WASTE MANAGEMENT IN RUSTENBURG LOCAL MUNICIPALITY DURING 2010 FIFA WORLD CUP™

A Preliminary Waste Management Plan

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ABSTRACT

Rustenburg Local Municipality was selected as one of the host cities of the 2010 FIFA World Cup South Africa™. The six matches at Royal Bafokeng Sports Palace and the fan parks that are to be established within the municipality will attract a large number of visitors to the area. These activities will generate a significant peak in waste volumes that The Waste Management Unit of the municipality is obliged to manage and dispose of.

The object of this study is to provide preliminary plans and models to manage and minimise the waste generated. Also included are rough projections for estimated volumes of waste and for operational costs of waste management during the tournament. The proposed measures for waste minimisation are adaptations of measures implemented at 2006 FIFA World Cup™ in Germany. A further recommendation is made to implement a two-bin system in waste separation to intensify recycling, and further gradually shifting to the system in solid waste management throughout the municipality.

The study indicates that the most environmentally sound option is to implement comprehensive waste minimisation measures along with effective waste recycling and educational campaigns. The financial inputs the measures require are compensated by environmental benefits and employment opportunities. It is also clear that more accurate and comprehensive plans are needed as more information about the staging of the tournament becomes available.

Keywords: waste management, mass event, waste minimisation, waste separation, recycling

Lahden ammattikorkeakoulu
Tekniikan laitos
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Alustava jätehuoltosuunnitelma jalkapallon MM-lopputurnauksen ajalle Rustenburgin kaupunkiin

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TIIVISTELMÄ

Rustenburg valittiin yhdeksi vuonna 2010 Etelä-Afrikassa järjestettävän jalkapallon MM-lopputurnauksen isäntäkaupungeista. Kaupungissa pelattavat kuusi ottelua sekä turnauksen ajaksi pystytettävät kisapuistot tuovat mukanaan suuret ihmismassat, joiden synnyttämät jätemäärät kaupungin jätehuoltoyksikkö on velvollinen käsittelemään.

Tämän opinnäytetyön tarkoituksena on esitellä alustavia suunnitelmia sekä keinoja jätemäärien käsittelemiseksi sekä jätteen synnyn ehkäisemiseksi. Mukana on myös karkeita arvioita turnauksen aikana syntyvistä jätemääristä sekä niiden käsittelyyn tarvittavista kuluista. Jätteen synnyn ehkäisemiseksi ehdotetut keinot ovat sovelletuksia vuoden 2006 MM-lopputurnauksessa Saksassa käytetyistä ratkaisuista. Työssä suositellaan myös kahden astian syntypistelajittelua kierrätyksen tehostamiseksi, sekä asteittan siirtymistä kahden astian syntypistelajitteluun koko kaupungin jätehuollossa.

Tarkasteluiden perusteella ympäristön kannalta paras vaihtoehto on kattavien jätteen synnyn ehkäisemiseen tähtäävien keinojen toteuttaminen yhdessä kierrätyksen tehostamisen sekä tiedotus- ja koulutuskampanjoiden kanssa. Toteutukseen vaaditut taloudelliset panostukset kompensoituvat vähentyneillä ympäristöhaitoilla sekä työllistävillä vaikutuksilla. On myös selvää, että tarkempia ja kattavampia suunnitelmia tarvitaan sitä mukaa kun turnauksen järjestelyistä on tarkempaa tietoa saatavilla.

Asiasanat: jätehuolto, suurtapahtuma, jätteen synnyn ehkäisy, jätteen lajittelu, kierrätys

TABLE OF CONTEST

1 INTRODUCTION

South Africa will host the 2010 FIFA World Cup™ in June and July of 2010. Rustenburg Local Municipality was selected as one of the nine host cities and Royal Bafokeng Sports Palace will serve as the venue for six matches during the tournament. An Official FIFA Fan Park will be erected in Dr. Moroka Avenue as well as public viewing areas, although the number and location of the areas are still undetermined. These activities will attract a large number of visitors to the municipality, especially to Rustenburg town area.

As a host city, Rustenburg is aiming for an efficient and effective waste management during the 2010 World Cup. Due to the incoming masses of football fans and visitors to the municipality, a significant peak in generated waste volumes is to be expected. The Waste Management Unit of Rustenburg Local Municipality is by law obligated to collect and manage the increased quantities of waste and therefore comprehensive planning is recommended to help the unit to cope with the challenge.

In addition to the legislative responsibilities, benefits and opportunities of properly executed waste management are many. Visually clean and litter-free city and stadium are essential to the image of the municipality and the nation. Visitors should have the opportunity to enjoy a clean and green Rustenburg with the hope of them visiting the area again. Environmental benefits of an operational waste management include minimising the risk of waste contaminating and endangering water, nature and human health. Reducing the amount of waste ending up at the landfills by implementing waste minimisation measures and by efficient recycling – together with proper treatment at the right facilities – decreases the methane emissions

from decomposing organic waste and lowers the contribution to global warming.

Employment opportunities are expected to arise in recycling and waste management sectors in conjunction with the tournament along with other financial benefits including direct income from selling the recyclable materials, and indirect incomes from savings on transfer and landfill costs.

The objective of this study is to form a guideline for waste management plan. It should pinpoint some of the key issues in waste management during the tournament and provide basic data, tools and models for further and more accurate planning. The study includes calculations on estimated waste volumes and fractions for the stadium and fan parks as well as suggestions and recommendations for raising public awareness through educational campaigns and recycling and waste minimisation measures at the venues, which are in line with the national waste hierarchy of avoidance, reuse and dispose. The study also introduces some rough financial projections for the operational costs of waste management during the tournament and ideas how waste management can benefit from the legacy of 2010 World Cup.

This study focuses only on management of solid waste generated during the 2010 World Cup in the jurisdictional area of Rustenburg Local Municipality, focusing on Royal Bafokeng Sports Palace and the FIFA Fan Park and public viewing area(s). The waste streams generated during the preparation, construction and demolishing the additional temporary facilities for the tournament are left out of the study. Also the additional waste streams generated by the increased number of visitors at places of accommodation and attractions as well as Rustenburg CBD are covered only generally, and are left out of the estimations for waste volumes and fractions as well as excluded from financial scenarios.

The basic information for the study was gathered during my practical training at The Waste Management Unit of Rustenburg Local Municipality and at The Environmental and Waste Management Unit of Bojanala Platinum District Municipality between May and August of 2007. The conclusions and projections are partly based on the Green Goal Legacy Report published by the Organising Committee of 2006 FIFA World Cup™ as well as consultations with Mr. Andre Venter of Rustenburg Local Municipality, Ms. Vuokko Laurila of Bojanala Platinum District Municipality and Mr. Sakari Autio of Lahti University of Applied Sciences.

2 OVERVIEW OF 2010 WORLD CUP IN RUSTENBURG LOCAL MUNICIPALITY

2.1 FIFA 2010 World Cup™ in South Africa

The FIFA World Cup™ is an international football tournament organised by Fédération Internationale de Football Association (FIFA), the sport's global governing body. The tournament takes place every four years and it is the most widely-viewed sporting event in the world. Eighteen tournaments have been organised the latest being The FIFA 2006 World Cup™ in Germany where the final was being watched by estimated 715 million people.

The Republic of South Africa – a country with a population of 48 million at the southern tip of the continent of Africa – won the bid to host The 2010 FIFA World Cup™ on 15th of May 2004 in Zurich, Switzerland. The 2010 FIFA World Cup South Africa™ (2010 World Cup) will be held between June 11th and July 11th 2010 in nine host cities across the country: Johannesburg, Nelspruit, Pretoria, Polokwane, Durban, Port Elizabeth, Bloemfontein, Cape Town and Rustenburg. The tournament will consists of 32 national teams playing total of 64 matches at ten different venues.

Hosting of the tournament is seen as a big opportunity in South Africa. An estimation of 500 000 international tourists will visit the country during June and July 2010 and the government and business sector are expecting major economical opportunities especially for small, medium and micro enterprises (SMME). The event is also seen as an opportunity to market the nation and the whole continent. Football is the most popular sports in South Africa and the general enthusiasm for the tournament is high and the nation is determined to make the tournament a successful and historic spectacle.

2.1.1 The Organisational Structure

FIFA has appointed the South African Football Association (SAFA), one of its member associations, with the organisation and staging of the 2010 World Cup and for this purpose SAFA has created the Local Organising Committee (LOC). The LOC compromises of people from SAFA, the government, labour and business community and it was registered in August 2005 as a non-profit company. (South Africa 2010 – Structures [referred 8.3.2008].) The government of South Africa supports the organisation and has provided certain guarantees to FIFA upon entering the bid to host the event, to assure a successful tournament. These guarantees include issues such as safety and security, transportation and health. (South Africa 2010 - Guarantees [referred 8.3.2008].)

The Host City Forum was established in late 2005 as a platform for the LOC and the nine host cities to manage all aspects of the host cities' preparations and commitments. The forum meets on a monthly basis. Each of the host cities has set up several committees responsible of specified fields

of the preparation work. (South Africa 2010 – Structures [referred 8.3.2008].)

Detailed organisational structures can be found in Annex 1.

2.1.1.1 Environmental Initiatives

The Greening of the Stadia 2010 is a South African expansion of the Green Goal initiative set up by Urban Environment Management Programme and Department of Environment and Tourism (DEAT). It aims to provide technical assessment evaluation of the environmental situation and potential of the stadiums. The host cities have been called to apply for the initiative but no information is currently available of the project's status. (Greening of RSA's Stadia for The World Cup 2010 [referred 9.3.2008].)

The Global Environment Facility (GEF), the world's largest funder of projects to protect the environment, has agreed to help South Africa to mitigate greenhouse gas emissions through the implementation of transport system improvements in the host cities of 2010 World Cup. The project will be carried out by The Department of Transport in conjunction with United Nations Development Programme. (GEF – Project Details [referred 9.3.2008].)

2.1.2 FIFA Confederations Cup South Africa 2009

The FIFA Confederations Cup will be held in South Africa between June 14th and 28th. It is an official FIFA tournament held every four years. In recent times, it has been seen as a warm-up event to the FIFA World Cup. In the 2009 edition, the continental champions from South America, North and Central America and the Caribbean, Africa, Europe and Asia will join

hosts South Africa in competing for the trophy. The tournament will be held in five host cities: Johannesburg, Bloemfontein, Port Elizabeth, Pretoria and Rustenburg.

The Confederations Cup can serve as an excellent "dry run" for the 2010 World Cup. Especially for waste management it provides potential testing ground for planned measures.

2.2 Rustenburg Local Municipality

Rustenburg Local Municipality (RLM) is situated in the north east part of the North West Province of South Africa, approximately 120 kilometres north west of Johannesburg and 180 kilometres east of the Botswana border with a geographical area of approximately 3500 km^2. The RLM is centrally located in within the Bojanala Platinum District Municipality (BPDM). The other 4 local municipalities with the District are Madibeng Local Municipality to the east, Moses Kotane Local Municipality to the north, Kgetleng River Local Municipality to the south west and Moretele Local Municipality to the far north east.

In 2001, the municipality had a population of 395 540 although due to informal settlements the number is assumed to be much higher. Africans make up the majority of the population (87 %). Other population groups include White (12 %), Coloured (0.7 %) and Indian (0.5 %). Setswana is the most spoken language with a 50 % share followed by IsiXhosa and Afrikaans, both taking a share of around 10 %. The unemployment rate in the municipality is approximately 30 % which is in line with the country's average. (Demographics/Culture & Language of Rustenburg Local Municipality [referred 11.3.2008].)

The town of Rustenburg within the municipality is reputed to be one of South Africa's fastest growing urban areas. The growth is largely due to the heavy mining industry in the area. Two of the world's biggest platinum mines and the largest platinum refinery are found in the immediate vicinity of the Rustenburg town and approximately 70 % of world's platinum originates from the area. The mining sector provides around 50 % of all formal employment in the area.

Due to the rapid growth in the area, the population is estimated to be 636 220 by 2010. The issues of HIV and out migration have not been taken into account in terms of the population growth rate. (Jarrod Ball & Associates cc 2006)

RLM is also the home of Royal Bafokeng Nation (RBN). Royal Bafokeng numbers roughly 300 000 people of which 160 000 live in the 1 200 km^2 area within RLM owned and administrated by the Nation. RBN leases this land to the mining companies and receives a note-worthy income annually. RBN is its own legal entity led by a king and the nation's largest town is Phokeng some 15 kilometres north west of Rustenburg town. (The Royal Bafokeng Kingdom [referred 11.3.2008].)

2.2.1 2010 World Cup in RLM

Rustenburg was selected as one of the nine host cities of 2010 World Cup out of 13 candidates. Rustenburg is also one of the host cities of 2009 FIFA Confederations Cup. Host cities are responsible for fulfilling the obligations contained in the host city agreements signed with FIFA, with support from national and provincial government. The host city agreements include aspects such as stadiums and official training grounds, supporting infrastructure, official fan parks, city beautification and compliance with FIFA marketing guidelines within the cities.

The hosting of 2010 World Cup in Rustenburg is a joint venture of RLM, RBN and BPDM with the support of Madibeng and Moses Kotane Local Municipalities. In February 2007, a Memorandum of Understanding was signed between the host city and the mines that the mines will assist with the planning process for the needed infrastructure. The support referred to water and sanitation, roads and storm water, electricity and waste management. (Kruger, G. 2007.)

The effects of 2010 World Cup activities in RLM are mostly focused on Rustenburg town area. The six matches are played at the Royal Bafokeng Sports Palace in Phokeng, 12 kilometres out of town, but the other activities take place closer to the town. The incoming flow of tourists is at least partly accommodated in the town area and most of the restaurants and pubs are located in the town centre.

Olympia Park Stadium and Bleskop Stadium will serve as training venues during the tournament. The venues will be closed for public so no considerable amounts of additional waste is to be expected and therefore the training venues are left out of this study.

A map indicating some of the strategic venues of the tournament in RLM can be found in Annex 2.

2.2.1.1 Royal Bafokeng Sports Palace

The stadium was constructed in 1999 and will undergo minor upgrading after which the capacity will reach approximately 42 000 seats. The upgrading commenced in September 2007 and in terms of the FIFA requirements the stadium should be ready by December 2008. The upgrading will cost around R 147 000 000. (Kruger, G. 2007.)

The stadium is owned and administrated by RBN, and a Memorandum of Understanding was signed between RBN and the host city that the host city will be responsible for the financial management and that RBN will be responsible for the construction work. (Co-Operation Agreement between Royal Bafokeng Nation and Rustenburg Local Municipality 2007.)

Five of the first round matches and one second round match are going to be played at the stadium during the 2010 World Cup. The matches will be played between June 12th and 26th. It is a safe bet to predict that the stadium will be completely packed and sold-out for the matches. No information is currently available about the possible use of the facility during the rest of the tournament.

In this study, Royal Bafokeng Sports Palace consists of the stadium and the so-called external security area which means the fenced area around the stadium where spectators need a valid ticket to, and need to go through security controls before entering into. The immediate vicinity of this area is also included in the study as gatherings of people without tickets are expected to show up in the stadium surroundings. The stadium is further defined in two parts, the spectator and backstage areas. The spectator area covers the premises accessible to a "regular" spectator. Premises accessible only with a VIP-ticket, areas designated for catering, vendors, media representatives and officials are defined as backstage area.

2.2.1.2 FIFA Fan Park and Public Viewing Areas

Fan park or fan fest is a concept that broke through in 2006 Germany World Cup. It is a place where people without tickets to the actual matches can gather to watch football on a big screen and enjoy the tournament in a festive atmosphere. The fan park will be open during the whole tournament. It will provide ordinary South Africans, who may not

be able to afford match tickets, an access to the event. Furthermore, the fan park will provide international visitors a safe, secure and football-friendly place to go during the tournament.

As agreed on the host city agreement, the host city shall provide FIFA – free of charge and in accordance with FIFA's requirement – a suitable location at or near the centre of the host city for the Official FIFA Fan Park. The host city shall further ensure that the necessary security is provided and that the area is fenced and free of any third party advertising. (Kruger, G. 2007)

Every host city will have one Official FIFA Fan Park. The FIFA Fan Park in Rustenburg is going to be located at Dr. Moroka Avenue. In addition to the FIFA Fan Park, public viewing areas may be organised which are similar to the FIFA Fan Park in infrastructure and idea. The establishment of such areas is on the account of stakeholders and provincial government, not the host city. The number and location of such public viewing areas in RLM are still to be determined. Concerning waste management, FIFA Fan Park and public viewing areas play a significant role as they will be in operation and attended by large number of people during the whole tournament.

The FIFA Fan Park in Dr. Moroka Avenue and the public viewing areas (collectively "fan parks") are treated as similar events in this study. Also these venues are divided into two sectors: the spectator areas and the backstage area. The calculations are made for three different scenarios at these venues. The first is a low profile day where approximately 10 000 people are expected to attend the fan park or a public viewing area during a day. This would mean a day when matches of only low interest to the public, for example a first-round match with two teams that are not favourite in the tournament or in other way of lower interest to a South Af-

rican football fan, are played or an off-day when other festive activities are held in the FIFA Fan Park. A medium profile day means approximately 22 000 people arriving at the venues in a day to watch matches of medium interest. An example of such day would be a second-round match or a first-round match with proficient teams playing. A high profile day is expected to gather approximately 35 000 people to the venues. At least all the matches from second-round onwards and matches of South Africa national team playing would fall into the high profile category.

For the projections and calculations, an assumption is made that out of the total of 31 days that the tournament will last, 7 days are marked as low profile days (including the six days when matches are not played), 10 days are marked as medium profile days and the remaining 14 days are marked as high profile days.

The number of days for each specified profile can be specifically projected after the final programme of the tournament is ready. The number of people attending the FIFA Fan Park and the public viewing areas is also strongly dependant on how many public viewing areas there are going to be erected in not only RLM but in the neighbouring municipalities as well. At least Kgetleng River and Madibeng Local Municipalities have announced plans to have their own public viewing areas.

2.2.1.3 CBD, Routes and Surroundings

During the tournament, masses of spectators and visitors will roam the streets of Rustenburg CBD, wandering from places of accommodation to the stadium, fan parks and restaurants. For the image of the city and the nation, Rustenburg CBD, car parks, routes to the stadium, and fan parks and surrounding areas, or any other site that will be passed by or clearly visible to the visitors, need to be kept clean of waste and litter. Waste

management plans and measures must therefore be also extended to these areas.

2.2.2 Waste Management in RLM

The Waste Management Unit falls under the Directorate of Infrastructure Development and Management of RLM, and currently has a workforce of around 180 people. The unit's capital budget for the financial year of 2007/2008 was around R 5 500 000 and operational budget for the year 2006/2007 around R 43 000 000 (Venter, A. 2007a).

The waste management unit is responsible for the collection and cleansing services, the transport and transfer of waste, waste minimisation and recycling systems/initiatives, and waste disposal in the municipal area. The unit collects waste from 39 000 domestic service points, which include 78 000 households, and from 3 200 business service points. Currently 65 000 households are without a waste removal services, most of them in rural and/or tribal areas (Venter, A. 2007a).

Bulk of the collection work is appointed to contractors who provide services to approximately 54 000 households. Contractors are also appointed for CBD litter picking and ablution cleaning as well as for the operation of Townlands landfill site. (Venter, A. 2007b)

The immediate future plans of the unit include completing the Section 78 process which would enable them to outsource some of the services. One of the top priorities would then include providing services to the currently un-serviced areas. New transfer stations are also planned to optimise waste transfers and recycling in the municipality. A new landfill site is also desperately needed and plans are underway for construction work to begin. (Venter, A. 2007b.)

2.2.2.1 Legal Mandates

In terms of the Constitution of South Africa (Act 108 of 1996), all South Africans are guaranteed the right to an environment that is not harmful to their health or well-being. The implementing policies that ensure that this right is upheld, and that bound the RLM include: National Waste Management Strategy, Municipal Structures Act (Act 117 of 1998), Municipal Systems Act (Act 32 of 2000), White Paper on Integrated Pollution and Waste Management, Draft for Waste Management Bill and a number of environmental legislation. (DEAT 2000; DEAT 2004.)

The Constitution devolves the competency for waste removal, refuse sites and solid waste disposal to local government level. In terms of the Health Act (Act 63 of 1977) and the Municipal Structures Act (Act 117 of 1998), local municipalities have the responsibility of collecting and disposing of waste within their area, while district municipalities are responsible for the planning, establishment and operating of regional landfill sites in their area, i.e. a landfill site serving more than one local municipality. The Municipal Systems Act (Act 32 of 2000) states how these functions and powers should be exercised. It is also a municipality's responsibility to pass by-laws on waste management and enforce existing litter laws. (DEAT 2000; DEAT 2004.)

The National Waste Management Strategy of South Africa is based on the waste hierarchy of avoidance, re-use and safe disposal. The White Paper on Integrated Pollution and Waste Management sets out the principles that underpin the National Waste Management Strategy. This strategy translates the policy principles into strategic plans and actions. (DEAT 2004.)

FIFA has no regulations in regards of waste management during the 2010 World Cup although it endorses the measures proposed in the Green Goal

programme. (Football Stadiums: Technical Recommendations and Requirements 2007.)

2.2.2.2 Landfill Sites

There are currently 5 landfills owned and operated by RLM of which Townlands landfill site is the only one with a permit and receives vast majority of waste (130 000 tons/annum). Townlands landfill site has, however, reached its maximum capacity and the site needs to be closed and rehabilitated. Estimated final closure is currently December 2008. Closure of un-permitted and poorly managed Monnakato and Phatsima sites as well as developing Hartbeesfontein and Marikana sites to transfer stations need to be considered as well. (Jarrod Ball & Associates cc 2006.)

A new Waterval landfill site is being developed in partnership with Anglo Platinum in an abandoned mining area west of town. Although bureaucratic procedures for the development of the new regional landfill have slowed down the permitting process, feasibility studies are now completed and permit applications commenced and construction should start during 2008 and the landfill site should be ready and in operation for the 2010 World Cup. (Venter, A. 2007a)

2.3 Characteristics of Waste Management in South Africa

South Africa faces many of the problems typical for a developing country in terms of waste management and treatment. Illegal dumping and the creation of informal landfills – often in the form of burning on open dumps – is a major problem in lower income areas, due to the lack of organised waste collection and exacerbated by a lack of environmental ethics. Informal salvaging at the working face of landfills is widespread in

South Africa. This practice is problematic – although it provides income to a number of people – as salvagers are exposed to health and safety risks, and proper operation of the landfill is distracted. (Action Plan for Waste Treatment and Disposal 1999.)

The emphasis of waste treatment remains on disposal of general waste by landfill without treatment as the lowest cost disposal option, as landfill airspace is still available in South Africa. The lack of pre-treatment of general waste before disposal is therefore currently not regarded as a problem. The country has approximately 400 permitted landfill sites and up to 15 000 unrecorded communal sites. The incineration of general waste is not economically feasible in South Africa since its warm climate limits the market for the energy/heat derived from the incineration process. (DEAT 2005.)

Littering and general disregard towards environmental issues is also a note-worthy problem. According to studies made in 1997, 39 % of the respondents stated lack of service as the main reason for littering. It is worrying to note that 29 % responded don't care and 12 % ignorance as reasons. This is at least partly explained by the fact that 84 % of the respondents have had no exposure to education or awareness regarding waste management. 47 % of the respondents feel that the municipality should have responsibility for cleaning and 63 % think that municipality should also have the responsibility of the costs. Only 5 % of the respondents were of the opinion that they themselves should be directly responsible for the costs of the cleaning. (Waste Generation in South Africa 1998.)

Waste separation at source is not yet a common practise in South Africa. Post-consumer recycling activities are mainly undertaken by private recycling companies although many local authorities have established voluntary drop-off facilities and buy back centres to encourage and stimulate

recycling. Large quantities of recyclable materials in the waste stream end up at landfill sites where recycling is done by informal scavengers. The majority of recycling initiatives have been developed and funded by the private sector, with relatively minor financial inputs from the authorities. As a result recycling initiatives have to be financially viable in order to be sustainable. In 2004, 85 % of tin cans, 52 % of paper, 22 % of glass and 14 % of plastics were recycled in South Africa. (DEAT 2005.)

3 ENVIRONMENT AND MASS SPORTS EVENTS

3.1 Environmental Impacts of a Mass Sports Event

The organisers of major international sporting events are increasingly paying attention to the impacts their actions are having on environment. The impacts can be divided into different categories: short-term and long-term impacts as well as direct and indirect impacts. The impacts of a mass sports event are often similar to those of tourism or any other activity where there is a high concentration of people in a short time and in a limited space.

Environmental impacts of a mass sporting event are caused by the consumption of material, energy and water and the impacts include air, water and noise pollution. The impacts occur during preparation and construction work and during and even after the event.

The most important single environmental impact of a major event relates to the greenhouse gas emissions produced by traffic and due to energy use. Other important environmental impacts of mass events are related to construction and waste management. Waste and littering are also the most

visible impacts and thus effect the spectator directly already during the actual event.

3.2 Green Goal Programme in FIFA World Cup 2006

> *FIFA has embarked upon an initiative to address environmental sustainability through the Green Goal programme, an initiative which FIFA fully expects its partners to embrace.* (Football Stadiums: Technical Recommendations and Requirements 2007.)

The programme was established during the preparations for the 2006 FIFA World Cup™ in Germany and for the first time in the history of the World Cup the environmental issues were integrated into the planning process. The main Green Goal objectives include the protection of resources of potable water, waste avoidance, saving and improving the efficiency of energy use and increasing the share of public transport. Behind Green Goal was also the idea of providing a model for other large sporting events, such as the 2010 World Cup in South Africa. (Green Goal Legacy Report 2006.)

For waste management, the main objective of the programme was waste avoidance through waste minimisation measures not only in the stadiums but also in the surrounding areas. The target was set that the quantity of waste would be reduced by 20 %. A further objective was waste recycling and separation at source. (Green Goal Legacy Report 2006.)

The target was achieved through the measures resulting in a reduction in waste of 17 % (305 tons). This includes also waste generated during the erection and dismantling of temporary facilities, which was addressed separately. Had this special waste not been mixed with stadium waste, the percentage reduction in waste would have exceeded 17 %. The different

waste minimisation measures and their reported results are shown in Table 1. (Green Goal Legacy Report 2006.)

TABLE 1. Waste minimisation measures implemented in Germany 2006

Action	Description	Type of waste avoided	Amount of waste avoided
Returnable beakers	Deposit on plastic beakers	Plastic	51 tons
Multi-use systems for the supply of drinks	Returnable PET bottles for nearly all non-alcoholic drinks; for the most part beer in barrels	Plastic Glass Cardboard	109 tons 86 tons 23 tons
Multi-use containers	Multi-use systems used in transport for the supply of bread and pretzels	Cardboard	18 tons
Reusable crockery	Meals are provided on returnable crockery to media representatives and volunteers	Plastic	3,2 tons
"Put it in a roll"	Grilled sausages, schnitzels etc. are sold in a bread roll without a cardboard plate; large dispensers for mustard and ketchup	Cardboard	5,3 tons
Paperless media	Electronic "Media Channel" in the media centres	Paper	n/a
Dispensing with flyers	Flyers and give-aways are distributed by sponsors only in limited quantities	Paper	9 tons
Instruction on the waste concept	Catering employees and volunteers are instructed on waste management	n/a	n/a

To achieve the objective of recycling, separate waste collection systems were set up for bio waste, light packaging materials, paper, glass and residual refuse at each venue. At the hospitality areas backstage, glass, paper, cardboard and bio waste were collected separately and in the other backstage areas mainly only paper and cardboard were collected separately. Plastics and other packaging materials were separately collected only in one-third of the stadiums. All in all, the organisers feel that the separate collection of waste in the backstage area was carried out to a satisfactory extent. (Green Goal Legacy Report 2006.)

In the spectator areas waste was collected in four fractions: glass, paper, (plastic) packaging material and residual refuse. Waste collection "islands" for the different fractions were placed at regular intervals and at

central points. It was, however, realised that with effective waste avoidance measures separate collection in the spectator areas is unnecessary. The organisers also came to the conclusion that separate waste collection is both sensible and necessary at admission control points to the external security ring. (Green Goal Legacy Report 2006.)

The Green Goal concept achieved notable results in also other sectors and provided important information to use in future events. What makes the achievements even more dignified is the fact that Green Goal concept was implemented without any binding FIFA framework. Much of the actions were executed with voluntary involvement of stadium developers and operators, representatives of the host cities, official FIFA partners and national suppliers as well as the media. For waste management, the involvement of the host cities was important for planning and implementing the waste concepts and the returnable beakers system would have not been possible without the involvement of official FIFA partners Coca Cola Company and Anheuser Busch. (Green Goal Legacy Report 2006.)

This study relies on more than occasion on the experiences and information gained from – and on the examples set at – the Green Goal concept in FIFA World Cup 2006 in Germany. It contains documented information closest to the topic of this study available. Although the sport, the tournament and much of the stadium infrastructure are the same, alternations and adjustments are in order for the measures planned to be implemented in Rustenburg during the 2010 World Cup.

3.3 Ecomass Project for IAAF World Championships in Athletics – Helsinki 2005

The LOC of IAAF World Championships in Athletics held in Helsinki in 2005 implemented Ecomass – the first environmental programme in the

history of the IAAF – together with Helsinki University of Technology, and with input from various role players. Based on the data and experience gained during the games, Helsinki University of Technology's Lifelong Learning Institute Dipoli composed the Eco-efficient Major Event Manual.

The manual is intended for LOC's, key actors, environmental experts and authorities to understand and help to implement actions to minimise the environmental impacts that the major events create. In the manual, the environmental programme is divided into four categories: management, CO_2 –emissions and climate change, material flows and efficiency, and crosscutting issues such as water and paper. The data, methods and indicators in the manual were verified and validated by an independent verification body. (Koivusalo, S. & Heinonen, U. 2006.)

The objectives of the environmental programme for intensifying material reuse were increasing recycling by 20 % and reducing the total amount of landfill use by 25 %. According to the information in the manual, the objectives were fulfilled. The waste prevention strategy that was used in Helsinki included aspects such as the use of durable and biodegradable tableware, renting of furniture and equipment and optimising packaging sizes. (Koivusalo, S. & Heinonen, U. 2006.)

Fractions of waste that were collected separately at the stadium and its surroundings were bio waste, mixed waste, energy waste, cardboard and plastic water bottles. Recycling guidance by volunteers was organised around the stadium but not at the stadium. Results showed that the use of recycling guidance had an encouragingly positive effect. (Koivusalo, S. & Heinonen, U. 2006.)

4 A PRELIMINARY WASTE MANAGEMENT PLAN FOR RLM DURING THE 2010 WORLD CUP

4.1 Volumes and Fractions of Waste

The first, and the most important, phase of the planning process is to estimate the volumes and types of waste that are going to be generated. This information will serve as the basis for planning the capacity of needed facilities, equipment and employees. The estimations are based on data available from FIFA World Cup 2006 in Germany, Torino Winter Olympics in 2006, Helsinki World Championships in Athletics 2005, and Waste Stream Analysis of General Waste Stream in Rustenburg 2004.

4.1.1 Waste Generation at Royal Bafokeng Sports Palace

At the stadium waste will originate primarily from the provision of catering services for spectators and through the production and supply of the relevant products. Waste will also arise from the promotional materials handed out to spectators and through the merchandising stalls. (Green Goal Legacy Report 2006.)

The available data on waste generation rates in comparable events is shown in Table 2. The rates are calculated from the data available for total produced waste in tons divided by reported amount of spectators or, as for Torino, tickets sold. No specific reason was spotted for the significantly higher rate in Torino Winter Olympics 2006. This could be most likely due to differences in reporting.

The information for World Cup 2006 in Germany is obtained from the Green Goal Legacy Report published by the organising committee of the tournament. The data for Helsinki World Championships in Athletics 2005

is taken from the Ecomass manual. The number used for total amount of waste produced in Helsinki may not be precisely accurate as the information is a reading from a chart and not a given exact number. Sustainability Report published by the Environment Department of the Organising Committee for the XX Olympic Winter Games Torino 2006 is the source of information in case Torino. The rate for general waste stream in Rustenburg appears in the table for comparative reasons. The rate originates from the waste stream analysis of general waste stream conducted by Jarrod Ball & Associates cc for RLM. The analysis was made from different socio-economic areas in RLM: high income residential, middle income residential, low income residential and very low income residential (informal) areas, as well as from the CBD. The waste production rate for this table is calculated from the average of CBD, high and middle income areas as it is assumed to be more representative of the socio-economic level of people attending the stadium during the tournament.

TABLE 2. Waste generation rates at comparable events

Event	Waste production	Remarks
Germany 2006	0.44 kg / spectator	Reported average of waste collected at the stadiums
Germany 2006	0.53 kg / spectator	Estimation of waste generation rate if Green Goal measures had not been implemented
Helsinki 2005	0.32 kg / spectator	Reported average of waste collected inside the stadium
Helsinki 2005	0.72 kg / spectator	Reported average of waste collected inside and around the stadium
Torino 2006	1.35 kg / ticket sold	Reported average of waste collected at the venues
General waste stream in Rustenburg 2004	0.92 kg / household in a day	Waste collected in RLM, average of CBD, high and middle income areas

The estimation of waste generation rate for Royal Bafokeng Sports Palace during the matches of 2010 World Cup is strongly based on the rate acquired from Germany 2006. The stadium facilities, infrastructures and catering services can be assumed to be quite similar as is the duration of time one spectator will spend at the premises. Although the economical

level in Central Europe is higher than in South Africa, the purchasing power of a spectator attending a match in 2010 World Cup should not be significantly lower than in 2006 World Cup in Germany as the ticket prices for the stadium are out of reach for a typical South African, and the matches are going to attended by a lot of international spectators. This would result in rather similar amounts of waste.

Based on these observations and a discussion with Mr. Andre Venter from RLM, the estimated waste generation rate at Royal Bafokeng Sports Palace in this study is set at 0.45 kilograms per spectator. The accuracy of this estimation is crucial to any further conclusions and projections. To lower the risk of the uncertainties that follow the estimation, any further calculations in this study that include the waste generation rate are presented with a 10 % deviation (0.41 – 0.50 kilograms). The actual rate depends on how extensively waste minimisation measures are implemented. As seen in Table 2, in Germany it was estimated that the measures had an effect of 0.09 kg per spectator on the rate.

Estimating the fractions of different types of waste to be produced at the stadium is a challenging task. Even if the types of waste that are going to be produced are rather easy to project, defining their individual shares of the total waste stream needs further investigation.

Figure 1 shows the fractions of the reported collected waste in weight from the events used as comparative resource. As it shows only the portions that were collected separately, waste collected and reported as residual or mixed waste includes also large portions of recyclable materials which complicate estimation of shares to be produced even more. Waste stream analysis of Rustenburg conducted in 2004 is different in that respective as it indicates the accurate fractions in the analysed waste stream (Jarrod Ball & Associates cc 2004).

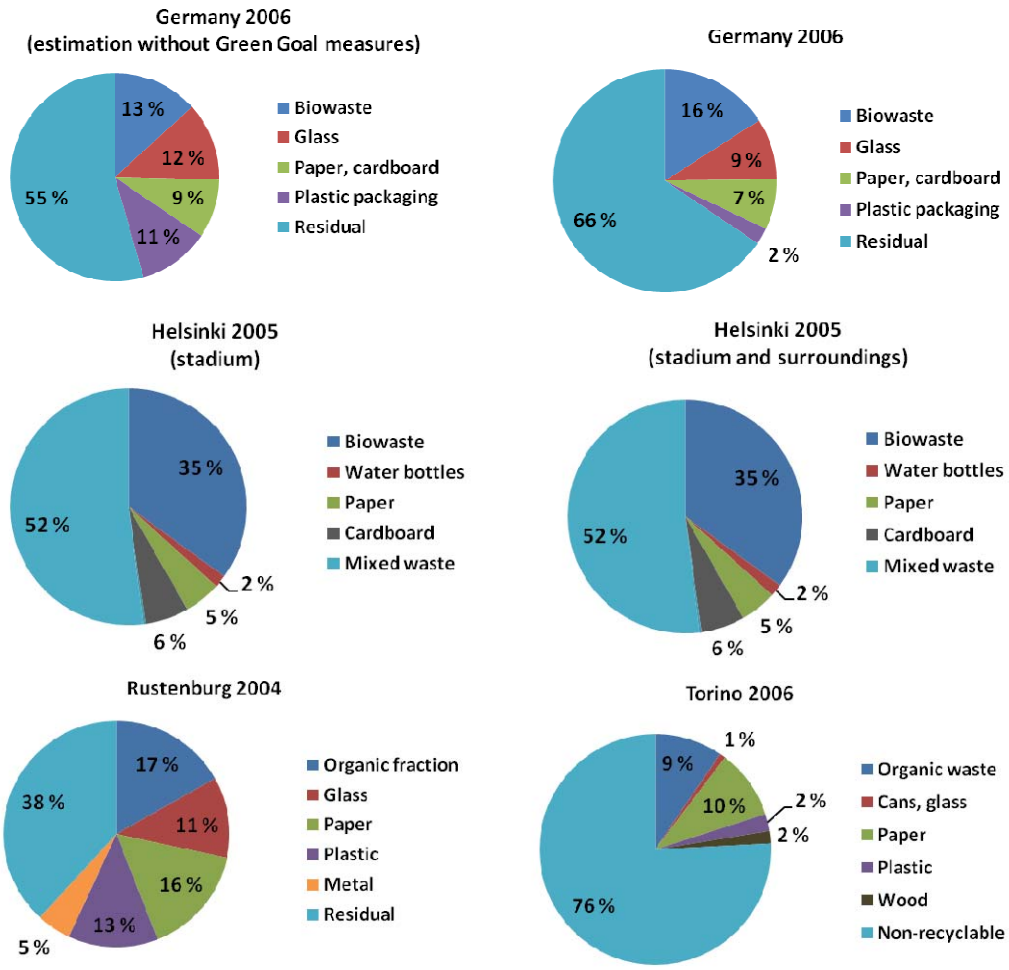

FIGURE 1. Reported waste fractions by percentage in comparable events

The waste fractions that are covered in this study are listed in Table 3. It also includes the main sources of each fraction and whether the fraction primarily originates from the spectator or backstage area. The percentage of each fraction in weight in the waste stream is an estimation based on the results presented in Figure 1. The percentages are extremely rough estimations as there are many uncertainties associated with the estimation. The information from comparative resources is not fully accurate, and the types of waste that are going to produced at the stadium are dependent on the used method for deliveries and packaging for the supplies, the packaging and serving of food and merchandise and the amount and type of handed out promotional material, for example. Even the weather condi-

tions can have an effect. For example during a hot day an increase in the sales of drinks is expected.

TABLE 3. Projected sources of different waste fractions at the stadium

Fraction of waste	%	Source	Spectator area	Backstage area
Bio waste	20	catering backstage, snack kiosks in the spectator area	X	X
Glass	20	wine etc. bottles from the catering		X
Plastic	15	packaging material from catering, kiosks and merchandise stalls		X
Paper, cardboard	15	packaging material from catering, kiosks and merchandise stalls (cardboard mainly), media premises and offices, promotional material (paper)	X (paper only)	X
Other recyclables	10	metal cans, wood etc. from packaging materials		X
Residual	20	unclean and wet waste, waste not suitable for recycling	X	X

Small quantities of hazardous waste, mainly batteries from cameras for example, and medical waste from the first aid premises are also expected to arise at the stadium but they are left out this study because of their rather insignificant quantities. Hazardous waste should however be separated from the general waste stream if possible, and medical waste can be stored correctly at the source of origin.

More detailed calculations of estimated waste generation at Royal Bafokeng Sports Palace during the 2010 World Cup are found in Annex 4. The projections are made for 3 different scenarios; if waste separation and recycling is not done at all, and if 20 % or 40 % of waste stream is recovered for recycling. According to the estimations, 17 – 21 tons of waste would accumulate during a match day at the stadium which results in total of 102 – 125 tons of waste during the six matches. If waste separation is executed with 40 % efficiency, total of 41 – 50 tons of waste can be recovered for recycling.

4.2.2 Waste Generation at FIFA Fan Park and Public Viewing Areas

Projecting the waste generation rate for the FIFA Fan Park and for the public viewing areas has some differences compared to estimations made for the stadium. First of all, no relevant information is available that could be used for comparison. Also many issues relating to the arrangements and regulations of the areas that could affect the amount and type of waste to be generated are still pending.

The affecting factors in regards of arrangements are for example the level of security at the venues. In the fan fest held in Berlin, Germany in 2006, the area was secured and no glass bottles or cans were allowed to pass through the security checks. Supplies and drinks in plastic bottles and packaging were allowed in the area, and food and drinks were also sold at stalls inside the venue. The projections in this study are based on the assumption that these regulations are in use in FIFA Fan Park at Dr. Moroka Avenue and at public viewing areas in Rustenburg as well.

A fan park visitor will most likely spend more hours at the venue compared to a stadium visitor – the fan fests in Germany were held open for 10 to 12 hours a day – which would indicate an increase in the waste generation rate. The assumption that the visitors are allowed to bring in own supplies is also an increasing factor. On the other hand, the VIP guests at the fan parks are significantly less in number to the stadium which has a decreasing effect on the waste generation rate as the catering services for VIP guests are a major source of waste

Based on these speculations, the waste generation rate for the FIFA Fan Park and the public viewing areas is set at 0.5 kilograms per visitor. With a 10 % deviation, the further calculations are made with the range of 0.45 – 0.55 kilograms.

The waste at the venues will originate from sources similar to the stadium. One notable difference can be expected in that a bigger share of the total waste stream is generated at the spectator areas. The waste fractions and their primary sources are presented in Table 4.

TABLE 4. Projected sources of different waste fractions at fan parks

Fraction of waste	%	Source	Spectator area	Backstage area
Bio waste	20	catering backstage, food stalls, left over supplies	X	X
Glass	20	wine etc. bottles from the catering and drink stalls		X
Plastic	15	packaging material from catering, stalls and supplies	X	X
Paper, cardboard	15	packaging material from catering, stalls and supplies, promotional material	X	X
Other recyclables	10	metal cans, wood etc. from beverage cans and other packaging material		X
Residual	20	unclean and wet waste, waste not suitable for recycling	X	X

More detailed calculations of estimated waste generation at the FIFA Fan Park and at the public viewing areas can be found in Annex 5. As with the stadium, the projections are made for the same three scenarios. Based on the calculations made with aforementioned assumptions, one fan park would generate 351 – 429 tons of waste during the tournament. With 40 % separation efficiency, approximately 140 – 172 tons of that waste stream can be recovered for recycling.

4.3 Waste Collection and Recycling

In short, the basic idea of waste collection at the stadium and at the fan parks during the 2010 World Cup is that waste is first collected from the sources of origin – where it is separated to two fractions, recyclables and non-recyclables – then taken to appointed facilities where recyclable fractions are manually separated from the waste stream. The fractions that are

suitable for recycling are sold to recycling agencies and waste that cannot be recycled is transferred to Waterval landfill site by RLM or appointed contractor. Employees are needed for the four main activities: emptying the waste bins, clean up and litter picking, waste separation and transportation.

The waste fractions that are to be separated for recycling are glass, metal, plastics, paper and cardboard. An objective should be set that 40 % of the total waste stream generated at the venues during the tournament is separated for recycling and reuse. It is an ambitious goal but with a proper planning and implementation and with high motivation it is achievable.

4.3.1 Waste Separation at Source – The Two-bin System

Apart from some commercial and industrial districts, waste separation at source is currently not a practiced method in RLM or anywhere else in South Africa. All domestic waste and most of waste generated in business districts are collected as one.

The 2010 World Cup has the potential to be a stepping stone towards a more effective waste separation system in RLM. A system where waste is separated in two fractions at the point of generation is introduced in this study for the tournament and the system should be put in use in the whole RLM area when the tournament is over.

In all of the venues of the tournament – including the stadium, FIFA Fan Park, public viewing events and their surroundings and routes to them – there should be two bins available at all locations where waste is collected. Spectators should be instructed to put all clean and dry waste into the other and all wet and contaminated waste into the other bin by proper markings. The naming of the fractions for the markings needs to be considered

but one option is simply wet waste and dry waste. These names can be written in sizeable letters and an explanation of what types of waste can be put in the bin can be written in smaller lettering. Also the bins should be different in color to have the spectators an opportunity to distinguish and remember the fractions better. The coloring and markings must be similar in all locations.

To get the wet and dry waste fractions separated from each other would be beneficial for further processing. As the recyclable fractions are separated manually from the waste stream by appointed employees, their work would be much more comfortable, cleaner and faster if the waste stream was kept as distinct as possible. For example at the spectator areas at the stadium and fan parks one contributor to the wet waste fraction would be the serviettes in which sausages or weenies are sold that are wet and contaminated of the grease, ketchup et cetera. Another meaning behind the system is that contaminated waste fractions are not suitable for recycling and it is the most practical and cost-effective method to remove them from the waste stream as early as possible.

4.3.2 The Issue of Bio waste

There are currently no facilities to treat bio waste in RLM, and bio waste is primarily placed in landfill sites without any treatment. There are plans and talks about developing a composting plant at the upcoming Waterval landfill site but no definite decisions are made (Venter, A. 2007a). Therefore bio waste is treated as non-recyclable waste in this study and it is not aimed to be separated from the general waste stream. If by the time of the tournament, processing of bio waste is practised in RLM, plans to separate bio waste from the waste stream should be considered. For environmental reasons, bio waste would be best to be separated and treated correctly as the organic fraction emits methane when placed in landfill untreated.

The separate collection and treatment of bio waste would require a separate waste collection bins meant only for bio waste fraction at sources of origin. Bio waste cannot be placed among the other recyclable waste as it would contaminate the clean fractions. It is also impossible to manually be separated from any waste stream.

4.3.3 Waste Collection and Recycling at Royal Bafokeng Sports Palace

The placing of the waste bins at the spectator areas of the stadium and in the external security area needs to be thought out in advance. The waste bins should be placed so that they are easily collectable and in central places yet not in a way of anything. Special attention needs to be paid to the security checkpoints at entrances where people entering the stadium have to drop off any external waste, and surroundings of merchandise and food and drink stalls where people consume the provisions. As no bottles or cans of any kind are allowed beyond the security checks and if drinks are served in returnable cups, it can be expected that bulk of the waste generated in the spectator areas is wet waste. The number, size and emptying interval of the bins can be decided with the aid of the estimated waste volumes presented in Annex 4 when more specific arrangements concerning the stadium become available.

At the backstage areas, separate bins for glass should be considered as waste glass is only generated at the catering premises and it should be possible to collect separately. It would further make the manual separation work easier if the waste stream was excluded of broken glass. It is important to notice that over 50 % of waste generated at the stadiums of World Cup 2006 resulted from the backstage areas (Green Goal Legacy Report 2006). Therefore the number and size of the waste bins need to be adequate and the bins need to be correctly placed in strategic spots. More ac-

curate planning can be made when more information is available concerning the positioning and arrangements of the backstage and catering areas.

Adequate facilities should be made available at the premises of the stadium for waste management. The facilities should have enough space to accommodate the employees appointed for the waste separation, bins and containers for recyclable fractions and at least one compactor for wet waste.

Clean up of the stadium should be performed after each match and litter and waste resulting delivered to the waste management facilities for further treatment.

4.3.4 Waste Collection and Recycling at FIFA Fan Park and Public Viewing Areas

Waste collection and separation at fan parks should be arranged in a similar manner than at the stadium. The facilities should be more easily available at the fan parks as space is not so limited. If possible, the facilities should be easily accessible as waste transfers must possibly be done during the opening hours of the venues. As bigger volumes of waste are expected to arise at the fan parks, the facilities must have space enough for at least two waste compactors and bins and containers for the recyclable fractions as well as enough room for waste separation.

The waste bins in the spectator areas must be placed in regular intervals and at strategic spots. They should be placed in positions where they are easily transferred to be emptied as emptying must be done at regular intervals during the opening hours of the fan parks. Clean up and litter picking should also be executed all the time. Waste glass should be separately collected at the backstage areas where it is mostly generated. As with the

stadium, more accurate planning of the quantity, type and positioning of the waste bins both at the spectator areas and backstage areas can be done when more information is available about the fan parks.

4.3.5 Waste Collection and Recycling in CBD, Routes and Surroundings

As stated in Chapter 2.2.1.3 waste management plans must also be extended to the main routes leading from CBD to the stadium and to the fan parks. The main routes and places of importance concerning litter generation must be spotted and plans set when more information is made available.

The two-bin system should also be put in use when placing the bins to appointed places in the town, and sufficient and effective emptying of the bins must be planned as well as clean up and litter picking. The routes, surroundings, car parks and similar locations are also crucial in terms of spreading awareness through posters and signs.

4.4 Waste Minimisation

Actions to minimise waste generation are many. Individually their effects might seem a bit negligible but effectively executed as once they can create a significant contribution. The waste minimisation measures proposed in this study are for the most part same that are presented in the Green Goal programme and that were implemented in World Cup 2006.

As the Waste Management Unit of RLM will have to stretch their capacity to manage the waste generated during the tournament, it would be unreasonable to roll over the sole responsibility of implementing the waste minimisation measures to them. It is therefore advised that in Rustenburg

bulk of the responsibilities to be handed over to BPDM and/or LOC who would work together with the associated sponsors and stakeholders.

The heart of the waste avoidance concept of Green Goal programme in Germany was the use of returnable beakers for drinks sold at the stadiums. Drinks were poured into and sold in polypropylene beakers. A deposit of one euro had to be paid for the drink which was repaid upon returning the beaker to the kiosk or to a special collection point. After the use, the beakers were washed and used in subsequent matches. An external company was employed for the manufacturing, supplying, washing and transportation of the beakers. (Green Goal Legacy Report 2006.)

In Rustenburg – and in other host cities nationwide – the returnable beakers system should be implemented at the stadiums and at the fan parks. The absence of litter from disposable plastic cups not only decreases the amount of generated waste but contribute largely to the overall cleanliness of the venues. The official FIFA partners – Coca Cola Company for non-alcoholic beverages and Budweiser for beer – will supply the drinks at least for the stadiums and for the FIFA Fan Parks and their involvement is needed. As official partners want to have their logo visible the beakers need to printed the associated logos and as no third-party advertising is allowed at the stadium or at the FIFA Fan Park any drinks supplied by a company that is not an official partner of FIFA must be served in unprinted beakers.

By choosing the right material and method for packaging the supplies from manufacturers to vendors and from vendors to consumers lay a great potential for minimising waste quantities. Transportation and supplying of merchandise and provisions are in many cases possible to deliver in reusable packages or in minimal packaging. Beer should be provided in

barrels, other drinks in recyclable PET bottles and bread and such in reusable (plastic) baskets whenever possible.

Snacks and food that are sold to the spectators can be served in biodegradable serviettes and using as less cardboard or disposable plates and cutlery as possible. Ketchup and mustard should be available in large dispensers instead of single packed portions. At the hospitality areas backstage and in media and volunteer centres food and drinks should be served in reusable crockery whenever possible.

The distribution of various flyers and promotional material by sponsors and partners should be controlled and limited as much as possible. Also the "paperless media" concept of Green Goal should be extended to the media facilities of Royal Bafokeng Sports Palace to avoid any unnecessary paper waste.

As most of the actions would be executed on voluntary basis without any binding regulations, the implementation of these waste minimisation measures require motivated involvement and willingness of various stakeholders. To have the actions produce desired results means that many of the associated parties need to be properly informed and educated.

4.5 Education and Awareness

A mass sports event like the 2010 World Cup is a good opportunity to promote environmental awareness through different campaigns. This study concentrates only on raising awareness on waste management and in that respect the work is divided into two: informing and guiding people to separate waste they produce at the spectator areas and educating vendors on how they can contribute to waste minimisation when choosing

their suppliers as well as educating them to separate waste they produce at the backstage areas.

One major challenge in waste management for the tournament is how to get people to separate their waste according to the proposed two-bin system. South Africans are not accustomed to separation at source and in midst of all the festive atmosphere and football frenzy waste and litter might not be the topics an average spectator would concentrate on. The information and instruction on how to use the two-bin system should be as widely seen as possible at the stadium, fan parks and routes and surroundings to these venues. Posters and sings should be placed in all strategic spots including the entrances, kiosks and immediate vicinity of waste collecting points. Both at the stadium and at the fan parks organisers should be prompted to hand out a slot on the screen to show environmental related clips, including instructions on how to operate with the two-bin systems.

The use of recycling guidance is a widely used method in many mass events including the 2006 World Cup in Germany and World Championships in Athletics in Helsinki 2005 where in particularly positive results in waste separation in conjunction with the use of guidance was achieved (Koivusalo, S. & Heinonen, U. 2006). In Rustenburg, recycling guides should be positioned at least to Royal Bafokeng Sports Palace during the matches and – if resources allow – also at the fan parks at least during the high profile days. The volunteers should be placed at the spectator areas surrounding the stadium to not only guide spectators in waste separation but to give out information on other environmental issues as well.

The Environmental and Waste Management Unit of BPDM has already – over the course of last two years – trained 25 volunteers to work as eco-guides during the tournament and more will be trained during the years

up to 2010. An Environmental Awareness Week has also been organised for schools and communities in 2006 and 2007 by BPMD with the theme "Kick It To The Bin" which focuses on environmental and waste management issues around 2010 World Cup. (Laurila, V. 2007a.)

As over 50 % of the total waste stream is generated at the backstage premises, extending the education and awareness campaigns there is of vital importance. Systematic education and workshops should be arranged for vendors and other associated people to understand the importance of proper waste separation and to familiarise them with the system. Another important aspect is equipping the vendors with information on how they can contribute to waste minimisation by choosing supplies with minimal packaging or supplies that are delivered in reusable packaging. A condition could be added to the licenses for vendors that only companies committed to attend the educational programs and involve waste minimisation initiatives are allowed to apply. Contacting the suppliers on these matters is recommended as well.

4.6 Financial Needs and Opportunities

The financial requirements of The Waste Management Unit of RLM for managing the waste during the tournament include operational costs of providing the services and capital investments in additional equipment and fleet. The financial estimations presented in this study are only for operational costs that occur during the tournament. Capital costs as well as monetary requirements for further waste management plans, consulting and similar matters are not included.

The operational costs include salaries of hired additional employees, transportation costs and landfill tariffs. Additional workforce is needed to handle the waste collection and clean up at the stadium, fan parks as well

as – although to a lesser extent – in surrounding areas and CBD. At the stadium and at the fan parks employees are also needed to do the waste separation manually. Additional foremen and supervisors are also needed to manage the operations. As The Waste Management Unit of RLM has to provide their regular services even during the tournament and all waste management actions are thereof extra load on their duties, it is to be expected that the unit cannot do this with their current workforce and capacity and most of the waste management duties during the tournament must be executed with additionally and specifically hired employees, possibly by an external company appointed to the task. For the same reason it cannot be expected that the unit would be able to finance all the extra costs from their yearly budget unless a specific additional budget is approved.

Financial incomes are expected to arise from sales of recyclable materials to the recycling agents. Having as much as possible of the total waste stream separated and sold is also beneficial as it saves landfill space and transportation costs and therefore also money. Even if having no waste separation would be financially more viable option, environmental and socio-economic benefits cannot be neglected. Waste management can offer job and business opportunities – even if only temporary – for many and in a nation where unemployment is one of the biggest challenges that cannot be bypassed.

Rough financial calculations on operational costs of waste management during the tournament can be found in Annex 6. A summary of the calculations is presented in Table 5. The calculations are made for the estimated average of waste to be produced and the fares used in the calculations are approximate rates from 2007. The calculations are not intended to be accurate or complete but to give examples of what kind of expenses can be expected. Hiring of extra employees needed for CBD/street –cleansing and waste management is excluded in the calculations.

TABLE 5. Breakdown of estimated operational costs

Type of cost	No recycling	20 % recovered	40 % recovered
Salaries (foremen + cleaners)	R 912 540	R 912 540	R 912 540
Salaries (separators)		R 400 800	R 400 800
Transportation	R 88 725	R 68 985	R 54 285
Landfill tariffs	R 80 406	R 64 325	R 48 244
Recycling income		R 77 726	R 155 452
Total	**R 1 081 671**	**R 1 368 924**	**R 1 260 417**

The table shows that arranging the waste separation system would cost around R 400 000. If recycling is executed with 40 % efficiency, R 250 000 of that sum can be recouped by decreased transportation and landfill costs as well as through incomes from selling the recyclable fractions.

Business and entrepreneurship opportunities will hopefully arise in conjunction with waste management and recycling. In procurements for waste management, SMMEs and Black Economic Empowerment (BEE) strategies should be promoted. LOC has already agreed to procure of 30 % of the products and services from SMME and BEE companies. Seventy percent of the procurement allocated to BEE companies and SMMEs must be allocated to smaller black enterprises – especially to co-operatives with a large number of female members, and small businesses where women are key stakeholders. (South Africa 2010 – Procurement [online]).

4.7 Legacy of 2010

The 2010 World Cup will see the government making large investments in the country's infrastructure, transport and social services, and making sure the tournament runs smooth and tourists and officials are accommodated according to international standards. The investments should be made beneficial also to an average South African and the improvements and developments should be valid beyond 2010. For waste management in RLM this object can be achieved in two ways: using the tournament as a

starting point for transition over to the two-bin system in waste collection throughout the municipality and using the tournament to get extra budgets for capital investments in waste management fleet and equipment that is crucially needed in the municipality.

The current fleet of waste management unit is not adequate and the unit is understaffed to provide service according to even today's demands; therefore it is unreasonable to expect them to provide sufficient waste management for the tournament unless they are allocated an additional capital budget. As the government is determined to host a successful tournament – which also means a clean and litter-free tournament – they are spending money indulgently than usual and getting the additional budget should be possible. It should also be studied if grants can be applied from other facets. The trucks, containers, compactors and such that can be purchased are all needed for further developing of waste management services in RLM.

It is proposed that studies and plans should be made to see if 2010 would become the starting year of transition to two-bin system for waste collection in RLM. The activities around the tournament can serve as an imposing introduction to the system although numerous and extensive additional awareness and educational campaigns need to be implemented. The transition is best to execute gradually township at a time. The transition should be started and tested as soon as possible to have it going for the Confederations Cup in 2009 and for the World Cup 2010 by latest.

A waste management company called Waste Plan has started a similar system in selected suburbs of Cape Town. A pilot project titled "Think Twice" was launched in November 2007. Residents of the designated areas were supplied with a starter pack which included clear plastic bags the size of a regular black refuse bag, and introduction letter and information brochure that explained what can and cannot be recycled. Residents were

instructed to put all refuse suitable for recycling inside the bag and the bag was instructed to be placed on the top section of a waste bin on a normal waste collection day. The bags are delivered to a sorting plant where they will be opened, sorted again and the materials will be sold to the recycling agencies. In RLM, the planned new transfer stations could be used as sorting plants. It needs to be studied if the separation and recycling work would be best to appoint to a specified contractor. As the pilot project in Cape Town is still in its early stages, no preliminary results are yet available. (Think Twice – Media Release 8.11.2007 [online]).

4.8 Rustenburg – The Greenest Host City of 2010?

A concept has been discussed that Rustenburg should market and identify itself as The Greenest Host City of 2010. As Rustenburg is not – although a charming city in its own right – a high profile town like Cape Town or Durban for example, it should focus on environmentally friendly actions throughout the tournament activities, and make them visible, and use the positive image that would follow as a marketing tool. The Greenest Host City concept would include that environmental issues are put in forefront of the agenda in every aspect of the planning process. (Laurila, V. 2007b)

Apart from effective measures in waste management, other environmental schemes such as promoting the use of public to minimising greenhouse gas emissions, reducing water use and electricity would all be part of the concept. The implementation would require total commitment from LOC and the commitment should be made as early as possible to have the concept integrated in every sector of the planning process.

5 CONCLUSIONS AND RECOMMENDATIONS

With the information currently available about the staging of the tournament activities in Rustenburg, more accurate planning is difficult to conduct. Plans and observations should be revised and updated as more information becomes available. It is clear that efficient and functional waste management is the most feasible and beneficial solution for all parties: the environment, the world cup visitors, the organisers and the local community. It is also clear that the actions proposed in this study cannot be carried out without additional financial investments and sharing of the workload. All aspects considered, the investments should however pay off.

The projections presented in this study concerning waste volumes and fractions are only rough estimations. Variables and factors of uncertainty for the results are still many. The projections should however give a rather good view of what kind of quantities are expected and what size the corresponding measures should be like.

According to the projections presented in Annexes 4 and 5, approximately 113 tons of waste would result from Royal Bafokeng Sports Palace during the six matches and one fan park would produce around 390 tons of waste during the whole tournament. If the assumption is made that apart from the Official FIFA Fan Park there will be one public viewing area established in RLM that would mean approximately 893 tons of waste generated during the tournament. An estimated 120 000 tons of waste is going to be produced in RLM in 2010 annually. Based on this information, the tournament venues included in this study would have an increasing effect of approximately 9 % in total monthly waste volume produced.

The financial projections shown in Annex 6 indicate that the operational costs for the stadium, FIFA Fan Park and for one public viewing area are approximately R 1 250 000. A saving of around R 160 000 would be

achieved if waste separation and recycling were left undone. For environmental benefits and to increase job creation approving the expenditure is fully recommended, though.

To achieve the optimum results both financially and environmentally, the emphasis on waste management should be set on waste minimisation and waste separation – to keep the total waste stream as low as possible and to have as much as possible of the generated waste stream to be separated for recycling. The education and informing concerning waste minimisation and separation – especially for catering personnel working backstage – are also of great importance.

Although this study only introduces and proposes means and models for managing the waste during the tournament and unquestionably more information and observation is required, further studies and planning are recommended for possible implementation of the measures. Topics that can be further studied and considered for implementation can be found in Table 6.

TABLE 6. Recommendations and proposals for further studies

Action	Target	Timeline
Revising and updating the plans	Keep the plans concerning waste management up to date and adapt where needed	Present – 2010
Consultations with other host cities	Exchange and integration of ideas and information	Present – 2010
Allocation of responsibilities	Determining roles of different players in waste management	ASAP
"Dry run" of waste management measures in Confederations Cup 2009	Setting plans so that at least some, if not all, of the measures would be tested in action during the Confederations Cup in 2009	Present – 2009
Evaluation of "dry run"	Assessing the results obtained from the "dry run" and adapting the plans accordingly	2009 – 2010
Waste stream analysis at the stadium	Performing a small scale waste stream analysis during an event at the stadium to determine the generated portions of each waste fraction and comparing the results to projections in this study	Present –
Instruction on waste concept	Setting up a systematic educational program for the vendors and caterer personnel on waste minimisation and separation	When companies for catering are selected – 2010
Contacting the sponsors	Seek possible opportunities for funding and co-operation in waste minimisation actions (especially Coca-Cola and Budweiser)	Present – 2010
Determining needed operational resources	Revising and evaluating the projections for operational costs presented in this study to apply for additional operational budget, secure the availability of required additional workforce	Present – 2010
Determining needed capital resources	Reviewing the state of current fleet and estimating the amount of upgrading needed, applying for additional capital budgets	Present – 2010
Transition to the two-bin system in RLM	Working towards the goal of making the transition to be running in 2009/2010 in Rustenburg	Ongoing

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ANNEXES

ANNEX 1: Organisational structures of 2010 World Cup (Kruger, G. 2007)

ANNEX 2: Map of Rustenburg town area

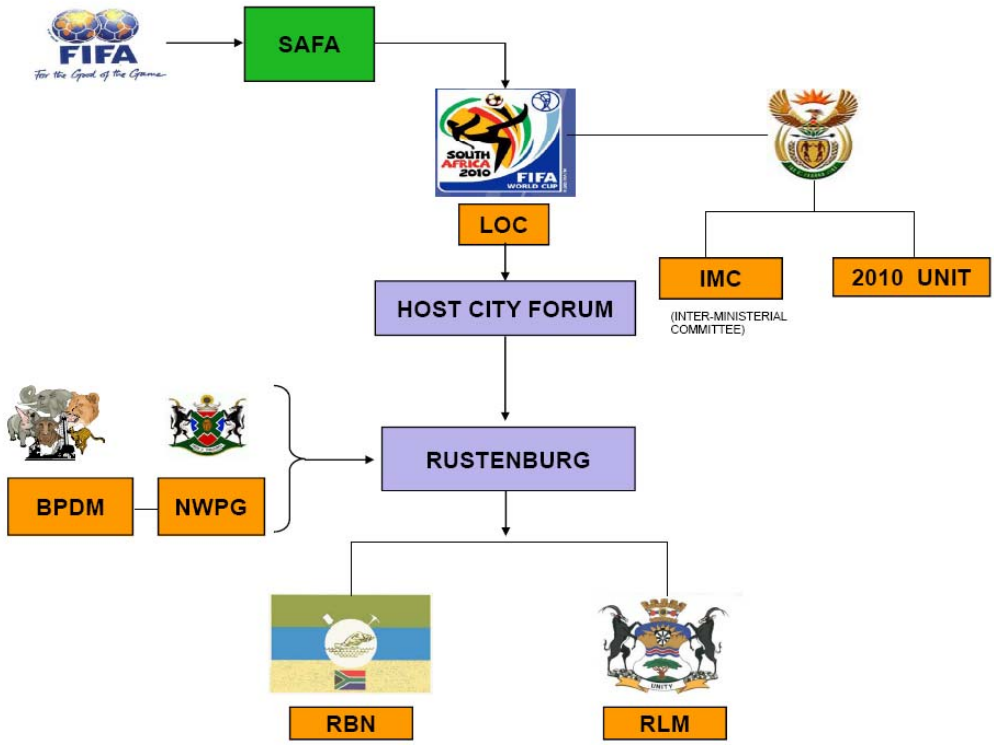
ANNEX 3: Pictures of Royal Bafokeng Sports Palace and a fan fest in Germany

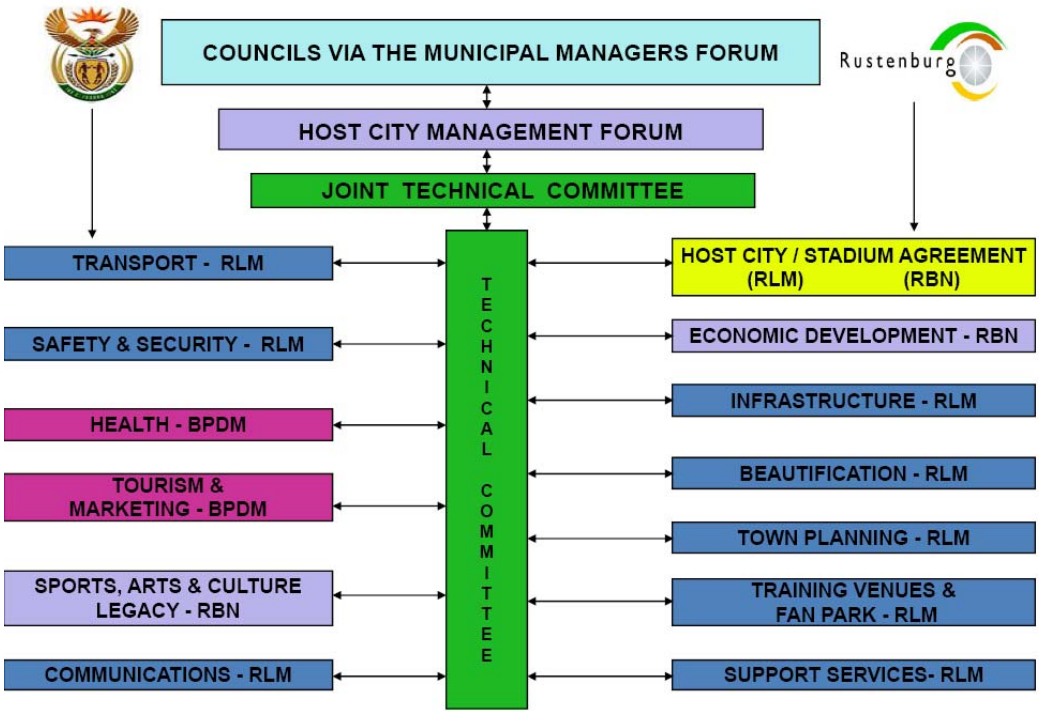
ANNEX 4: Calculations of estimated waste generation at Royal Bafokeng Sports Palace

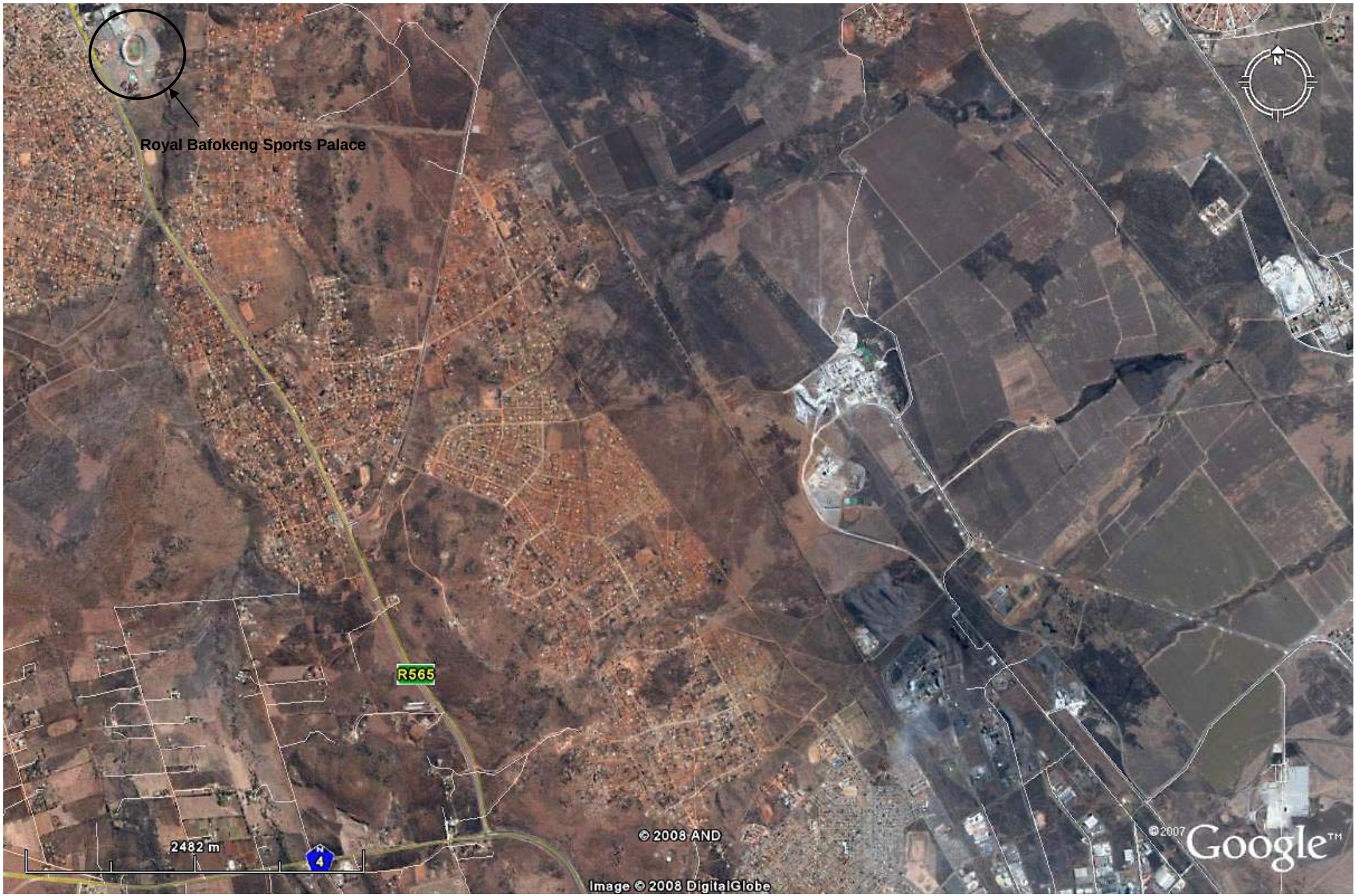
ANNEX 5: Calculations of estimated waste generation at the fan parks

ANNEX 6: Calculations of estimated operational costs

ANNEX 1


FIFA
SAFA
SOUTH AFRICA 2010
FIFA WORLD CUP
LOC
IMC
(INTER-MINISTERIAL COMMITTEE)
2010 UNIT
HOST CITY FORUM
BPDM
NWPG
RUSTENBURG
RBN
RLM


COUNCILS VIA THE MUNICIPAL MANAGERS FORUM
Rustenburg
HOST CITY MANAGEMENT FORUM
JOINT TECHNICAL COMMITTEE
TRANSPORT - RLM
SAFETY & SECURITY - RLM
HEALTH - BPDM
TOURISM & MARKETING - BPDM
SPORTS, ARTS & CULTURE LEGACY - RBN
COMMUNICATIONS - RLM
TECHNICAL COMMITTEE
HOST CITY / STADIUM AGREEMENT (RLM) (RBN)
ECONOMIC DEVELOPMENT - RBN
INFRASTRUCTURE - RLM
BEAUTIFICATION - RLM
TOWN PLANNING - RLM
TRAINING VENUES & FAN PARK - RLM
SUPPORT SERVICES- RLM


Royal Bafokeng Sports Palace
R565
2482 m
N
4
© 2008 AND
Image © 2008 DigitalGlobe
©2007 Google™


R565
4
Townlands landfill site
N
Dr. Moroka Avenue
(proposed site for FIFA Fan Park)
Waterval landfill site
(10-15 km)
R510
Olympia Park Stadium
(training venue)
Rustenburg
2500 m
© 2008 AND
©2007 Google™
Image © 2008 DigitalGlobe

ANNEX 3

Royal Bafokeng Sports Palace

The official fan fest in Stuttgart during 2006 World Cup

PROJECTIONS OF WASTE GENERATION AT ROYAL BAFOKENG SPORTS PALACE

Information in fields shaded in violet are adaptable

						Deviation	
					kg / visitor	Min (-10%)	Max (+10%)
Capacity	42 000	No. of matches	6	Waste generation	0,45	0,41	0,50

WASTE GENERATION PER MATCH DAY

Scenario: 0 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	18900	17010	20790	54,00	105,00	350	180
Non-recyclables	100 %	18900	17010	20790	54,00	105,00	350	180
Recyclables	0 %	0	0	0				275
Glass	0 %	0	0	0				400
Paper and cardboard	0 %	0	0	0			500	200
Plastic	0 %	0	0	0			400	200
Other recyclables	0 %	0	0	0				300

Scenario: 20 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	18900	17010	20790		105,00	350	180
Non-recyclables	80 %	15120	13608	16632	43,20	84,00	350	180
Recyclables	20 %	3780	3402	4158		13,75		275
Glass	30 %	1134	1021	1247		2,84		400
Paper and cardboard	25 %	945	851	1040	1,89	4,73	500	200
Plastic	30 %	1134	1021	1247	2,84	5,67	400	200
Other recyclables	15 %	567	510	624		1,89		300

Scenario: 40 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	18900	17010	20790		105,00	350	180
Non-recyclables	60 %	11340	10206	12474	32,40	63,00	350	180
Recyclables	40 %	7560	6804	8316		27,49		275
Glass	30 %	2268	2041	2495		5,67		400
Paper and cardboard	25 %	1890	1701	2079	3,78	9,45	500	200
Plastic	30 %	2268	2041	2495	5,67	11,34	400	200
Other recyclables	15 %	1134	1021	1247		3,78		300

WASTE GENERATION TOTAL

Scenario: 0 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	113400	102060	124740	324,00	630,00	350	180
Non-recyclables	100 %	113400	102060	124740	324,00	630,00	350	180
Recyclables	0 %	0	0	0				275
Glass	0 %	0	0	0				400
Paper and cardboard	0 %	0	0	0			500	200
Plastic	0 %	0	0	0			400	200
Other recyclables	0 %	0	0	0				300

Scenario: 20 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	113400	102060	124740		630,00	350	180
Non-recyclables	80 %	90720	81648	99792	259,20	504,00	350	180
Recyclables	20 %	22680	20412	24948		82,47		275
Glass	30 %	6804	6124	7484		17,01		400
Paper and cardboard	25 %	5670	5103	6237	11,34	28,35	500	200
Plastic	30 %	6804	6124	7484	17,01	34,02	400	200
Other recyclables	15 %	3402	3062	3742		11,34		300

Scenario: 40 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	113400	102060	124740		630,00	350	180
Non-recyclables	60 %	68040	61236	74844	194,40	378,00	350	180
Recyclables	40 %	45360	40824	49896		164,95		275
Glass	30 %	13608	12247	14969		34,02		400
Paper and cardboard	25 %	11340	10206	12474	22,68	56,70	500	200
Plastic	30 %	13608	12247	14969	34,02	68,04	400	200
Other recyclables	15 %	6804	6124	7484		22,68		300

PROJECTIONS OF WASTE GENERATION AT FAN PARKS

Information in fields shaded in violet are adaptable

						Deviation	
					kg / visitor	Min (-10%)	Max (+10%)
Attendance	10 000	No. of days	7	Waste generation	0,50	0,45	0,55

WASTE GENERATION PER LOW PROFILE DAY

Scenario: 0 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	5 000	4500	5500	14,29	27,78	350	180
Non-recyclables	100 %	5 000	4500	5500	14,29	27,78	350	180
Recyclables	0 %	0	0	0				275
Glass	0 %	0	0	0				400
Paper and cardboard	0 %	0	0	0			500	200
Plastic	0 %	0	0	0			400	200
Other recyclables	0 %	0	0	0				300

Scenario: 20 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	5000	4500	5500		27,78	350	180
Non-recyclables	80 %	4000	3600	4400	11,43	22,22	350	180
Recyclables	20 %	1000	900	1100		3,64		275
Glass	30 %	300	270	330		0,75		400
Paper and cardboard	25 %	250	225	275	0,50	1,25	500	200
Plastic	30 %	300	270	330	0,75	1,50	400	200
Other recyclables	15 %	150	135	165		0,50		300

Scenario: 40 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	5000	4500	5500		27,78	350	180
Non-recyclables	60 %	3000	2700	3300	8,57	16,67	350	180
Recyclables	40 %	2000	1800	2200		7,27		275
Glass	30 %	600	540	660		1,50		400
Paper and cardboard	25 %	500	450	550	1,00	2,50	500	200
Plastic	30 %	600	540	660	1,50	3,00	400	200
Other recyclables	15 %	300	270	330		1,00		300

						Deviation	
					kg / visitor	Min (-10%)	Max (+10%)
Attendance	22 000		No. of days	10	Waste generation	0,50	0,45	0,55

WASTE GENERATION PER MEDIUM PROFILE DAY

Scenario: 0 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	11000	9900	12100	31,43	61,11	350	180
Non-recyclables	100 %	11000	9900	12100	31,43	61,11	350	180
Recyclables	0 %	0	0	0				275
Glass	0 %	0	0	0				400
Paper and cardboard	0 %	0	0	0			500	200
Plastic	0 %	0	0	0			400	200
Other recyclables	0 %	0	0	0				300

Scenario: 20 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	11000	9900	12100		61,11	350	180
Non-recyclables	80 %	8800	7920	9680	25,14	48,89	350	180
Recyclables	20 %	2200	1980	2420		8,00		275
Glass	30 %	660	594	726		1,65		400
Paper and cardboard	25 %	550	495	605	1,10	2,75	500	200
Plastic	30 %	660	594	726	1,65	3,30	400	200
Other recyclables	15 %	330	297	363		1,10		300

Scenario: 40 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	11000	9900	12100		61,11	350	180
Non-recyclables	60 %	6600	5940	7260	18,86	36,67	350	180
Recyclables	40 %	4400	3960	4840		16,00		275
Glass	30 %	1320	1188	1452		3,30		400
Paper and cardboard	25 %	1100	990	1210	2,20	5,50	500	200
Plastic	30 %	1320	1188	1452	3,30	6,60	400	200
Other recyclables	15 %	660	594	726		2,20		300

						Deviation	
					kg / visitor	Min (-10%)	Max (+10%)
Attendance	35 000	No. of days	14	Waste generation	0,50	0,45	0,55

WASTE GENERATION PER HIGH PROFILE DAY

Scenario: 0 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	17500	15750	19250	50,00	97,22	350	180
Non-recyclables	100 %	17500	15750	19250	50,00	97,22	350	180
Recyclables	0 %	0	0	0				275
Glass	0 %	0	0	0				400
Paper and cardboard	0 %	0	0	0			500	200
Plastic	0 %	0	0	0			400	200
Other recyclables	0 %	0	0	0				300

Scenario: 20 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	17500	15750	19250		97,22	350	180
Non-recyclables	80 %	14000	12600	15400	40,00	77,78	350	180
Recyclables	20 %	3500	3150	3850		12,73		275
Glass	30 %	1050	945	1155		2,63		400
Paper and cardboard	25 %	875	788	963	1,75	4,38	500	200
Plastic	30 %	1050	945	1155	2,63	5,25	400	200
Other recyclables	15 %	525	473	578		1,75		300

Scenario: 40 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	17500	15750	19250		97,22	350	180
Non-recyclables	60 %	10500	9450	11550	30,00	58,33	350	180
Recyclables	40 %	7000	6300	7700		25,45		275
Glass	30 %	2100	1890	2310		5,25		400
Paper and cardboard	25 %	1750	1575	1925	3,50	8,75	500	200
Plastic	30 %	2100	1890	2310	5,25	10,50	400	200
Other recyclables	15 %	1050	945	1155		3,50		300

WASTE GENERATION TOTAL FOR ONE FAN PARK

Scenario: 0 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	390 000	351000	429000	1114,29	2166,67	350	180
Non-recyclables	100 %	390 000	351000	429000	1114,29	2166,67	350	180
Recyclables	0 %	0	#REF!	#REF!				275
Glass	0 %	0	0	0				400
Paper and cardboard	0 %	0	0	0			500	200
Plastic	0 %	0	0	0			400	200
Other recyclables	0 %	0	0	0				300

Scenario: 20 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	390000	351000	429000		2166,67	350	180
Non-recyclables	80 %	312000	280800	343200	891,43	1733,33	350	180
Recyclables	20 %	78000	70200	85800		283,64		275
Glass	30 %	23400	21060	25740		58,50		400
Paper and cardboard	25 %	19500	17550	21450	39,00	97,50	500	200
Plastic	30 %	23400	21060	25740	58,50	117,00	400	200
Other recyclables	15 %	11700	10530	12870		39,00		300

Scenario: 40 % of total waste stream recycled

Waste fraction	Share	kg	kg (min)	kg (max)	Compacted m^3 (average)	Collected m^3 (average)	Ratio compacted kg / m^3	Ratio collected kg / m^3
Total waste stream	100 %	390000	351000	429000		2166,67	350	180
Non-recyclables	60 %	234000	210600	257400	668,57	1300,00	350	180
Recyclables	40 %	156000	140400	171600		567,27		275
Glass	30 %	46800	42120	51480		117,00		400
Paper and cardboard	25 %	39000	35100	42900	78,00	195,00	500	200
Plastic	30 %	46800	42120	51480	117,00	234,00	400	200
Other recyclables	15 %	23400	21060	25740		78,00		300

ANNEX 6. (PAGE 1 of 2)

FINANCIAL PROJECTIONS OF OPERATIONAL COSTS

Information in fields shaded in violet are adaptable

PERSONNEL COSTS

Type	Quantity	Shifts / day	Days	Shifts Total	Rand value / Shift	Total R
Supervisor/foreman (stadium)	10	1	6	60	160	9 600
Waste separators (stadium)	55	1	6	330	100	33 000
Collectors/cleaners (stadium)	100	1	6	600	100	60 000
Sub-total (stadium)						*102 600*
Supervisor/foreman (fan parks/low profile)	4	1,5	7	42	160	6 720
Waste separators (fan parks/low profile)	18	1,5	7	189	100	18 900
Collectors/cleaners (fan parks/low profile)	35	1,5	7	367,5	100	36 750
Sub-total (fan parks/low profile)						*62 370*
Supervisor/foreman (fan parks/med profile)	6	1,5	10	90	160	14 400
Waste separators (fan parks/med profile)	40	1,5	10	600	100	60 000
Collectors/cleaners (fan parks/med profile)	80	1,5	10	1200	100	120 000
Sub-total (fan parks/medium profile)						*194 400*
Supervisor/foreman (fan parks/high profile)	10	1,5	14	210	160	33 600
Waste separators (fan parks/high profile)	50	1,5	14	1050	100	105 000
Collectors/cleaners (fan parks/high profile)	100	1,5	14	2100	100	210 000
Sub-total (fan parks/high profile)						*348 600*
Sub-total (FIFA Fan Park + PVA)						*1 210 740*
Cleaners are also needed to keep CBD and similar areas free of litter.					**Total**	**1 313 340**
Costs relating to that are not included.					Total (if waste separation not implemented)	912 540

WASTE DISPOSAL COSTS

Type	Quantity	Unit	Rand value / Unit	Sub-total	Total R
Transportation (100 % waste stream)	2 535	km	35	88 725	
Transportation (80 % waste stream)	1 971	km	35	68 985	
Transportation (60 % waste stream)	1 551	km	35	54 285	
Landfill tariff (no recycling)	893	ton	90	80 406	**1 081 671**
Landfill tariff (20 % recycled)	715	ton	90	64 325	**1 446 650**
Landfill tariff (40 % recycled)	536	ton	90	48 244	**1 415 869**

The costs of transportation are calculated with the assumptions that the distance between RBSP and Waterval is 30 km between FIFA Fan Park and Waterval 15 km and between PVA and Waterval 20 km. Icalculations are also made with the assumptio that around 18-20 m^3 of compacted waste is transported at once.

ANNEX 6. (PAGE 2 of 2)

INCOMES

Recyclable fraction	Quantity 20% (kg)	Quantity 40% (kg)	Rand value / Kilogram	Total 20% (R)	Total 40% (R)	Total R
Glass	53 604	107 208	0,25	13 401	26 802	
Paper and cardboard	44 670	89 340	0,60	26 802	53 604	
Plastic	53 604	107 208	0,50	26 802	53 604	
Other recyclables (if 80 % metal)	21 442	42 883	0,50	10 721	21 442	
				77 726	155 452	
Total, if 20 % recycled						**1 368 924**
Total, if 40 % recycled						**1 260 417**
Total, without recycling						**1 081 671**