

2. Contractor Tasks: (a) Review and assess:

-- The current City Council solid waste management system in terms of its financial, regulatory, manpower, plant, and equipment characteristics.
-- Requirements for modernization of existing solid waste collection, treatment, and disposal services.
-- Projected increase in the volume of demand for solid waste collection and disposal services.
-- Existing environmental statutes concerning solid waste collection and disposal as well as existing procedures for enforcing such statutes.
-- Opportunities for and constraints to privatization of solid waste collection and disposal services in Gaborone.
-- Potential local and/or international entrepreneurs interested in and capable of assuming responsibility for solid waste collection and disposal services.
-- General financial management procedures of the GCC.

b) On the basis of this review and assessment, the Consultant will make recommendations to Government in favor or against privatization. If recommendations are for privatization, and are acceptable to the Government of Botswana, the Consultant will then prepare a comprehensive strategy for solid waste collection and disposal which will address the following:

-- Recommended general short- and long-term improvements to the current solid waste collection and disposal system. The consultants shall, in particular, examine the viability of introducing a state of art waste-to-energy system in Gaborone and examine the cost, manpower, and management implications of such a system for the GCC.
-- Identification of new equipment required for introduction of recommended improvements to the solid waste collection and disposal system. This shall include recommendations regarding the types and amounts of equipment needed, specifications for such equipment, appropriate suppliers of such equipment, and estimated costs. Standardization and ease of equipment servicing/maintenance shall be priority considerations in preparation by the consultants of equipment specifications and recommendations regarding appropriate equipment suppliers.
-- Specific steps to minimize the negative environmental impact of solid waste collection and disposal practices. This will include recommendations regarding necessary changes, if any, in existing environmental statutes and in statute enforcement procedures to ensure environmentally sound solid waste collection and, possibly, disposal services by a private firm. This will also include general recommendations for future collection and disposal of hazardous wastes.

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-- Identification of alternative schemes for privatization of solid waste management services within the City, including short-term measures for immediate implementation and more long-term measures applicable to proposed improvements to these services. The consultants shall also identify the preferred short- and long-term schemes for privatized services.

-- Identification of suitable private sector contractors and contracting mechanisms for implementation of the recommended short- and long-term privatization schemes. This shall include suggested terms of reference for private contractor solid waste collection/disposal services to the GCC. This shall also include suggested arrangements for leasing existing and new solid waste collection/disposal equipment to the private contractors selected.

-- Recommended management and financial systems to be adopted by the GCC for oversight of privately contracted solid waste collection/disposal services and GCC revenues resulting from such contracts or contract. This shall include recommendations for the establishment and management of a GCC revolving fund which will accept GCC revenues resulting from the privatization of solid waste collection/disposal services and which may be used to finance the privatization of other City services.

-- Identification of the type, approximate duration, and recommended venue of training required by mid- to upper-level GCC staff to effectively manage privatized solid waste management services. If possible, the consultants shall also specifically identify the appropriate personnel to undergo such training.

3. Level of Effort: The Contractor shall provide a three-person consulting team to undertake Phase I tasks in Gaborone, as well as appropriate project management support from the Contractor's core staff in Washington. The consulting team leader will be designated by the Contractor. A six-day work week is authorized.

The consulting team shall consist of individuals with the following technical capabilities and qualifications:

-- A Municipal Finance Specialist, with extensive knowledge of financial aspects of solid waste collection and disposal systems. The individual selected shall have had considerable experience with government contracting of private firms to perform solid waste collection/disposal services and government management of such contracts. This individual shall have also had previous experience in analyzing the cost implications of privately- vs. publicly-provided solid waste collection and disposal services. Previous African experience is highly desirable (60 person days).

-- A Public Works Sanitation Specialist, with extensive practical experience in the planning, implementation, and management of solid waste collection systems, including procurement of necessary equipment and services. The individual selected shall have a background in engineering or a related field. Previous African experience is highly desirable (80 person days).

-- A Public Works Sanitation Specialist, with extensive experience in the planning, implementation, and management of solid waste treatment and disposal systems, including procurement of necessary equipment and services. The individual selected shall be familiar with refuse site disposal problems and various treatment options, including regulatory measures to minimize negative environmental impact. The individual selected shall have a background in the field of engineering or a related field. Previous African experience is highly desirable (80 person days).

Knowledge of and access to micro-computer equipment and applicable software is highly desirable.

4. Reports:

-- Within 5 working days of arrival, the consulting team shall provide to the City Clerk for approval and to the Steering Committee for review and comment a plan of work which will include: (a) the methodology to be used; (b) proposed interviews and site visits, with approximate scheduling; (c) a listing of documents required; and (d) a tentative outline of the final strategy report.

-- While in Gaborone, the consulting team shall meet regularly with the Steering Committee and periodically on a required basis with the USAID/Botswana Project Manager.

-- Five working days prior to completion of the assignment, the consulting team will provide ten copies of a draft final report (in oral and written form) to the City Clerk and the Steering Committee which includes the analyses and recommendations defined in Section III(A) (2) above. The consulting team will incorporate suggested changes/modifications in the final draft (25 copies), which will be provided to the City Clerk and USAID/Botswana prior to the consultants' departure from Botswana.

5. Equipment: The consultant will provide computer, printer and software necessary to carry out this activity related work in Botswana, and at the end of his contract, in consultation with USAID, the equipment may be turned over to the Gaborone City Council for their future use.

6. Period of Performance: ~~February~~ April 1, 1991 through ~~May~~ July 31, 1991.

B. Phase II Assistance

1. Objective: Following Phase I consultant activities, and on the basis of the consultants' recommendations on GOB's evaluation of the report issued during that period, the GCC, with AID assistance, will initiate procurement of necessary equipment and contracting of private firms (or firm) to undertake solid waste management functions. The purpose of Phase II consultant activities will be to provide follow-on, hands-on assistance to the GCC in the implementation of the solid waste management strategy and to assist with identification of strategies for privatization of other city services.

2. Contractor Tasks: (a) Provide technical advise and on-the-job training assistance to GCC staff regarding:

-- Introduction of new GCC management systems vis-a-vis private firms (or firm) contracted for solid waste collection and/or disposal services.
-- Introduction of environmentally sound solid waste collection and disposal practices and statutory enforcement measures adopted for this purpose.
-- Activation of new solid waste treatment and disposal systems at the refuse site, including commissioning of new equipment acquired for this purpose.
-- Activation of new solid waste collection systems, including commissioning of new equipment acquired for this purpose.
-- Maintenance and servicing procedures for existing/new collection, treatment, and disposal equipment.

3. Level of Effort: The Contractor shall provide a three-person consulting team to undertake Phase II tasks in Gaborone, as well as appropriate project management support from Contractor headquarters in Washington. A six-day work week is authorized. The Contractor shall designate the consulting team leader.

The consulting team shall consist of individuals with the following technical capabilities and qualifications:

-- A Public Works Sanitation Specialist, with extensive practical experience in the implementation and management of solid waste collection systems, including installation of necessary equipment and services. The individual selected shall have a background in engineering or a related field. Previous African experience is highly desirable (50 person days).

-- A Public Works Sanitation Specialist, with extensive experience in the implementation and management of solid waste treatment and disposal systems, including commissioning of necessary equipment and services. The individual selected shall be familiar with site disposal problems and various treatment options, including regulatory measures to minimize negative environmental

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impact. The individual selected shall have a background in the field of engineering. Previous African experience is highly desirable (50 person days).

-- A general Technical Coordinator, with broad-based experience in the planning, implementation, and management of municipal projects. The individual selected shall have the ability to examine in depth the potential for privatization of various City services and the introduction of municipal management systems to administer such privatized services. Previous African experience is highly desirable (20 person days).

4. Reports:

-- While in Gaborone, the consulting team shall meet regularly with the City Clerk and relevant staff and periodically with USAID/Botswana to advise them regarding the progress of work.

-- During the Phase II period, the consulting team will issue brief written progress reports, on a bi-weekly basis, to the City Clerk regarding the status of solid waste collection and disposal strategy implementation. These reports will identify key issues, problems, and recommended solutions.

-- Five working days prior to completion of the assignment, the consulting team will provide a final report to the City Clerk and USAID/Botswana which will summarize consultant team activities during the Phase II period and key solid waste management strategy implementation issues for short- and long-term attention of the GCC. The consulting team shall discuss this final report in depth with the City Clerk and other appropriate GCC officials prior to the team's departure from Botswana.

-- Five working days prior to completion of his/her assignment, the Technical Coordinator shall provide a written report to the City Clerk and USAID/Botswana which includes analyses and recommendations for potential privatization of other City services, as defined in Section IIIB(2)(b) above. The Technical Coordinator shall incorporate suggested changes/modifications in the final draft, which will be provided to the City Clerk and USAID/Botswana prior to departure from Botswana.

5. Period of Performance: Estimated to commence 9 months following completion of Phase I assistance; ~~July 1~~, September 1, 1991 through ~~September 31~~, 1991. November 30, 1991

APPENDIX B - WASTE GENERATION & COMPOSITION

APPENDIX B

WASTE GENERATION AND COMPOSITION

B.1 GENERAL

The evaluation of waste management options was preceded by a determination of the approximate amount and composition of the waste stream. This process began with an evaluation of previous studies and then procedded with a weighing program to determine current total waste disposal and unit disposal rates. Although the weigh program produced the most accurate information regarding current disposal, upon which overall alternatives are evaluated, a theoretical computer simulation was also prepared to predict total waste generation and an estimate of the composition of the waste. This computer simulation obtained input from several sources, including national population estimates, unit generation rates from the weighing program, the 1985 NZA report and various reference documents on waste generation.

B.2 POPULATION PROJECTIONS

A Population and housing census was performed in Botswana in 1971 and again in 1981 with the latest results published in 1987. The 1991 census process has just begun. Due to the unprecedented growth that has occurred in all three planning regions in the past ten years it will be difficult to determine the current populations with a high degree of confidence, especially since we are at the end of a 10 year census cycle. Although the consultant team has interviewed many public officials and has obtained a wide variety of opinions regarding the current population, the projections included within the 1981 Census Report appear to be the only statistical basis from which we can proceed.

In addition to Gaborone, two other regions have been identified in order to evaluate larger scale disposal alternatives. These include Gaborone plus the two adjoining villages of Tlokweng and Mogoditshane, and a much larger region that includes population centers within an approximate radius of 200 kilometers of Gaborone. The larger planning region is shown on Figure B.1.

Figure B.2 presents population data taken from the 1981 Census Report for the three planning regions. Projections are shown at five year intervals. All alternatives will be based on 1991 population figures and costs.

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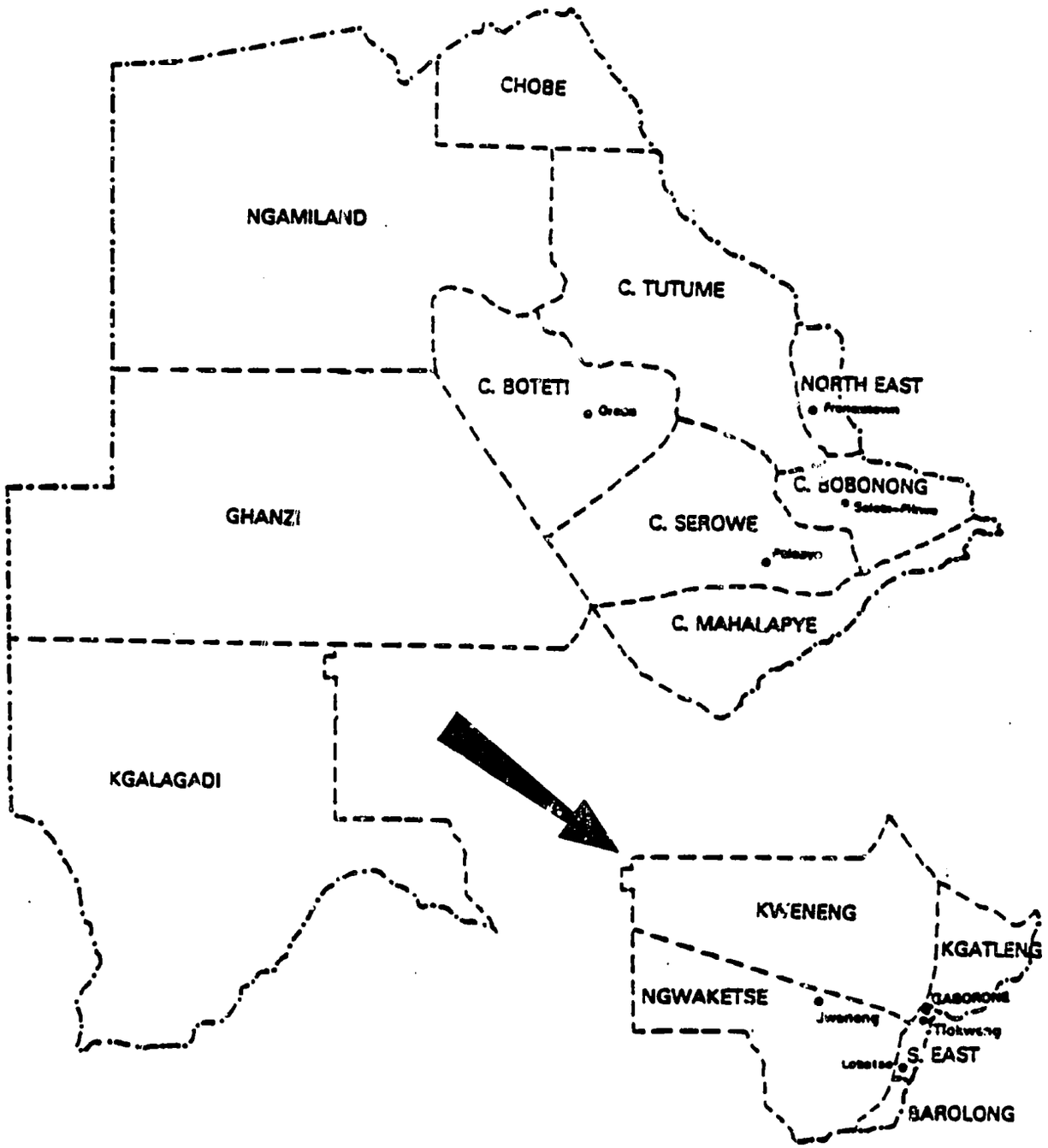

PLANNING REGION

REPUBLIC OF BOTSWANA

EXHIBIT B.1
PLANNING REGIONS

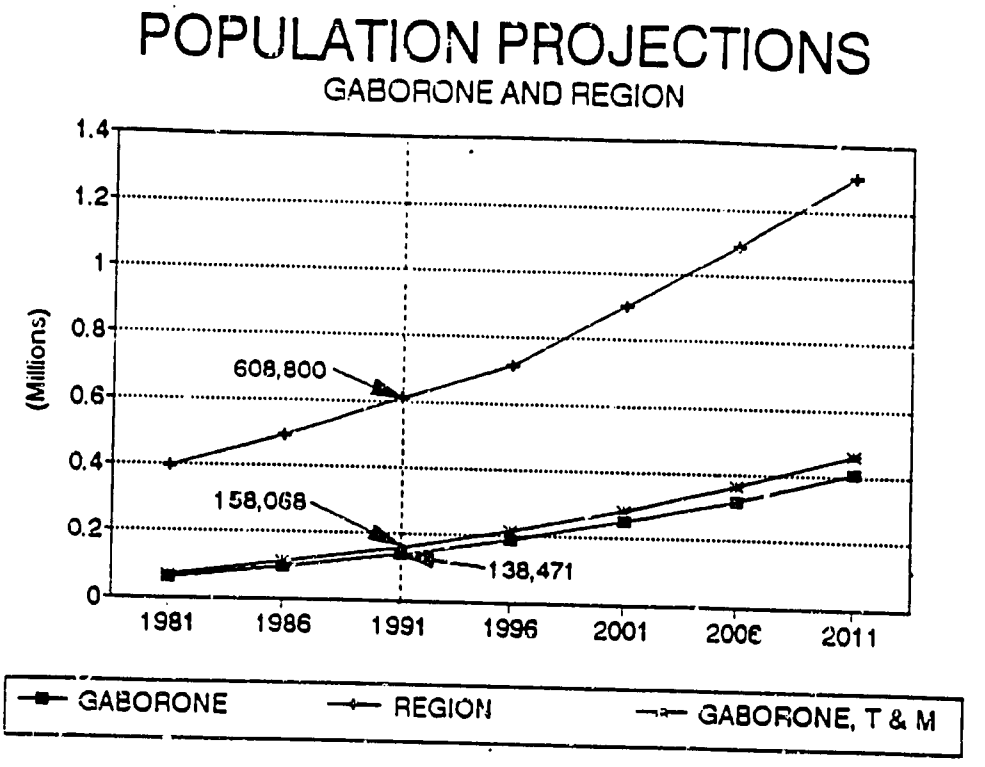

FIGURE B.2
POPULATION PROJECTIONS

B.3 WASTE COMPOSITION CALCULATION

Waste composition will vary widely based on geography, climate, and socioeconomic conditions. Since Botswana has emerged from a basically rural society to an urbanized region in a relatively short time, there is a very diverse mix of people residing in Gaborone. Each of the residential classes will generate wastes having unique characteristics. The 1985 NZA report established four classifications of residential landuse and sampled 471 plots to determine waste generation and composition. The methodology used in the sampling was not presented in the report and the only documentation consisted of summary tables.

An initial review of the NZA data showed that some of the data was consistent with reference information prepared by various international sources but several data points especially within the low income and SHHA classifications appeared to be inconsistent. Density calculations and generation coefficients also appeared inconsistent with initial field observations obtained during the two week weighing program. Based on the NZA figures, waste generation in 1991 was estimated at 134 TPD, but the weighing program produced only an average 60 TPD.

This initial finding, prompted the project team to review the NZA data more closely. It appears from descriptions included in the report that NZA based their evaluation on a 9 day period in February 1985, during which waste was monitored at the landfill.

Since the data was presented as 3,900 cubic meters at a density of

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WASTE COMPOSITION

By Mass and Volume

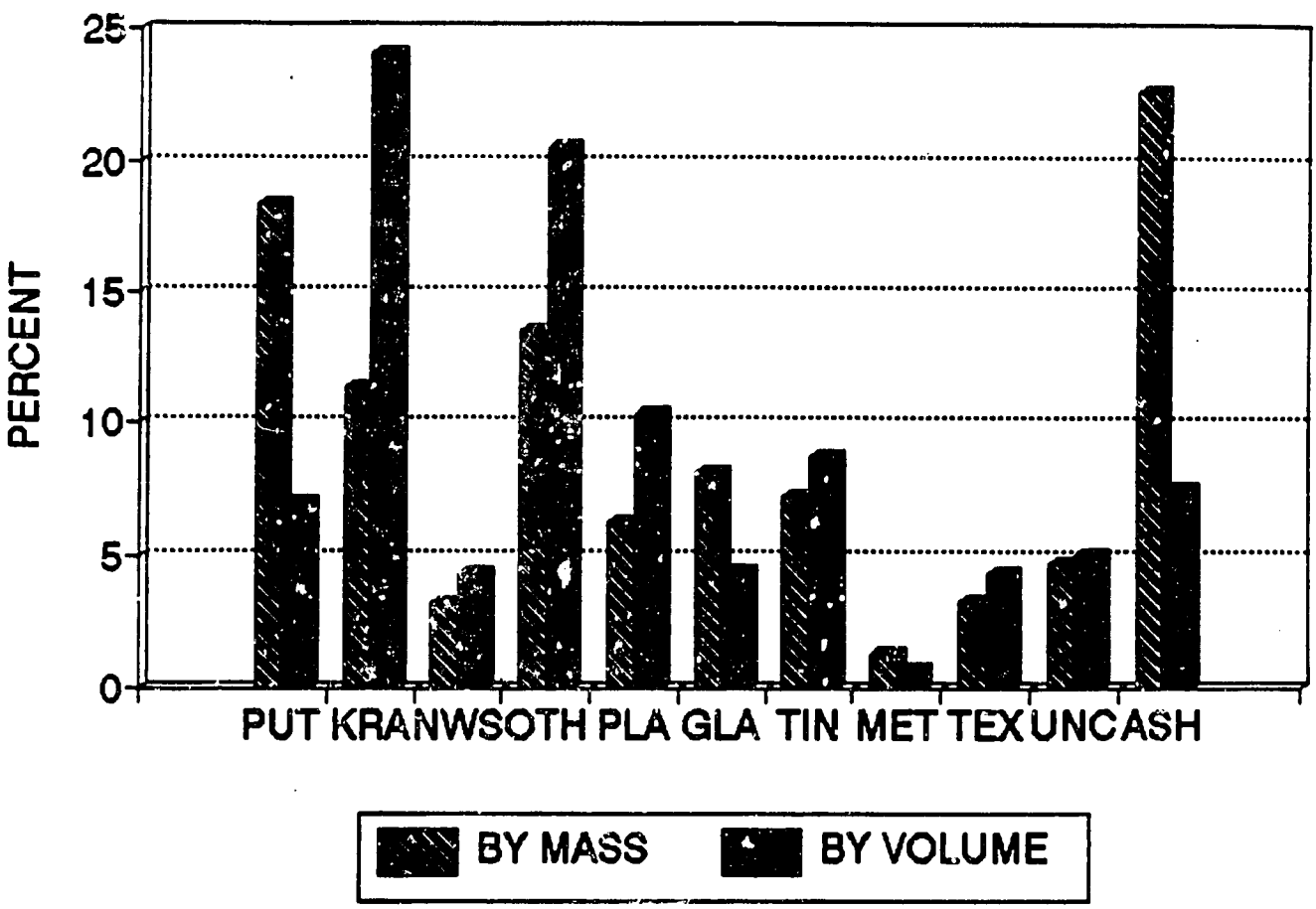

EXHIBIT B.3
WASTE COMPOSITION

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131 kg/cubic meter, it is assumed that the evaluation was based on volume rather than weight. Volume studies can often result in significant errors by failing to account for partially full vehicles. Since the NZA report did not provide details of their field work, we are unable to confirm their field results.

B.4 COMPUTER DATA BASE

The computer data base utilized the four residential classifications presented in the NZA report, and six other generation categories as follows:

Category	Generation Unit
High cost Residential	Per Capita
Medium Cost Residential	Per Capita
Low Cost Residential	Per Capita
SHHA Residential	Per Capita
Industrial	Per Plot
Commercial	Per Plot
School	Per Pupil
Medical	Per Bed
Institutional	Per Employee
Litter	Lump Sum

Generation rates for the residential categories were based on the weighing program (see Appendix C) and the rates for the other six categories were based partially on the NZA data with adjustments based on the weighing study and/or reference information.

Due to the rapid growth being experienced in Gaborone, it was not possible to obtain 1991 population information or numbers of industrial/commercial plots, and therefore these were extrapolated from the 1985 data, based on population and economic growth projections from various sources, including the National Economic Plan No.5. Total waste generation calculated by the computer model, in tonnes per year, was based on the above data, assuming full time residency (7 days per week).

B.4 WASTE COMPOSITION

Several waste management methods, including waste sorting and composting, are based, in part, on estimates of materials found in the composite waste stream. The computer data base includes a calculation of waste generation by 11 waste components that were identified in the NZA Report. These waste components are shown on the data base as percentages of total waste by weight (mass) and are based partially on work performed by NZA and adjusted based on the weigh program and reference material. A composite chart of the waste composition is shown on Exhibit B.3

B.5 RESULTS

After a review of initial data, it became obvious that insufficient data existed to use the computer simulation to estimate waste generation and composition for the larger region. Therefore the computer simulation was performed only on the information obtained for Gaborone and the local region.

The results of the computer simulations are presented in Exhibits B.4 and B.5. These exhibits are the actual computer printouts for the two regions analyzed and represent our preliminary assessment of waste generation in Gaborone and the surrounding local region.

The first page of each exhibit includes the generation rates for each type of generator by unit of generation, and the composition data from the NZA report, in percent by mass. The second page of the exhibit includes the input data regarding the number of generating units for each generation category and the calculation of waste for each generation category and composition component. The third page is a summary table. The results of the computer simulation were utilized to estimate actual waste generation and disposal rates, presented in Chapter 3 and in formulating the privatization alternatives.

SOLID WASTE GENERATION WORK SHEET

GABORONE 1991

REVISED 26-6-91

TOTAL POPULATION: 133,471

POPULATION DISTRIBUTION

HIGH COST	16,057
MED. COST	21,435
LOW COST	11,410
SHHA	87,569

GENERATION COEFFICIENTS BY GENERATOR TYPE

GENERATOR TYPE	RESIDENTIAL HIGH COST	RESIDENTIAL MED COST	RESIDENTIAL LOW COST	RESIDENTIAL SHHA	OTHER INDUST	OTHER COMM	OTHER SCHOOLS	OTHER MEDICAL	OTHER INSTITU	OTHER LITTER
TOTAL GENERATION										
COEFFICIENT	2.16	1.69	1.65	1.56	200	150	0.25	10	0.5	7,000
UNITS	(M/YR) PER CAP	(M/YR) PER CAP	(M/YR) PER CAP	(M/YR) PER CAP	(M/YR) PER PLOT	(M/YR) PER PLOT	(M/YR) PER PUPIL	(M/YR) PER BED	(M/YR) PER EMPLOY	(M/YR) LUMP SUM
DENSITY (Kg/Cu.M)	125	125	120	91	74	161	174	127	84	78
TOTAL(KG/YR/UNIT)	270	211	198	142	14,800	24,150	44	1,270	42	546,000
WASTE COMPONENT PERCENT (BY MASS)										
PUTRESCIBLES	23.6	21.6	20.2	8.3	3.0	40.0	50.0	26.0	5.0	2.0
KRAFT/CORR	10.7	9.3	7.8	5.8	25.0	20.0	8.0	22.6	20.0	5.0
NEWSPRINT	5.7	5.7	3.2	1.5	2.0	5.0	0.5	1.3	1.0	1.0
OTHER PAPER	9.2	8.3	5.1	5.9	50.0	15.0	20.0	15.6	50.0	20.0
PLASTICS	7.3	8.7	7.0	5.0	4.0	6.0	4.0	18.7	10.0	15.0
GLASS	10.2	13.1	10.0	8.2	0.5	8.0	0.5	5.5	2.0	10.0
TIN	11.0	8.7	12.0	8.4	0.5	2.0	4.0	5.5	4.0	15.0
OTHER METALS	0.9	0.9	2.6	1.0	3.0	1.0	1.0	0.0	3.0	3.0
TEXTILES/RUBBER	5.1	3.7	3.3	3.9	2.0	1.0	2.0	4.8	0.0	3.0
UNCLASSIFIED	2.8	6.4	12.0	5.0	5.0	1.0	5.0	0.0	5.0	5.0
FINES (ASH)	13.5	13.6	16.6	47.0	5.0	1.0	5.0	0.0	0.0	21.0
	100	100	100	100	100	100	100	100	100	100

EXHIBIT B.4

GABORONE WASTE GENERATION

PAGE 1

GABORONE

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WASTE GENERATION CALCULATION

BY WASTE TYPE AND COMPONENT

COMPONENT GENERATION IN Kg/YR

WASTE COMPONENT	GENERATOR UNITS	NUMBER OF UNITS	TOT GEN (CU.M)	PUTRESC	KRAFT/ CORR	NEWS	OTHER PAPER	PLASTICS	GLASS	TIN CANS	OTHER METALS	TEXTILES RUBBER	UNCLASSF	FINES/ ASH	TOTALS
DENSITY (Kg/CU.M)				280	50	80	70	64	194	68	200	80	100	320	
GENERATOR TYPE															
RESIDENTIAL															
HIGH COST	PER CAPITA	18,057	39,003	1,150,592	521,667	277,697	448,536	355,303	497,290	556,293	43,678	248,645	136,511	658,178	4,875,390
MED COST	PER CAPITA	21,435	36,225	978,079	421,117	258,104	375,836	393,949	593,187	393,949	40,753	167,541	289,601	615,828	4,528,144
LOW COST	PER CAPITA	11,410	18,827	456,354	176,216	72,294	115,218	158,143	225,918	271,102	58,739	74,553	271,102	379,542	2,259,180
SHEA	PER [illegible]	87,569	136,608	1,031,798	721,015	186,469	733,446	621,565	1,019,366	1,044,229	124,313	484,821	621,565	5,842,709	12,431,295
OTHER															0
															0
INDUSTRIAL	PER PLOT	250	50,000	111,000	925,000	74,000	1,850,000	148,000	18,500	18,500	111,000	74,000	185,000	185,000	3,700,000
COMMERCIAL	PER PLOT	200	30,000	1,932,000	966,000	241,500	724,500	289,800	366,400	96,600	48,300	48,300	48,300	48,300	4,830,000
SCHOOLS	PER PUPIL	30,000	7,500	652,500	104,400	6,525	261,000	52,200	6,525	52,200	13,050	26,100	65,250	65,250	1,305,000
MEDICAL	PER BED	237	2,370	78,257	68,024	3,913	46,954	56,285	16,554	16,554	0	14,448	0	0	300,990
INSTITUTIONAL	PER EMPLOY	3,000	1,500	6,300	25,200	1,260	63,000	12,600	2,520	5,040	3,780	0	6,300	0	126,000
LITTER	LUMP SUM	1	7,000	10,920	27,300	5,460	109,200	81,900	54,600	81,900	16,380	16,380	27,300	114,660	546,000
			(CU M)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)
SUBTOTAL RESIDENTIAL GENERATORS			230,662	3,559	1,811	782	1,646	1,505	2,298	2,210	263	950	1,298	7,376	23,709
SUBTOTAL OTHER GENERATORS			98,370	2,746	2,062	327	3,006	631	477	266	189	176	327	407	10,635
TOTAL ALL GENERATORS			329,032	6,305	3,893	1,109	4,652	2,136	2,776	2,476	453	1,136	1,625	7,783	34,344
PERCENT OF TOTAL BY MASS				18.4%	11.3%	3.2%	13.5%	6.2%	8.1%	7.2%	1.3%	3.3%	4.7%	22.7%	
PERCENT OF TOTAL BY VOLUME				7.0%	24.0%	4.3%	20.5%	10.3%	4.4%	8.7%	0.7%	4.4%	5.0%	7.5%	
ESTIMATED ON-SITE DISPOSAL			37,257	1,200	200	50	600	150	300	250	20	100	200	2,000	5,270
ESTIMATED CURRENT RECYCLING			63,336	0	2,000	0	500	200	0	1,[illegible]	30	0	0	0	3,770
NET REMAINING FOR DISPOSAL/RECYCLING			228,479	5,105	1,693	1,059	3,552	1,786	2,476	1,176	413	1,036	1,425	5,763	25,304

EXHIBIT B.4

GABORONE WASTE GENERATION

WASTE GENERATION SUMMARY - GABORONE - 1991

GENERATOR TYPE	GENERATION UNITS	GEN RATES CU.M/YR	NUMBER OF UNITS	TOTAL GEN (CU.M/YR)	TOTAL GEN (T/YR)	PER CAP GEN (KG/CAP/DAY)	
RESIDENTIAL							
HIGH COST	PER CAPITA	2.16	18,057	38,203	4,737	0.74	
MED COST	PER CAPITA	1.69	21,435	36,225	4,456	0.58	
LOW COST	PER CAPITA	1.65	11,410	18,827	2,223	0.54	
SHHA	PER CAPITA	1.56	87,569	136,609	12,232	0.33	
OTHER							
INDUSTRIAL	PER PLOT	200	250	50,000	3,641		
COMMERCIAL	PER PLOT	150	200	30,000	4,753		
SCHOOLS	PER PUPIL	0.25	30,000	7,500	1,284		
MEDICAL	PER BED	10	237	2,370	296		
INSTITUTIONAL	PER EMPLOY	0.5	3,000	1,500	124		
LITTER	LUMP SUM	7000	1	7,000	537		Tonnes/day
TOTAL GENERATED				329,032	34,344	0.69	94
ESTIMATED ON-SITE DISPOSAL				37,257	5,270	0.11	14
ESTIMATED CURRENT RECYCLING				63,296	3,770	0.08	10
NET REMAINING FOR DISPOSAL				228,479	25,304	0.51	69
NET GENERATION PER WEEK					487		

EXHIBIT B.4
GABORONE WASTE GENERATION

SOLID WASTE GENERATION WORK SHEET

LOCAL REGION 1991

REVISED 16-6-91

TOTAL POPULATION: 158,068

POPULATION DISTRIBUTION

HIGH COST	18,057
MED. COST	23,435
LOW COST	29,007
SEHA	87,569

GENERATION COEFFICIENTS BY GENERATOR TYPE

GENERATOR TYPE	RESIDENTIAL HIGH COST	RESIDENTIAL MED COST	RESIDENTIAL LOW COST	RESIDENTIAL SEHA	OTHER INDUST	OTHER COMM	OTHER SCHOOLS	OTHER MEDICAL	OTHER INSTITU	OTHER LITTER
TOTAL GENERATION										
COEFFICIENT	2.16	1.69	1.65	1.56	200	150	0.25	10	0.5	7,500
UNITS	(M/YR) PER CAP	(M/YR) PER CAP	(M/YR) PER CAP	(M/YR) PER CAP	(M/YR) PER PLOT	(M/YR) PER PLOT	(M/YR) PER PUPIL	(M/YR) PER BED	(M/YR) PER EMPLOY	(M/YR) LGHP SOM
DENSITY (Kg/Cu.M)	125	125	120	91	74	161	174	127	84	78
TOTAL(KG/YR/UNIT)	270	211	198	142	14,800	24,150	44	1,270	42	585,000
WASTE COMPONENT PERCENT (BY MASS)										
PUTRESCIBLES	23.6	21.6	20.2	8.3	3.0	40.0	50.0	26.0	5.0	2.0
KRAFT/CORR	10.7	9.3	7.8	5.8	25.0	20.0	8.0	22.6	20.0	5.0
NEWSPRINT	5.7	5.7	3.2	1.5	2.0	5.0	0.5	1.3	1.0	1.0
OTHER PAPER	9.2	8.3	5.1	5.9	50.0	15.0	20.0	15.6	50.0	20.0
PLASTICS	7.3	8.7	7.0	5.0	4.0	6.0	4.0	16.7	10.0	15.0
GLASS	10.2	13.1	10.0	8.2	0.5	8.0	0.5	5.5	2.0	10.0
TIN	11.0	8.7	12.0	8.4	0.5	2.0	4.0	5.5	4.0	15.0
OTHER METALS	0.9	0.9	2.6	1.0	3.0	1.0	1.0	0.0	3.0	3.0
TEXTILES/RUBBER	5.1	3.7	3.3	3.9	2.0	1.0	2.0	4.8	0.0	3.0
UNCLASSIFIED	2.8	6.4	12.0	5.0	5.0	1.0	5.0	0.0	5.0	5.0
FINES (ASH)	13.5	13.6	16.8	47.0	5.0	1.0	5.0	0.0	0.0	21.0
	100	100	100	100	100	100	100	100	100	100

EXHIBIT B.5

LOCAL REGION WASTE GENERATION

WASTE GENERATION CALCULATION

by Waste Type and Generator

COMPONENT GENERATION IN Kg/Th

WASTE COMPONENT	GENERATOR UNITS	NUMBER OF UNITS	TOT GEN (CU.M)	PUTRESC	HEART/ CORE	NEWS	OTHER PAPER	PLASTICS	GLASS	TIN CANS	OTHER METALS	TEXTILES RUBBER	UNCLASSF	FINES/ ASH	TOTALS
DENSITY (Kg/CU.M)				280	50	80	70	64	154	68	200	80	100	320	
GENERATOR TYPE															
RESIDENTIAL															
HIGH COST	PER CAPITA	18,057	39,003	1,150,592	521,667	277,897	448,536	355,903	437,290	536,293	43,879	248,645	136,511	658,178	4,875,390
MED COST	PER CAPITA	23,435	39,605	1,063,339	450,410	282,187	410,903	430,706	648,534	430,706	44,556	183,174	316,841	673,288	4,950,644
LOW COST	PER CAPITA	29,007	47,862	1,160,164	447,934	183,788	292,913	402,037	574,339	629,206	149,328	189,532	669,206	964,889	5,743,386
SUM	PER CAPITA	87,569	136,608	1,031,798	721,015	186,469	733,446	621,565	1,019,366	1,044,229	124,313	484,821	621,565	5,842,709	12,431,295
OTHER															
INDUSTRIAL	PER PLOT	270	54,000	119,880	999,000	79,920	1,998,000	159,840	19,980	19,960	119,880	79,920	199,800	199,800	0
COMMERCIAL	PER PLOT	220	33,000	2,125,200	1,062,600	265,650	796,950	318,780	425,040	106,260	53,130	53,130	53,130	53,130	0
SCHOOLS	PER PUPIL	33,000	8,250	717,750	114,840	7,178	287,100	57,420	7,178	57,420	14,355	28,710	71,775	71,775	3,996,000
MEDICAL	PER BED	237	2,370	78,257	68,024	3,913	46,954	56,285	16,554	16,554	0	14,448	0	0	5,313,000
INSTITUTIONAL	PER EMPLOY	3,200	1,600	6,720	26,880	1,344	67,200	13,440	2,688	5,376	4,032	0	6,720	0	1,435,500
LITTER	LUMP SUM	1	7,500	11,700	29,250	5,850	117,000	87,750	58,500	87,750	17,550	17,550	29,250	122,850	300,990
															134,400
															585,000
			(CU M)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)	(TONNES)
SUBTOTAL RESIDENTIAL GENERATORS			263,077	4,341	2,117	915	1,856	1,781	2,696	2,657	356	1,083	1,736	8,009	27,553
SUBTOTAL OTHER GENERATORS			106,720	3,011	2,264	358	3,260	682	521	289	206	191	355	440	11,577
TOTAL ALL GENERATORS			369,797	7,352	4,380	1,273	5,116	2,464	3,217	2,946	562	1,279	2,091	8,449	39,129
PERCENT OF TOTAL BY MASS				18.8%	11.2%	3.3%	13.1%	6.3%	8.2%	7.5%	1.4%	3.3%	5.3%	21.6%	
PERCENT OF TOTAL BY VOLUME				7.2%	24.1%	4.4%	20.1%	10.6%	4.6%	9.2%	0.8%	4.4%	5.7%	7.3%	
ESTIMATED ON-SITE DISPOSAL			48,361	1,500	250	65	1,000	190	375	315	25	125	260	3,000	7,105
ESTIMATED CURRENT RECYCLING			65,328	0	2,100	0	500	360	0	1,050	20	0	0	0	3,870
NET REMAINING FOR DISPOSAL/RECYCLING			256,108	5,852	2,030	1,208	3,616	2,074	2,842	1,581	517	1,154	1,831	5,449	28,154

EXHIBIT B.5

LOCAL EXPORT WASTE GENERATION

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WASTE GENERATION SUMMARY - LOCAL REGION

REVISED 6-26-91

GENERATOR TYPE	GENERATION UNITS	GEN RATES CU.M/YR	NUMBER OF UNITS	TOTAL GEN (CU.M/YR)	TOTAL GEN (T/YR)	PER CAP GEN (KG/CAP/DAY)	
RESIDENTIAL							
HIGH COST	PER CAPITA	2.16	18,057	39,003	4,797	0.74	
MED COST	PER CAPITA	1.69	23,435	39,605	4,871	0.58	
LOW COST	PER CAPITA	1.65	29,007	47,862	5,651	0.54	
SHHA	PER CAPITA	1.56	87,569	136,608	12,232	0.39	
OTHER							
INDUSTRIAL	PER PLOT	200	270	54,000	3,932		
COMMERCIAL	PER PLOT	150	220	33,000	5,228		
SCHOOLS	PER PUPIL	0.25	33,000	8,250	1,413		
MEDICAL	PER BED	10	237	2,370	296		
INSTITUTIONAL	PER EMPLOY	0.5	3,200	1,600	132		
LITTER	LUMP SUM	7500	1	7,500	576		Tonnes/day
TOTAL GENERATED				369,797	33,129	0.63	167
ESTIMATED ON-SITE DISPOSAL				48,361	7,105	0.13	19
ESTIMATED CURRENT RECYCLING				65,338	3,870	0.07	11
NET REMAINING FOR DISPOSAL				256,108	23,154	0.50	77
	NET GENERATION PER WEEK				541		

EXHIBIT B.5
LOCAL REGION WASTE GENERATION

APPENDIX C - WEIGHING PROGRAM

APPENDIX C

WEIGHING PROGRAM

C.1 SUMMARY

A two week waste quantity analysis was conducted for all waste generated in Gaborone and disposed at the City's landfill. An accurate assessment of waste disposal rates is crucial in the development of improvements to the current collection and disposal system.

The results of the weighing programme indicate that the City of Gaborone discards 57.6 TPD of refuse (does not include construction waste). This includes: 42.0 TPD from GCC refuse collection vehicles (compactors, round bodies, and square bodies), 6.3 TPD delivered by Skip Hire; and 9.2 TPD of self haul and GCC tipper and skip vehicles.

Waste delivered to the landfill by category can be divided as follows: 3.5 TPD source separated organics (vegetable waste, garden waste, and feathers), 2.4 TPD of ash, and 0.7 TPD of wood waste, and 51.0 TPD of mixed refuse.

In conclusion, this survey attempted to define the quantity of refuse collected and landfilled in Gaborone with the most accurate methodology. It should be noted that the data from this weighing survey differs greatly from the 1985 NZA study which estimated refuse waste disposal rates of over 85 TPD in 1985, and an expected rate of 167 TPD by 1995. Prior to expenditures on any processing technology where cost would be greatly effected by waste generation rates, it is recommended that GCC conduct a second two week weighing program using the same methodology reported herein during a different season. This would confirm the accuracy of the data presented in this appendix, and provide an additional data base.

C.2 METHODOLOGY

During the period of April 28 through May 12, 1991, the Consultancy conducted a weighing program for the City of Gaborone. During this time, GCC refuse collection vehicles (compactors, round bodies, and square bodies) were instructed to report to the weigh bridge station prior to disposal at the landfill. The weigh bridge is located about 3 km from the landfill, and was used since no scale house exists at the landfill.

The scales used at the weigh bridge station are manufactured by Ashworth Ross & Company, Ltd (Dewsbury, England) and are accurate to within 10 kilograms. The scales were operated by a weigh master during the survey and the scales were balanced and tested for

accuracy each morning.

At the weigh bridge, refuse collection drivers were interviewed for type of waste collected (residential or commercial) and the extension served. In order to ensure that refuse collection vehicles were weighed prior to unloading at the landfill, two staff members were located at the landfill. Drivers were required to provide a receipt from the weigh bridge station upon entering the landfill indicating that their truck was weighed.

In order to document other sources of waste delivered to the landfill, the two staff members interviewed all vehicles entering the landfill. Staff members were responsible for estimating volume and weight of the refuse self-hauled to the landfill. To more accurately estimate refuse quantities from Skip Hire, the exclusive private hauler in Gaborone, ten skips were delivered to the weigh bridge station. This allowed estimates for average densities for the other Skip Hire vehicles which were measured by volume.

Average temperatures during the week ranged from 7.7 to 22 degrees. At the time of this report, meteorological data was not available, but precipitation occurred only once and was estimated at less than 10 millimeters.

C.3 RESULTS

Exhibit C.1 presents the results of the two week weighing program. These figures include only refuse, and do not include construction waste (rubble and earth). Based on a seven day week, the City of Gaborone discards an average of 57.5 TPD of refuse. As shown, this includes: 42.0 TPD from GCC refuse collection trucks (compactors, round bodies, and square bodies), 6.3 TPD delivered by Skip Hire, and 9.2 TPD delivered by private businesses or organizations, and waste delivered by GCC using either tipper bodies or skips.

The daily disposal rate ranged from 13.7 TPD on Sunday, May 5, to 80.1 TPD on Monday, 6 May. The average variation of the two weeks was less than four percent.

Exhibit C.2 provides a breakdown by category of the waste delivered to the landfill. This exhibit indicates only those loads of exclusively separated waste, and does not represent an overall disposal rate for each category. This table is presented to illustrate the potential of material recovery at the landfill. As shown, source separated organics account for 3.5 TPD, or 6.1 percent of the waste stream. Source separated organics is limited to vegetable waste, garden waste, manure, and feathers.

The other two categories identified were ash and wood waste. These two categories accounted for 4.2 and 1.2 percent of the waste stream, respectively.

During the two week period, a total of 1,345 vehicles were recorded to enter the landfill. This included: 392 GCC refuse collection vehicles (compactors, round bodies, square bodies), 116 vehicles from Skip Hire, and 837 self-haul or GCC tipper or skip vehicles. On average, 96 vehicles enter the landfill each day.

Exhibit C.1 Gaborone Solid Waste Weighing Program
April 28 - May 12, 199
(Kg per day)

	Date	City Council a)	Skip Hire b)	Other c)	Total
	April 29	47,750	8,415	14,005	70,170
W	April 30	60,020	9,425	14,233	83,678
E	May 1	64,210	7,220	10,005	81,435
E	May 2	47,180	8,080	4,345	59,605
K	May 3	46,680	7,063	6,100	59,843
	May 4	23,220	0	3,605	26,825
1	May 5 d)	9,020	0	4,650	13,670
	Week Subtotal:	298,080	40,204	56,943	395,227
	Week Average (Kg/day):	42,583	5,743	8,135	56,461
	May 6	54,840	11,787	13,505	80,132
W	May 7	58,030	7,252	9,664	74,946
E	May 8	49,270	15,762	13,840	78,872
E	May 9	38,480	0	9,090	47,570
K	May 10	53,390	13,260	9,850	76,500
	May 11	27,590	0	11,275	38,865
2	May 12	9,020	0	4,650	13,670
	Week Subtotal:	290,620	48,060	71,874	410,554
	Week Average (Kg/day):	41,517	6,866	10,268	58,651
	Overall Average (Kg/Day):	42,050	6,305	9,201	57,556

a) Based on a weighing program conducted between April 30 and May 12. During this time all City Council refuse collection vehicles (compactors, round body, and square) were required to report to the Weigh Bridge prior to entering the landfill.

b) Based on average densities as obtained by weighing a limited sample number of Skip Hire's vehicles.

c) Includes private haulers, and GCC tipper and skip vehicles. Weight estimates based on visual survey of vehicles entering the landfill.

d) Estimates for May 5 based on results from following Sunday (May 12).

Exhibit C.2 Solid Waste Disposed by Category a)

	Date	Source Separated Organics b)	Ash	Wood Waste	Mixed Refuse	Total
	April 29	3,280	1,800	1,346	63,744	70,170
W	April 30	4,175	0	1,346	78,158	83,678
E	May 1	2,690	0	897	77,848	81,435
E	May 2	540	3,300	1,794	53,971	59,605
K	May 3	870	0	1,794	57,179	59,843
	May 4	650	0	0	26,175	26,825
1	May 5 c)	4,100	0	0	9,570	13,670
	Week Subtotal:	16,305	5,100	7,176	366,646	395,227
	Week Average (Kg/day):	2,329	729	1,025	52,378	56,461
	May 6	3,405	5,400	1,645	69,682	80,132
W	May 7	2,580	3,300	0	69,066	74,946
E	May 8	5,660	12,600	0	60,612	78,872
E	May 9	6,050	0	0	41,520	47,570
K	May 10	4,970	7,200	527	63,803	76,500
	May 11	6,235	0	0	32,630	38,865
2	May 12	4,100	0	0	9,570	13,670
	Week Subtotal:	821,109	788,109	759,609	757,437	410,554
	Week Average (Kg/day):	4,714	4,071	310	49,555	58,651
	Overall Average (Kg/Day):	3,522	2,400	668	50,966	57,556
	Percent of Total	6.1%	4.2%	1.2%	88.6%	100.0%

a) As identified at the landfill based on visual survey and interviews w/ drivers.
b) Source separated organics included: vegetable waste, brush, grass, and feathers. In addition, loads of manure were included.
c) Estimates for May 5 based on results from following Sunday (May 12).

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APPENDIX D - RECYCLING

APPENDIX D

RECYCLING

This appendix provides a brief overview of recycling potential for the City of Gaborone, and a a strategy for implementing increased material recovery. There are many social, economic, and environmental benefits inherit with recycling. These include: increased job creation; reduction in refuse collection and disposal costs for the GCC; flow of foreign money into the local economy; and extension of the life of the landfill.

Recycling strategies discussed in this appendix are limited to source separation technologies. Source separation involves some level of separation of salvageable material by either the waste generator (i.e., plot owner) or refuse collector during collection. This technique is commonly used in the United States and Europe for recovering material from both the residential and commercial waste stream. In Gaborone, this technique is used rather effectively by Waste Paper Recovery, Ltd. in their programme of collecting cardboard from businesses in Gaborone.

Compared to other recycling techniques such as sorting salvageable materials from mixed refuse, source separation offers several unique benefits. These include:

- Reduction in the amount of waste that must be collected and delivered to the landfill
- Recyclable materials have a cleaner quality for the end-market user because it has not been cross-contaminated with mixed refuse (food waste, garden waste, etc...). Thus, end-markets pay a higher premium for the material.
- Additional jobs are created in the area of collection
- Source separated recyclables require less processing, and thus less capital intensive equipment for processing are required then sorting of materials from mixed waste
- The public is educated on environmental issues
- By creating a market for various materials, littering would be reduced.

The main consideration for the GCC in deciding to implement a source separation program is the economic viability of such a program. This appendix provides a preliminary costs analysis. The cost analysis was conducted through a detailed assessment of the

waste stream, telephone interviews of material markets in Southern Africa, and an evaluation of collection and processing costs.

This appendix is divided in to six sections: existing recycling activities; material markets; residential recycling strategies; commercial recycling strategies; cost analysis; and recommendations.

D.1 EXISTING RECYCLING ACTIVITIES

As discussed in section 3.3.6, the main recycling activities in Gaborone are the collection of cardboard by Waste Paper Recovery, Ltd., and the collection of bi-metal cans by Metal Box, Ltd. Waste Paper Recovery owns a fleet of four vehicles to collect cardboard from the various businesses in Gaborone. The company provides free collection service in return for the cardboard. For large generators of cardboard, Waste Paper Recovery may pay for the material. The material is processed with an export type baler and railed to markets in Zimbabwe and South Africa.

Metal Box collects the majority of its cans from school sponsored collection programmes. They are provided an education program on environmental issues, and a contest is held quarterly to financially reward schools that recycle the most.

Combined, the two companies recycle 220 tonnes of materials per month and hire over 50 employees. Both companies have additional processing capacity and are interested in additional materials.

D.2 MATERIAL MARKETS

The availability of end-markets is vital for any recycling program. If no markets are available, there is no economic incentive to separate materials from the waste stream . (An end-market is the final step in recycling where the material is remanufactured into the same item, or a different product.)

A preliminary market survey was conducted of end-markets in Botswana, South Africa, and Zimbabwe. The survey indicated markets for the following materials:

- Bi-Metal Cans
- Food and Beverage Glass and Plate Glass (windows and mirrors)
- High Density Polyethylene (HDPE)
- Paper (cardboard, high grade, mixed grade, news).

As shown in Exhibit D.1, revenues for materials varied from P60 per tonne for bimetal cans to up to P250 for HDPE. These revenues are net transportation costs, but do require some level of processing.

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EXHIBIT D.1 MATERIAL MARKET VALUES

Material	Revenue (Pula/tonne) a)
Bi-metal Cans	45 - 60
HDPE	200 - 250
Glass	
Food and Beverage	80 - 100
Plate Glass	60 - 70
Paper	
Corrugated	115 - 130
High Grade	200 - 230
Newspaper	90 - 100

a.) F.O.B. Gaborone.

All markets identified were based in South Africa, with no end-markets located in Botswana. It is worth mentioning that while future markets are hard to project due to the volatility of the world market, the removal of international trade sanctions against South Africa should help stabilize or even increase revenues for recyclable materials in Southern Africa.

Paper end-markets included Lothlorein Waste; Mondi Paper Recycling; and Nambak, while the major bimetal market is Metal Box, Ltd. This company expressed a commitment to making recycling cost effective in Gaborone, and would negotiate an appropriate price to ensure the recycling of cans. Consol Glass is the primary market for beverage and food glass, and HDPE is purchased by both Eaton Plastics and Ronde Plastic.

D.3 RESIDENTIAL RECYCLING STRATEGIES

There are a wide variety of strategies for collecting salvageable materials from residential extensions, but they can be divided into two main methods. The first method involves residents separating each recyclable material into separate categories. In other words, a separate container would be used for glass, metal, paper, and plastic. This material would then be collected with a compartmentalized vehicle.

The second method, often referred to as commingled collection, involves residents placing all their recyclable materials into one container, such as a clear plastic bag. These materials are subsequently picked-up with a non-compactor vehicle and then delivered to a processing facility for sorting, processing, and transporting to market.

The Consultancy reviewed various collection strategies for GCC and recommends commingled collection as the preferred strategy for source separation. The commingled collection strategy offers several key advantages. These include: greater convenience for residents increasing the potential for higher recovery rates; ability for the GCC to use existing collection vehicles; and recyclable collection costs are reduced. However, the commingled approach would require increased labor for sorting at the processing facility. This adds to processing costs, but is off-set by reduced collection costs. It also has the advantage of providing additional jobs.

Based on the market survey, recommended materials for collection would include: bimetal cans; beverage and food glass; HDPE; and paper products (corrugated, high grade, and news). A review of waste generation rates (see Section 3.3.3) and a previous waste composition study indicates that the higher income areas generate the largest quantity of recyclable materials. Thus, the high and medium extensions in Gaborone represent the most appropriate area

to implement a source separation program. These areas should be provided labeled, clear plastic bags which would be picked-up once per week.

Exhibit D.2 provides a breakdown of the quantity of recyclables generated in a medium to high income area. As shown, the average plot generates 9.01 kilograms per week of recyclable materials. This represents 39.6 percent of the total waste generated. Assuming only modest participation, a source separation program would collect 4.38 kilograms per plot per week, or a 19 percent waste diversion rate.

In order to further define actual participation rates, it is strongly recommended that the GCC conduct an extended pilot source separation program of several hundred residential plots. The pilot program would measure recovery rates, participation rates and most importantly, interview residents for evaluating strategies which encourage participation. This would form the basis for an expanded program.

It should be noted that source separation programs have been attempted in South Africa with minimal success. These programmes, however, often focused on only single recyclable materials, were not properly designed, or did not include a large enough education component. The recommended programme for GCC addresses a full spectrum of materials and would place emphasis on a comprehensive education program. In addition, the pilot program would provide the GCC the necessary information in ensuring a successful program.

Source separate collection is not expected to be economical in lower income areas due to the low quantity of refuse generated, and lack of recyclables in the waste stream. The most likely program to provide these citizens with an opportunity to recycle is to develop economic incentives to recycle. This could best be accomplished by the private sector paying high enough revenues to encourage residents to save their recyclables. As mentioned previously, Metal Box has expressed a strong commitment for encouraging the recycling of bi-metal cans. If revenues were high enough and a pick-up system established, this would result in tremendous recycling activities in the lower income areas.

D.4 COMMERCIAL RECYCLING STRATEGIES

The GCC would benefit in developing an infrastructure of private entrepreneurs recycling because it would decrease the amount of waste collected and disposed. For example, every tonne of material recycled by the private sector would save the GCC over P80.

TABLE D.2 MATERIAL RECOVERY RATES

Material	Percent of Waste stream a.)	Generation Rate kg/plot/week b.)	Expected Recovery Rate kg/plot/week
Bi-Metal	11.0	2.50	1.40
HDPE	2.0	0.46	0.19
Glass	10.2	2.32	1.30
Paper			
Corrugated	10.7	2.43	0.85
News	5.7	1.30	0.64
Subtotal:	39.6	9.01	4.38
Non-Recyclable Materials	60.4	13.74	-
Total:	100.0	22.75	4.38
Material Diversion Rate (%)	-	-	19

a.) Waste composition based on 1985 NZA report.
b.) See Section 3.3.3.
c.) Assumes participation rates between 35 and 55 percent. These rates are relatively conservative. A well designed program could receive participation rates of 80 to 90 percent.

Three areas of commercial recycling collection are recommended for Gaborone. These areas include: office paper recycling programme; increased corrugated recycling; and public school recycling. These are described below.

Office Paper Recycling Program - An office paper recycling program would be established in all GCC offices and at Central Government offices. Each worker would receive a desk-top container to store used ledger paper. (An example of a desk-top container was provide to the Health Department.) This paper would be collected as needed by an approved private contractor. Because the paper has such a high value (up to P230 per tonne), the contractor would either collect the materials for free in exchange for the material, or even pay for the material. Other organizations that generate large quantities of paper, such as banks and hotels, would also be encouraged through an education outreach to implement an office paper recycling program.

Increased Corrugated Recycling - The commercial waste stream contains a significant quantity of corrugated containers (between 12 and 25 percent). Commercial establishments in the City not currently recycling should be strongly encouraged to begin a corrugated recycling program. Tipping fees at the future landfill or privatization of commercial collection would provide the necessary incentives for corrugated recycling.

Public School Recycling - Expanded bi-metal collection at all public schools is recommended. In addition, the recycling of other materials including paper and plastic should be evaluated.

A recycling system at the public schools is advantageous because it would teach young adults and kids the importance of recycling. This behavior would encourage further recycling at home.

D.5 COST ANALYSIS

A cost analysis of source separation was conducted. As shown in Exhibit D.3, the cost analysis is divided into three parts: material recovery; revenues; and costs. Based on current collection efficiencies and material recovery rates discussed earlier, a non-compactor vehicle is capable of collecting 3.75 tonnes of materials per day.

Based on the material market survey, this material has a value of P357. With a future avoided landfill costs of P32 per tonne, total revenues are projected at P477 per day.

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TABLE D.3 SOURCE SEPARATION COST ANALYSIS

Component	Costs Pula/Day
Material Recovery (tonnes/vehicle/day)	3.75
Costs Analysis	
A. Revenues	
1. Material Sales	(357)
2. Landfill Diversion (@ P32/tonne)	(120)
Subtotal:	(477)
B. Costs	
1. Collection Vehicle with Crew a.)	270
2. Distribution of Plastic Bags	45
3. Processing (@ P20/tonne)	75
Subtotal:	390
Total System Costs	(87)

a.) See Section 3.3.4.

The costs for a source separation program include: collection vehicle and crew; bags for residents; and processing costs. The operation of a non-compactor vehicle was determined to be P270 per day (see Section 3.3.4). Bags are estimated at P45 per day, while processing costs were estimated at P20 per tonne. Total operating costs were calculated at P390.

Overall system cost was estimated at a profit of P87 per day. This costs does not include reductions in refuse collection costs. Higher participation rates, additional materials targeted for recycling, and higher vehicle collection efficiency would further improve the profitability of source separation.

C.6 RECOMMENDATIONS

The following recommendations are provided to implement increase recycling activities in Gaborone:

- Existing recycling activities can form a basis for expanded material recovery in Gaborone.

- A more detailed material market survey should be conducted that includes written price quotes from the end-markets along with long-term contract possibilities.

- Develop and implement a pilot source separation program in Extension 9 to determine education needs for a larger program, and further refine the economic viability of this technology.

- The GCC should actively encourage Metal Box, Ltd to provide leadership in metal can recycling and pay sufficient revenues to motivate bi-metal can recycling. Since bimetal cans are a large component of litter, the GCC would benefit tremendously if these containers had a value that would discourage littering. In addition, the GCC and Metal Box, Ltd. should coordinated increased recycling at schools.

- Develop office paper recycling program in GCC offices. Waste Paper Recovery, Ltd. has stated that they would be willing to provide the necessary containers to implement this program. Depending on the quantity of material collected, the GCC might receive a revenue for the paper. If the proposal from Waste Paper Recovery Ltd. is not acceptable, other private companies to collect the office paper could be explored.

APPENDIX E - DISPOSAL METHODS

APPENDIX E

DISPOSAL METHODS

E.1 GENERAL

The disposal methods used in the various disposal alternatives were presented in brief form in Section 4.4.2 of the main body of the report. Appendix E expands the presentation of disposal methods in order to give the reader a more thorough understanding of each method and specific applications that may affect disposal methods in Gaborone.

E.2 LANDFILL

A new landfill, designed and constructed to current technical standards requires the input from several engineering disciplines. In the case of the proposed landfill in Gaborone, a site search was conducted in a previous investigation and the current site was chosen as the best available site. Initial work, conducted by previous consultants, identified the general hydrogeologic setting but performed only minimum surficial field testing to determine actual conditions. These preliminary investigations found bedrock at relatively shallow depths but did not define the condition of the bedrock, specifically its ability to transport leachate that may be produced by the landfill or the bedrock's relationships to groundwater and surface water resources, including the Ngotwane River. The effects on groundwater from seepage from the current sewage ponds and the seepage from the Gaborone Dam should both be investigated further.

The actual design of a landfill depends primarily on the soils in which it is located, the mechanisms by which leachate may impact water resources, the composition of the waste being landfilled, and an estimation of leachate generation which is proportional to annual rainfall and operating conditions. If these conditions are favorable, and relatively fine grained soils exist under the landfill, of adequate depth, then a liner may not be required. Based on the minimal information collected to date, the proposed Gaborone landfill site has less favorable hydrogeological conditions which would indicate a more conservative design, including a synthetic geomembrane liner.

For the purposes of this report the Project Team assumed a lined landfill using a plastic liner of high density polyethylene (hdpe). Based on information presented in a 1989 report by NZA and preliminary work by ARUP, the capital and recurrent costs of the new landfill have been estimated. Since the amount and

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composition of the waste, requiring landfilling, will vary depending on the amount of processing, costs have been estimated at five different capacities. The cost data, included in Exhibit E.1, is based on limited information and should be used only as a basis for comparing alternatives.

E.2 SORTING FACILITY

Although scavenging has a beneficial effect on the landfill by removing waste and extending landfill life, the current scavenging at the Gaborone Landfill is uncontrolled, is inefficient and creates significant health hazards. The Project Team has concurred with previous reports that a sorting facility should be built at the landfill to facilitate waste sorting in a more controlled and healthier manner.

For the purposes of this report we have assumed a sorting facility to handle approximately 50 to 60 Tonnes per day of mixed waste, expandable as the City continues to grow. Source separated waste that arrives at the landfill which contains no recoverable material will bypass the sorting facility. Waste is first dumped on a tipping floor where initial inspection and removal of bulky items will occur. The waste will then be placed on an inclined conveyor which will transfer the waste to a second conveyor and sorting platform located approximately three meters above the floor. Waste sorters will then manually pick through the waste, sorting the waste into storage bins or skips located beneath the sorting platform. The number of materials removed will depend on the availability of markets. The material that remains on the conveyor, after sorting, is loaded into a tipper truck and taken to the landfill or transferred to a composting facility. Sorted materials would be baled and sent to materials markets.

The Project Team estimates that approximately 15 Tonnes per day of materials could be removed through the sorting facility. A cost estimate for the above described facility is presented in Exhibit E.2

E.3 COMPOSTING

Composting is defined as the natural biological decomposition of organic waste material under controlled conditions. The finished product of the process is a soil conditioner and erosion control material. In Botswana the compost will increase the native soil's ability to retain moisture and would have many market applications. For the purposes of this report we have assumed that all of the compost would be used for public works projects such as covering the closed landfills. If the compost component of the disposal system is privately operated, the City would have the option of taking the compost for its own usage or allowing the private operator to market the material to private and commercial users.

LANDFILL COST ESTIMATES

	60 TPD MIXED WASTE	45 TPD SORTED WASTE	18 TPD SORTED WASTE	21 TPD ASH	2/4 TPD SORTED ASH
CAPITAL COST					
SITE WORK, FENCING, ON-SITE ROADS, DRAINS	200,000	200,000	200,000	200,000	200,000
BUILDINGS	80,000	80,000	80,000	80,000	80,000
UTILITIES	130,000	130,000	130,000	130,000	130,000
MONITORING BOREHOLES	50,000	50,000	50,000	50,000	50,000
WEIGHBRIDGE	80,000	80,000	80,000	80,000	80,000
STORMWATER CONTROL	380,000	380,000	380,000	380,000	380,000
INITIAL CELL CONSTRUCTION, EXCAVATION & LIN	400,000	400,000	400,000	400,000	400,000
ACCESS ROAD	650,000	650,000	650,000	650,000	650,000
LEACHATE HANDLING	250,000	250,000	250,000	250,000	250,000
SUBTOTAL CONSTRUCTION COSTS	2,220,000	2,220,000	2,220,000	2,220,000	2,220,000
EQUIPMENT COSTS					
LANDFILL COMPACTOR	410,000	410,000	410,000	410,000	410,000
FRONT END LOADER	160,000	160,000	160,000	160,000	160,000
7 TONNE TIPPER TRUCK	130,000	130,000	130,000	130,000	130,000
10 kl TANKER TRUCK	130,000	130,000	130,000	130,000	130,000
BAKKIE (FOR SUPERVISOR)	30,000	30,000	30,000	30,000	30,000
SUBTOTAL EQUIPMENT COSTS	860,000	860,000	860,000	860,000	860,000
TOTAL CAPITAL COSTS	3,080,000	3,080,000	3,080,000	3,080,000	3,080,000
ANNUAL CAPITAL 25 YRS. @ 8%	288,534	288,534	288,534	288,534	288,534
RECURRENT COSTS					
LABOUR					
SITE SUPERVISOR, 1 @ 18,000	18,000	18,000	18,000	18,000	18,000
WEIGHBRIDGE ATTENDANT, 1 @ 13,500	13,500	13,500	13,500	13,500	13,500
SECURITY, @ 6,000 EACH	36,000	30,000	24,000	18,000	18,000
EQUIPMENT OPERATORS @ 13,500 EACH	54,000	48,000	27,000	27,000	27,000
SUBTOTAL LABOUR	121,500	109,500	82,500	76,500	76,500
SUPPLIES, FUEL, MAINTENANCE	135,000	121,500	70,000	60,000	20,000
UTILITIES	22,000	20,000	10,000	10,000	10,000
ADMINISTRATION	20,000	18,000	10,000	10,000	10,000
EQUIPMENT REPLACEMENT RESERVE	120,000	105,000	75,000	70,000	50,000
SUBTOTAL RECURRENT COSTS	418,500	374,000	247,500	226,500	166,500
TOTAL ANNUAL COSTS	707,034	662,534	536,034	515,034	455,034
TONNES LANDFILLED	21,900	15,425	6,570	7,665	1,460
COST PER TONNE	32.38	42.94	81.58	67.19	311.67

EXHIBIT E.1
LANDFILL COSTS

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SORTING FACILITY ESTIMATE

ITEM	COST ESTIMATE (PULA)
CAPITAL COSTS	
BUILDING 750 SQUARE METERS @ P700	525,000
SITE WORK, UTILITIES	50,000
CONVEYOR	200,000
STORAGE BUNKERS	20,000
GLASS CRUSHER	10,000
HORIZONTAL BALER	350,000
MOBILE EQUIPMENT	120,000
SUBTOTAL	1,275,000
DESIGN & ADMINISTRATION @ 20%	255,000
TOTAL CAPITAL COSTS	1,530,000
ANNUAL COST, 25 YRS @ 8%	143,330
RECURRENT COSTS	
LABOR	
1 SUPERVISOR @ 18,000	18,000
3 EQUIPMENT OPERATORS @ 14,000	42,000
6 PICKERS @ 7,000	42,000
SUBTOTAL LABOR	102,000
SUPPLIES, FUEL, MAINTENANCE	40,000
EQUIPMENT REPLACEMENT	60,000
ADMINISTRATION, INSURANCE, CONTINGENCY	30,000
TOTAL RECURRENT COSTS	232,000
TOTAL ANNUAL COSTS	375,330
LESS MATERIAL REVENUE	27,375
NET TOTAL ANNUAL COST	347,955
COST PER TONNE OF MATERIAL	63.55

EXHIBIT E.2
SORTING FACILITY COSTS

The Process - Although the biological processes involved with controlled composting are complex, we will simplify it for presentation by referring to it as consisting of aerobic (with oxygen) microorganisms which biologically break down the organic matter producing heat, carbon dioxide, water vapor, and compost. This is different and in contrast with uncontrolled anaerobic decomposition that occurs in a landfill that produces organic acids, methane and leachate.

When these aerobic microorganisms are given favorable conditions for maximum growth they multiply quickly and assimilate the nutrients provided by the organic waste material. These conditions include temperature, oxygen, moisture, PH, and the ratio of carbon and nitrogen which are the nutrients that are the food for the aerobic microorganisms. These factors are dependent on eachother and must be kept in balance if the compost process is to proceed within a reasonable time frame and produce a stable product that will not be harmful to the soil or plant life associated with its final use.

Temperature is a key factor affecting biological activity in the composting process. The natural biological decomposition results in a temperature increase. Due to the insulating effect of the compost pile, temperatures will rise and ideally should be kept in the range of 100 to 150 degrees F. An effective composting process will manage temperatures by maintaining ideal moisture and turning the compost piles in order to kill pathogens, neutralize insect production, and render weed seeds inviable.

Although the biological decomposition process is relatively straight forward, there are many technological methods to achieve the desired compost results. In many respects, the type and composition of the waste entering the composting process and the desired quality of the end product will dictate the physical make-up of the compost system. For instance, if the end product will be a general use commercial compost used in private gardens, the degree of processing and screening will be much greater than if the compost were to be used strictly in agricultural use or public works projects.

For the purposes of this report we have assumed that the sorting facility will be in operation and a fairly uniform waste will enter the compost system. The waste will then be put through a hammermill or knife mill, mixed with the appropriate amounts of water and nitrogen material, if required, and placed in static pile windrows. An intermediate screening or trommel drum may be required to remove plastic bags and other oversized material.
After curing in the windrows, turned as required to maintain temperatures and aerobic conditions, the compost will be ground and screened to produce the finished compost product. This process is shown graphically in Exhibit E.3.

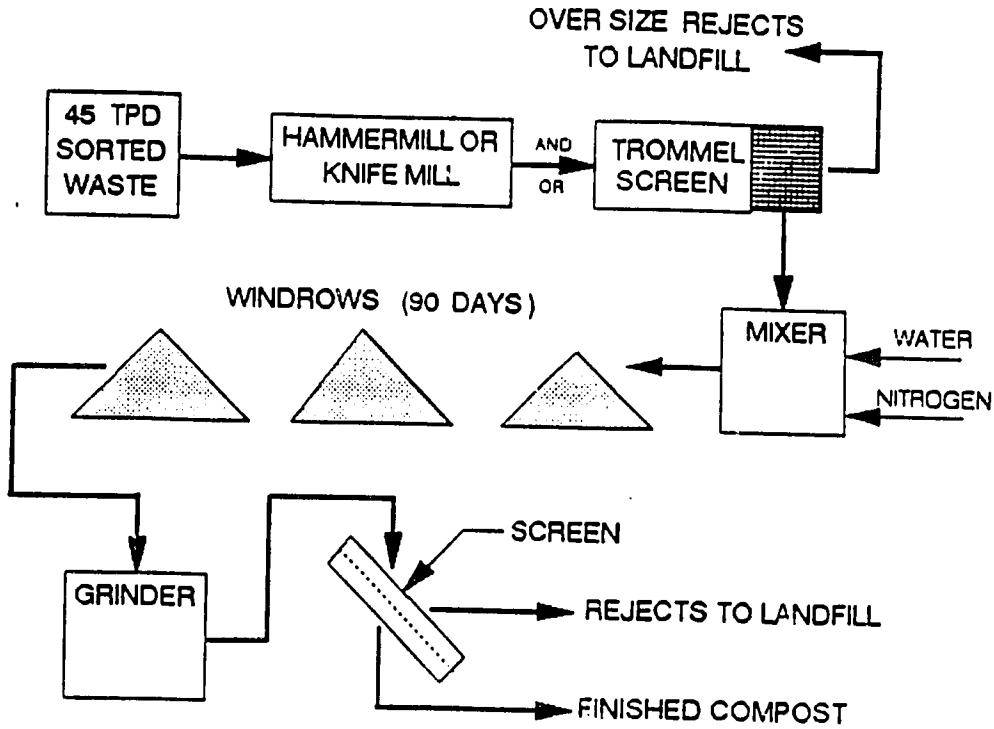

EXHIBIT E.3
COMPOST FACILITY

The Waste Generation Study and Weighing Program identified three to five tonnes per day of source separated organic material that could be composted using lower technology methods. These materials include vegetable waste, brush, feathers, manure and paunch contents. With a minimum investment these materials could be turned into a very high grade agricultural compost. Since these materials only represent six percent (6%) of the disposed waste, the composting of source separated organic material will have only a minor impact on landfill life. The more intensive composting system, following the sorting facility, will have a more dramatic effect on the landfill life, diverting an estimated twenty-seven TPD or forty-five percent (45%) of the disposed waste.

A cost estimate has been prepared based on the above described system and is included as Exhibit E.4.

Co-Composting - Composting of wastewater sludge has become a common practice in the United States and is often combined with mixed waste composting in a process known as co-composting. The two materials are mutually beneficial to each other and the combining of the two organic materials often results in a better quality of compost and lower total costs. The sludge adds nutrients and moisture to the mixed waste material while the mixed waste adds needed bulking material to the sludge.

COMPOST FACILITY COST ESTIMATE

ITEM	COST ESTIMATE (PULA)
CAPITAL COSTS	
SITE WORK	20,000
BUILDING, 400 SQUARE METERS @ P700	280,000
EQUIPMENT	500,000
COMPOSTING WINDROW PAD (1 ha)	50,000
LOADER	150,000
SUBTOTAL	1,010,000
DESIGN, ADMINISTRATION & CONTINGENCIES @20%	202,000
TOTAL CAPITAL COST	1,212,000
ANNUAL CAPITAL,25 YRS @ 9%	113,540
RECURRENT COSTS	
LABOUR	
1 SUPERVISOR @ 18,000	18,000
1 EQUIPMENT OPERATOR @ 14,000	14,000
5 LABORERS @ 7,000	35,000
SUBTOTAL LABOUR	53,000
SUPPLIES, FUEL, MAINTENANCE	30,000
EQUIPMENT REPLACEMENT	50,000
ADMINISTRATION, INSURANCE, CONTINGENCY	30,000
TOTAL RECURRENT COSTS	163,000
TOTAL ANNUAL COSTS	276,540
ESTIMATED REVENUE	197,000
NET ANNUAL COST	79,540
NET COST PER TONNE	8.07

EXHIBIT E.4
COMPOST FACILITY COSTS

During our investigations, we have learned that Gaborone is considering upgrading its wastewater treatment facilities in the near future. If the new process will produce a sludge requiring disposal, a feasibility study should be performed, evaluating the benefits of a co-composting system.

E.4 Incineration

Incineration produces the greatest volume reduction in the waste to be landfilled but also is the most expensive waste processing option. In addition to the high capital and recurrent costs, air pollution and ash handling problems can result if the incinerator is not operated properly. Waste incinerators that also produce energy in the form of steam or electricity are called Waste-To-Energy facilities.

Due to the high capital costs of incineration facilities, they are not usually considered to be viable alternatives in sizes under 200 TPD. However, their large volume reduction and avoided landfill costs can provide significant benefits, even in smaller sizes. For cost comparison purposes, incineration has been included as a component in Alternatives 4, 5 and 6. These alternatives result in incinerators of different capacities and differing ash characteristics. The estimated costs for the three incinerators are presented in Exhibit E.5.

INCINERATION COST ESTIMATES (1)

ITEM	COST ESTIMATE (PULA) 30 TPD	50 TPD	80 TPD
CAPITAL COSTS			
BUILDING INCINERATOR(S) BOILER POWER GENERATOR POLLUTION CONTROLS STACK	5,000,000	8,500,000	10,000,000
SITE WORK	50,000	75,000	50,000
MOBILE EQUIPMENT	300,000	300,000	300,000
START-UP AND TESTING	75,000	75,000	75,000
SUBTOTAL CAPITAL	5,425,000	8,925,000	10,425,000
ANNUAL CAPITAL 25 YRS @ 8%	508,214	836,094	976,614
RECURRENT COSTS	750,000	900,000	1,270,000
TOTAL ANNUAL COSTS	1,258,214	1,736,094	2,246,614
LESS ENERGY REVENUE (2)	112,320	187,200	299,520
NET ANNUAL COSTS	1,145,894	1,548,894	1,947,094
TONNES PROCESSED	9,360	15,600	24,960
COST PER TONNE	122.42	99.23	78.01

(1) Based on 1990 estimates provided by Consumat Systems, Inc Richmond, Va. USA and adjusted for freight and local labor.

(2) Based on 312 operating days per year, 250 kwh net power generation per tonne and P0.05 avoided fuel cost.

EXHIBIT E.5
INCINERATION COSTS

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APPENDIX F - EQUIPMENT AMORTIZATION SCHEDULE

APPENDIX F

EQUIPMENT AMORTIZATION SCHEDULE

Veh. No	& Type	Year	Est.Cost	Annual Cost
4471 D	Toyota,Comp.	90	P185,000	33,820
2176 D	Toyota,Comp.	89	175,000	32,000
7376 A	Toyota, Rnd.	87	90,000	16,457
7375 A	Toyota,Rnd	87	90,000	16,457
5564 A	Toyota,Rnd	86	85,000	15,543
6154 A	MAN,Comp.	86	160,000	29,257
5561 A	Toyota,Rnd	86	85,000	15,543
3665 A	Toyota,Rnd	86	85,000	15,543
2221 B	Toyota,Rnd	85	80,000	14,629
2321 A	Toyota,Comp	85	140,000	25,600
2096 A	Toyota,Rnd	85	80,000	15,543
2098	Toyota,Rnd	85	80,000	15,543
3 tractors			120,000	21,942
37 Skips			2,590	370
				268,256

Total Annualized Cost of Equipment ---P268,256

* After seven years vehicles are assumed to have no value for an annual capital cost viewpoint - Annual cost are derived from estimation initial cost and using eight percent cost of money per annum and seven year straight line depreciation.

APPENDIX G - ADVERTISEMENT FOR INTERESTED PARTIES

APPENDIX G

ADVERTISEMENT FOR INTERESTED PARTIES

NOTICE

THE CITY COUNCIL OF

THE CITY OF GABORONE

HEREBY GIVES NOTICE OF ITS INTENT TO TENDER A PORTION OF THE CITY TO PRIVATE INTERPRISE FOR SOLID WASTE COLLECTION. Interested parties must submit a letter of interest to the City Council of Gaborone in care of the City Clerk. All submissions must be accompanied by a financial statement and a brief statement of qualifications. Further information concerning this offer is available in the office of the City Clerk.

Date: Signed_____

APPENDIX H - NOTICE OF INTENT TO FRANCHISE

APPENDIX H

NOTICE OF INTENT TO FRANCHISE COMMERCIAL/INDUSTRIAL REFUSE COLLECTION

NOTICE

The CITY COUNCIL OF

THE CITY OF GABORONE

HEREBY GIVES NOTICE OF ITS INTENT TO FRANCHISE THE COLLECTION OF SOLID WASTE FROM BUSINESS AND INDUSTRY TO A PRIVATE PROVIDER. During the six months following the date of publication of this notice the City Council will select through tenders a private service company who will be awarded a contract to collect solid waste generated by businesses and industry in Gabarone. After an agreed date approximently six months henseforth and designated in the franchise the City will no longer collect refuse from businesses and industry and each business must arrange by contractual agreement with the franchised organization for collection and removal of the wastc generated by their operations. Each business will pay the franchisee according to the prices tendered in the franchise offer for the level of service it requires. In all cases business must contract for a level of service that assures the maintenance of clean sanitary conditions at their designated pickup point and this contract must recieve the approval of the City of Gabarone Chief Health Inspector.

Date: signed _____