New Composting Facility, Builders Rubble Processing Plant and Domestic Drop-off Centre for George

Technical Report for Waste Management Licence

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CLIENT:	PROJECT ENGINEERS:
George Municipality Department of Environmental Affairs 82 Meade Steeet, George, 6529 Giel Goosen Tel: 044 802 2911	Tuiniqua Consulting Engineers PO Box 9059, George, 6530 Paul Goedhart Tel: 044 874 4098 Fax: 044 874 5632 E-mail: paul@tuiniqua.co.za

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1 Introduction

One of the main focus areas for the National Waste Management Strategy (NWMS) and Waste Act is waste minimisation and recycling and in line with this, composting and the processing of builders rubble is encouraged. This can help decrease the amount of solid waste that must be sent to a landfill thereby reducing disposal costs and conserving valuable airspace. At the same time, composting can yield a valuable product for use by farmers, landscapers, horticulturists, local authorities and property owners as a soil amendment or mulch and processed builders rubble can be used as fill material for roads or in the manufacture of new concrete when arising at source.

George Municipality has recognised garden waste and builders rubble as a huge problem for disposal with it current landfill site already exceeding its limits in terms of the Permit Application. It is not financially sustainable to transfer garden waste via the refuse transfer station to PetroSA. It is also a requirement of PetroSA landfill that no garden waste is disposed at the facility.

Thus, it has been proposed to provide sufficient area close to the existing refuse transfer station for the development of a composting facility, domestic drop-off centre and builders rubble processing plant. Furthermore as the operation of these facilities is not a core function of the Municipality it is proposed that they will be managed by an experienced private contractor. The private contractor will be contractually be required to operate and manage the facility to specification.

This document forms part of the reports required by the national Department of Environmental Affairs for an application for a Waste Management Licence in terms of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008).

1.1 Licence Application Report

This report includes the following;

- General Overview
- Site and Services Report
- Design
- Operation Plan
- Monitoring Plan
- Environmental Impact Control Report
- Socio-Economical Impact of the Facility

2 General Overview

2.1 Waste Classification and Generation

2.1.1 Sources of Waste

a) Composting Facility

The bulk of the feedstock for the composting will be green waste received directly from the public (mainly from the high and medium income socio-economic levels), local authority and private contractor's e.g. garden services.

The green waste component consists of any plant material (lawn clippings, leaves, shrubs, trees, plants, etc.) that will be received at the composting facility. The monitoring and separation of green waste at the facility ensures that there will be little contamination.

An inherent problem is that some garden waste is either collected in admixture or separate, with domestic waste as part of the domestic collection service. This waste is categorised as household waste at the refuse transfer station and transported to the PetroSA landfill site. A solution to this problem would be the implementation of dedicated garden waste kerbside collection services. Garden waste could then be collected along with the normal weekly household collection service in a different colour bag which can then be separated at the refuse transfer station.

b) Builders Rubble Recycling

The term builders rubble, also commonly known as construction and demolition waste, can cover a wide range of materials. The most obvious categories include:

- waste from the total or partial demolition of buildings and civil infrastructure;
- waste from the construction of buildings and civil infrastructure;
- soil and rocks arising from earthworks, civil works and general foundations;
- road planings and associated materials arising from road maintenance activities.

The demolition of buildings, such as industrial, office buildings and homes provides a large potential; source of waste materials which can be salvaged and recycled.

The construction of new buildings produces wastes from two principal sources:

- the preparation of building sites where excess or unsuitable materials - for example clay - are removed offsite in order to produce a level site for construction. These materials generally find their way to landfill sites because this is the most expedient and economically viable option; and,
- interim and post-construction clean-ups of wastes from the construction process where materials are removed offsite, principally to inert landfill.

The classification of materials generally accepted as builders rubble is;

- concrete, bricks, tiles, ceramics, and gypsum based materials
- wood
- glass
- plastic
- asphalt, bitumen and bitumen products;
- metals
- soil and dredged spoil
- insulation materials
- mixed construction and demolition waste

There are also hazardous components of construction and demolition wastes such as asbestos products that must be identified.

Generally with large construction developments the separation of materials for recycling or for disposal can be achieved quite easily. However there is a prolific market for the renovation and extensions to existing houses by the small “bakkie” builder and these activities generally produce small quantities of mixed builders rubble which include soil, bricks, wood, plastic, paints and solvents and product wrapping. This sector of the construction industry is most likely to also be the largest source of illegal dumping and the strategy for the management of builders rubble must provide for this.

The management of builders rubble waste should respect the waste management hierarchy with waste prevention and minimisation being the first priority succeeded by reuse and recycling. Disposal should only be considered as a last resort.

c) Drop-off Centre

The domestic drop-off centre will form part of the builders rubble processing area and will receive household rubble such as wood, plastic, metals, etc and household hazardous wastes i.e. waste oils, paints, fluorescent tubes in open containers or skips.

2.1.2 Quantities of Material

a) Composting Facility

There are currently no records on the amount of garden waste generated in George, however an estimate has been made based on the population figures. According to the Eden District Municipality IWMP George had an estimated population of 162,104 in 2005 with an average annual growth rate of 4.6%. According the same document the distribution between the different social-economic levels is 19.1% high to very high income, 15.3% middle income and 65.6% low to very low income.

Previous studies and waste characterisation projects would indicate that low income areas produce insignificant amounts of green waste. It is therefore proposed for the purposes of this

study that only high and middle income areas will be considered in determining the quantities of green waste generated in George.

An estimate of the amount of garden refuse that a household will generate annually has been made based on the following assumptions.

- High-income group produce 3 x bags of grass clippings and 2 bags of other green waste every fortnight in summer and monthly in winter.
- Middle-income group produce 60% equivalent of high-income group.

The table below presents the estimate of green waste generation based on the number of households in George in year 2005 using the abovementioned figures and an average of 4 persons per household.

Income Group	No. of households	Annual Waste Generation (t/household)	Total Tonnage
High to Very High	7,740	0.75	5,805
Middle	6,200	0.45	2,790
Total	13,940		8,595

The above calculation excludes local authority generators such as Parks and Forest, Roads and Electricity department. Assuming that 10% of the green waste is from local authority sources an annual estimate of green waste generated in the George Municipal area for 2005 would be in the order of 9,500 tonnes.

Using an average growth rate of 4.6% per annum to 2010 and 3.5% thereafter and a density of 250kg/m³, the yearly tonnage and daily volume of green waste using 311 working days per year up to 2040 is presented in the table below.

	2005	*2010*	*2020*	*2030*	*2040*
Tonnage of Green Waste per year (t/annum)	9,500	11,900	16,800	23,700	33,400
Tonnage of Green Waste per working day (t/day)	30.5	38.3	54	76.2	107.4
Volume of Green Waste per working day (m3/day)	122	153	216	305	430

On a daily basis there will be, on average, the following process quantities of materials on site when the facility starts to operate in 2011 (based on 311 working days per year).

Material	Quantity	Storage
Greens waste	151m³/d	Material is placed directly to windrow.
Active composting	7,600m^3	Material is in windrows. Volume reduction due to process
Curing of compost	3,600m^3	Material is in windrows. Volume reduction due to process.
Compost output	81m³/d	Compost stored in bulk or bags

The output of the facility is estimated to be 37 ton of compost per working day in 2011 increasing to 101 tons per working day by 2040. This is based on 311 working days per year. All these figures assume that all the generated green waste will be delivered to the composting facility which, with the present waste collection service, is not the case (see 2.1.1 a).

b) Builders Rubble Recycling

The assessment of waste generation in the Cape Town Metro for the IWMP completed in 2004 estimated that builders rubble was being generated at 0.29kg/capita/day. Using this figure and the 2005 population of 162,204 the total annual amount of builders rubble generated in the George Municipal area in 2005 is about 17,170 tons. Using a 4.6% growth rate the 2010 amount increases to 21,500 tons. However the estimated 0.29kg/capita/day of builders rubble being generated does not include the quantities that are already being recycled by the construction industry.

The existing builders rubble landfill site was surveyed on 8 March 2010. The site started operating in April 2006 and it is estimated from the survey that a total of 322,500m³ builders rubble and green waste was disposed at the site from April 2006 until March 2010. With an estimated growth rate of 4.6% per annum during this period the total waste disposed at the site in 2010 is about 90,000m³. The amount of green waste in 2010 is estimated as 11,900 ton or 48,000m³ which implies that the remaining 42,000m³ should be builders rubble. Using a unit weight of 1.1 ton/m³ for builders rubble the total amount generated in 2010 is 46,200 tons. This figure may however be on the conservative site since it may include cover material as well as other waste disposed of at the site.

It is therefore proposed that the average of 21,500 tons and 46,200 tons is used for the 2010 is used. Using an average growth rate of 3.5% and a density of 1,100kg/m³, the yearly tonnage and daily volume of builders waste using 311 working days per year from 2010 up to 2040 is presented in the table below.

	2010	*2020*	*2030*	*2040*
Tonnage of Builders Rubble Waste per year (t/annum)	34,000	48,000	68,000	96,000
Tonnage of Builders Rubble Waste per working day (t/day)	109	154	219	309
Volume of Builders Rubble Waste per working day (m3/day)	99	140	199	281

c) Drop-off Centre

The amount of waste that will be disposed at the drop-off centre will form part of the builders rubble quantities except for the household hazardous waste which is presently estimated as about 0.5 ton per operating day.

2.2 General Overview of the Processes

a) Composting

Composting is the process of controlled biological conversion of organic material into stable cured humus-like products. It can be undertaken either aerobically (in the presence of oxygen) or anaerobically (in the absence of oxygen).

Anaerobic decomposition generates a number of odorous by-products, and it is normally undertaken in-vessel - within enclosed units - with careful control and treatment of the gases generated from the process.

Most current composting operations in South Africa are aerobic composting operations using the turned windrow method operated outside. Typically, aerobic composting procedures involve stacking and turning material in outdoor, elongated windrows.

The processing and composting of organic waste is a six stage process, which involves:

Receipt of Raw Material/Feedstock

The first step in the process is acquisition of raw materials. Depending on the final products a range of organic materials can be composted and these may include;

- Garden and landscaping material (grass, leaves, plants, loppings, branches, tree trunks and stumps)
- Untreated wood waste (sawdust, shavings, timber off cuts, crates, pallets, wood packaging)
- Natural fibrous material (seed hulls/husks, straw, grape marc, other natural fibrous material)
- Processed fibrous material (paper, cardboard, paper processing sludge, non-synthetic textiles)
- Biosolids and manures (sewage biosolids and animal manure)
- Food waste

Only the first three types of materials will received at the George composting facility.

Primary Treatment (Mixing and/or Size Reduction)

The majority of raw feedstock is unsuitable for direct incorporation into composting without size reduction. This can be undertaken via a number of means but most commonly using industrial tub grinders/shredders. Large grinders are also an effective means of mixing different raw waste streams prior to composting.

Composting

There are a number of different types of aerobic composting systems.

Type	Odour Control	Establishment Costs
Static windrows	Lowest Odour Control	Low set-up costs
Turned windrows		
Forced aerated static pile		
Aerated covered windrows		
Rotating drums		
Agitated bed or channel		
Full in vessel composting	Highest Odour Control	High set-up costs

Aerobic composting comprises 2 stages - the thermophilic stage (so called due to the high temperatures generated during decomposition) and the curing stage. As the thermophilic stage of the composting process depends on a number of variables, mainly the availability of oxygen, water and nitrogen, the duration required can vary from a few days for in-vessel methods to a number of months for static piles.

For windrows and static pile methods of composting, large areas are required compared too more automated methods such as in-vessel. However all methods generally require large areas for static piles for the subsequent curing process.

The turned windrow process, which is the most used process in South Africa, requires a number of important factors to achieve an acceptable outcome and includes;

Aerobic conditions - compost rows are turned (aerated) to introduce oxygen to a row and to remove CO2. Oxygen kills of pathogens and is necessary for the microbial life to flourish in the compost and keeps the process from turning anaerobic thus eliminating the formation of methane gasses and other odours. The main argument for maintaining aerobic conditions though, is the detoxification of the compost.

Temperature levels - temperature is an important factor in the hygienisation of raw materials. Most undesirable infections will be killed off at 65°C if exposed to this for periods of 7 - 10 days. As soon as a windrow is laid down, the temperature level of a row starts to rise and reaches levels of 55°C - 65°C+. Temperature control in a windrow is achieved through turning and addition of water.

Turning - by turning windrows aerobic conditions can be achieved and controlled as well as allowing water and inoculum to be added to the process in a controlled and measured manner. This periodic mixing is essential to move outer surfaces of material inward so they are subjected to the higher temperatures deeper in the pile. Turning assures that the whole of a windrow is aerated and that water and inoculum reaches everywhere in the windrow. Material is also "fluffed" in the process and oxygen is introduced over the whole of the windrow and no pockets of anaerobic material are allowed to develop. The exposure that turning gives to the material in the windrow to outside temperatures helps with the alleviation of temperature levels when necessary.

Additives - inoculum –In addition to the waste materials themselves, composting always requires two additional feedstocks: water and oxygen. As long as these are present, composting will normally occur naturally, based on the micro-organisms available from the raw materials. In order to accelerate the decomposition rate, reduce odours and control flies and rodents, inoculation or additives are introduced to the windrows. Inoculum are live micro organisms in powder form mixed with water and added to a windrow through a boom fitted to a turner. Inoculum enhances the composting process by increasing active microbial activity and helps with more efficient composting. In addition disease, harmful insects and gasses are suppressed.

Water - moisture is introduced into the windrow by the turner through its irrigation boom while turning of the windrow is occurring. Moisture content of windrow should be between

45% and 60% at all times. Moisture is essential for the maintaining of microbial life in a windrow.

Carbon to Nitrogen Ratio (C/N) - Control of the C/N ratio is important in optimizing the biological decomposition. The micro-organisms use carbon as a source of energy and both carbon and nitrogen are used for building cell structure. The C/N ratio declines as the decomposition process proceeds. The final compost C/N value affects soil and plants when the compost is applied.

For the turned windrow composting method, incoming materials are placed directly to windrows which are in the order of 50-100m long 1,5m high and a base width of 3m. The windrows can be covered to retain moisture and reduce the affects of strong winds. Windrows are turned daily using a purpose made machine. The compost turner moves material backwards along the windrow and at the same time a spray system adds water to the active compost as required as well as the additive where applicable

Windrow turner

The active composting turned windrow process has a duration, on average, of 8-10 weeks.

Curing

The curing stage of the composting process is a period of declining microbial activity and decomposition where the compost becomes more stable. Curing normally occurs in static windrows and could last anywhere from 4 to 8 weeks depending on the nature of the material.

Screening/Final Product Preparation

The preparation of the compost for final sale and distribution often involves a process of quality control whereby the cured and stabilised product is screened and segmented into different streams. Additives such as sands, loams, limes etc. can also be added at this point to enhance the compost product and tailor it for certain market sectors. Quality control is undertaken and includes testing for microbial parameters, physical and stability indicators and chemical (pollutant) characteristics.

Composting reduces the volume of the waste by approximately 40 to 50 percent. The finished product is humus, a dark-brown material referred to as compost together with heat, water, and carbon dioxide. In addition to reducing waste volume, compost is a valuable commodity in itself. Compost has found widespread use in agriculture as well as in the horticulture and silviculture industries. As a soil amendment, compost can increase plant growth and suppress weed growth and increase soil fertility, improve soil structure and aeration and its ability to retain water and nutrients.

Packaging, Storage and Sales

Once the compost products have passed the quality control stage and are segmented into different product streams, they are suitable for sale either via distribution to retail outlets or direct sale at the facility. Products are normally sold in both bulk form and in a variety of bagged sizes for the retail market.

Market development depends upon the quality of the compost produced. The horticultural market requires high quality compost whereas in agriculture or as a restoration material it may be of lower quality. However to produce good quality compost a stream of high quality compostable material is required which implies that collection and separation systems need to be developed to ensure that undesirable materials are kept out of the feedstock.

Contamination of collected garden waste is a problem that has been experienced by similar existing facilities. To effectively reduce contamination, a balance is required between allocating resources to increase community awareness via education programs and implementation of physical measures. A key factor that will have to be reviewed is the effective collection of garden waste.

b) Builders rubble recycling

Unsorted loads of construction waste will generally be pre-sorted to remove contaminants, crushed and screened, followed by magnetic separation of metal materials. Different specification materials will then be stockpiled for distribution. Unsuitable spoil material from earthworks e.g. clays can be used for reclaiming disturbed areas such as quarries.

Irregular and unpredictable raw materials, which may or may not include hazardous materials, may create a problem and a careful inspection of the incoming materials prior to and during processing is required.

c) Drop-off centre

Small quantities of builders rubble e.g. from “bakkie” builders, recyclables and household hazardous waste will be disposed off in sealed open containers or skips under strict control to ensure that materials are off-loaded in the correct container. The containers can then be transported when full to the applicable processing facility e.g. the refuse transfer station, builders rubble processing plant or hazardous landfill site.

2.3 Environmental Issues

There are a number of environmental issues which must be addressed by the operation of a composting facility, builders rubble processing plant and drop-off centre.

Odours

Odour problems associated with composting and related organics processing facilities can be traced to problems with one or more of the following four processes: process control; containment of odorous areas; odour control technology and siting. Green organic feedstocks generally will not release odours during processing provided the process conditions are optimised. Under aerobic conditions the main gaseous product of composting is carbon dioxide, and the organics are characterised by an earthy or woody odour.

Particulate Matter

Composting may be sources of particles (or particulate matter) in the atmosphere. The highest concentrations of particulate matter from composting are reported to occur during pre-treatment (shredding and mixing) of fresh organics and the turning of biodegrading organics, and can be higher in summer and when organics are dry. Unsealed access roads and earthmoving equipment can also be sources of particulate matter.

Water Pollution

Organics such as green waste, wood and fibrous materials generally form leachate only when additional water (including rainfall) is introduced. Leachate from composting facilities has the potential to pollute groundwater and surface water bodies. They can be high in nutrients and gives them a high biological oxygen demand (BOD). Stockpiles of raw organics and processed organics have the potential to pollute waters, because leachate may be generated when the stockpiled organics contain excessive moisture (for example, when too much rain falls on to the organics or if stockpiled organics are not sufficiently aerated or turned).

Nuisances and Pests

Composting facilities with exposed, rapidly biodegradable organics may attract a large number of birds, particularly gulls; and this can lead to noise problems. Composting facilities may also attract pests or vermin

Litter

Wind-blown litter emanating from composting facilities and builders rubble processing plants can have an impact on surrounding areas. Mud on the wheels of vehicles leaving the premises may also have an impact on the quality of surface water run-off. Vehicles can also be a source of wind-blown litter.

Noise

The main problems associated with noise are generally attributed to the following activities:

- Vehicles delivering waste and collecting materials;
- Mechanical turning operations in an open-air windrow operation, or aeration fans in an enclosed facility;

- Waste shredding or chipping operations;
- Compost screening operations;
- Builders rubble crushing operation; and
- Stockpiling and loading of processed builders rubble.

The process operations are potentially noisy and most noise issues tend to be associated with plant used for the movement of materials. Noise control measures should be considered.

3 Site and Services Report

3.1 Site Selection

In order to identify candidate sites for the location of the composting facility, domestic drop-off centre and builders rubble processing plant a number of siting criteria have been used. Site suitability depends on a number of technical, environmental, economic, social and political criteria and a balance needs to be achieved among the multiple criteria that might have competing objectives.

The following criteria for the initial screening are generally technical, environmental and economic. It can be expected that the Scoping Process will identify additional social and political criteria to be addressed.

3.1.1 Buffer Zones

A suitable separation distance to the nearest sensitive land use is recommended. Where possible, surrounding industries and development should be compatible with the use of the site as a composting facility, domestic drop-off centre and builders rubble processing plant.

3.1.2 Land-Use

The site should conform to zoning requirements, building heights and setbacks. Appropriate land use designation would include municipal and industrial.

3.1.3 Infrastructure

It is anticipated that the proposed facilities will require various utility services, such as electricity and water (for domestic use and fire fighting), telephone, stormwater drainage and sewers. It would also be beneficial if the existing infrastructure of the transfer station such as the weighbridge can also be used for the new facilities. Water for the composting process may be provided from other sources such as a sewage works or the detention pond.

3.1.4 Access and transport considerations

Drop-off facilities provide a valuable waste management service for the community and to maximise their value the facilities must be easily accessible. Convenient access for customers, with close proximity to the waste collection areas, encourages use of the services offered by the facilities. Ease of access involves consideration of not only hours and days of operation but also location within an acceptable range for users. The “convenience “distance to a drop-off facility will be influenced by the drive time which is a direct function of the surrounding road network. A generally accepted “convenience“ radius is in the order of 5km.

The facilities should also be situated so that it is economical to transport the processed materials to prevailing markets and any residual waste to disposal at e.g. the transfer station.

Travel distances should be minimized as much as possible so that the facility operation is as efficient and profitable as possible. The impact of an potential increase in the amount of traffic in the vicinity of the centre must be assessed.

3.1.5 Visual impacts

The facilities should be sited so that the processing operations and vehicle traffic are not readily visible to residents or adjacent land users. Vegetative screening can improve the visual appearance of the centre and can provide a buffer to noise and dust.

3.1.6 Noise

Noise problems generally arise from processing equipment, traffic (both within and going to and from the centre) and other operations. Siting the facilities near residential or other sensitive or non-compatible areas should, where possible, be avoided and centralise noisy activities to minimise the nuisance and increase the separation distance.

3.1.7 Topography

The topography of the site will affect the required area of land, site drainage, facility visibility and, potentially, the movement of odours offsite. The composting site should have ideally a slope of between 2% and 4% although a minimum slope of 1% is permissible. Greater slopes will increase the amount of surface runoff and soil erosion and will require more costly earthworks to create working platforms. The drop-off centre on the other hand will require two different levels and a sloped site would minimize earthworks.

3.1.8 Odour and Dust

The facilities should be designed and operated so that odorous emissions and dust do not cause a nuisance or an offence, and airborne impurities do not pose a risk to human health. To minimise dust, it is recommended that major working areas and access roads are paved, and that dust suppressants are used on other areas wherever necessary. The builders rubble processing plant in particular can create a lot of dust and the location of this plant relative to the surrounding facilities should be carefully planned. The prevailing wind direction in George is generally northwest in winter and southeast to southwest in summer.

3.1.9 Cost of Land

The cost of purchasing land for a facility can be significant and impact on its viability. The preferred option would be to use municipal land.

3.1.10 Site Size Requirements

The area required for a composting facility, domestic drop-off centre and builders rubble processing plant varies significantly, depending on the site topography, the volume of garden waste or builders rubble that will be delivered, the active composting method used, and the

expected growth in waste volumes as well as the lifespan of the facility. Locating a site of sufficient size is critical to operating efficiencies and minimizing impacts on the surrounding community. There should be sufficient space for onsite roadways, queuing, parking and on-site storage of green waste and builders rubble, active composting and curing processes of green waste, processing of builders rubble and the storage of the processed materials. A minimum area of about 8ha will be required for the first 10 years of operation.

3.2 Candidate Site Identification

Three potential sites were identified by the Council. The sites are indicated on the locality plan.

	Site	Erf no.	Availible land area
1.	Next to the refuse transfer station	464	9.55 ha
2.	Rehabilitated landfill site next to airport road	464	12.7 ha
3.	Opposite refuse transfer station and adjacent to sewage works	464	Up to 40 ha

The three sites were further assessed for suitability and the results are tabulated on page 16.

3.3 Criteria Scoring of Site Alternatives

Criterion scoring is a method of evaluating site alternatives and is used to make a preferred site recommendation. Scoring for each criterion was based on either (1) all sites meeting the criterion and receiving the same score of 4, or (2) when there were relative differences among the sites within a criterion, using a weighted scale to note the variation from poor to very good.

Scoring values for relative differences were:

Poor	1
Reasonable	2
Good	3
Very Good	4

Site selection was awarded to the site receiving the highest total after adding scores. Table 3.1 below shows the total scores for each site alternative and Table 3.2 on page 16 shows the breakdown by criterion for each site selection criteria, including an explanation for each score.

Table 3.1 Criteria Scoring Results

	Site Alternative		
	1	2	3
Total Score	36	33	34

3.4 Site Recommendation

Technically none of the sites indicate possible fatal flaws and proper engineering and management will mitigate any potential impacts.

Site 1 next to the refuse transfer station earned the highest score and is recommended as the best site for developing the new composting facility, domestic drop-off centre and builders rubble processing plant for the following reasons:

- It is well situated between the refuse transfer station, sewage works and existing builders rubble landfill site.
- The operation and management of the facilities can be linked to the refuse transfer station should Council decide to appoint only one contractor to manage all the waste facilities.
- Infrastructure is readily available from the refuse transfer station or sewage works. Infrastructure from the refuse transfer station can be shared to save on costs.
- The new leachate detention pond can be shared with the rehabilitated builders rubble site to save costs.
- The topography of the site allows for split level platforms for the drop-off centre without significantly expensive earthworks.
- There are adequate buffers around the site to residential areas, public roads and rivers.
- The rehabilitated builders rubble site will be available for expansion of the facilities.
- The unused quarry can be rehabilitated with unwanted soils and dredged spoil.

Table 3.2 : Site Selection Score Sheet

Site Selection Criteria	Alternatives					
	1		2		3	
	Next to refuse transfer station		Rehabilitated landfill site next to airport road		Opposite transfer station next to sewage works	
General Location	2	Located away from the CBD and the High and Middle Income areas, which produce a large portion of the waste	2	Located away from the CBD and the High and Middle Income areas, which produce a large portion of the waste	2	Located away from the CBD and the High and Middle Income areas, which produce a large portion of the waste
Land-Use	4	Undeveloped municipal land surrounded by similar waste activities. Unused quarry available for dumping of unwanted soils and dredged spoil	3	Rehabilitated landfill area which cannot be developed apart from sport fields	2	Undeveloped municipal land. Future use may be residential and industrial. Buffer zone area will be increased and limited area available for future development.
Access to Major Transportation Routes	4	Direct access onto the airport road and close to N2 freeway	4	Direct access onto the airport road and close to N2 freeway	4	Direct access onto the airport road and close to N2 freeway
Traffic Compatibility	4	Existing traffic mainly to refuse transfer station and builders rubble landfill site. Existing intersection onto airport road	4	Existing traffic mainly to refuse transfer station and builders rubble landfill site. Existing intersection onto airport road	4	Existing traffic mainly to refuse transfer station and builders rubble landfill site. Existing intersection onto airport road
Dust and odours	3	Downwind of residential areas for northwest and southwest winds.	2	Downwind of residential areas for northwest and southwest winds. Airport road on north side is downwind of prevailing summer winds.	2	Downwind of residential areas for northwest and southwest winds. Five houses on sewage works property.
Buffers	3	1000m from residential area, 400m from airport road, 200m from Qwaing river, 20m from stream.	3	800m from residential area, 30m from airport road, 300m from Qwaing river, 70m from stream.	3	900m from residential area apart from five houses on sewage works property, 800m from industrial area, 500m from airport road, 500m from Qwaing river.
Site Size Requirements	3	Adequate but limited for expansion by stream on north, power lines on west, sewage works on south and gravel road on the east. Can use rehabilitated builders refuse site for future expansion.	3	Adequate but limited for expansion by airport road on the north, power lines on the west, stream on the south and gravel road on the east.	4	Adequate with additional area availible for future expansion
Cost of Land	4	Municipal property.	4	Municipal property.	4	Municipal property.
Infrastructure	4	All available in vicinity. Can make use of RTS infrastructure. Leachate pond can be shared with rehabilitated builders rubble site.	3	All available in vicinity but will have to be extended. . Leachate pond of rehabilitated landfill site can be used.	2	All available in vicinity but will have to be extended.
Topography	2	Ground slopes fairly steep (average about 11%) to stream on north. Extensive earthworks will be required for composting working platforms.	3	Ground has a gently slope (average about 5%). Minor earthworks may be required for composting working platforms.	4	Ground is relatively flat with 2/3 having 1%-0.5% slope and remaining area about 3%. Earthworks will be required for split drop-off centre
Visual Impact	3	Site will be visible from the airport road but distance will be more than 400m	2	Site will be slightly visible from airport road but can be screened with berm and vegetation.	3	Site will be visible from the airport road but distance will be more than 400m
Total	**36**		**33**		**34**	

4 Design

The design requirements for a good compost facility, builders rubble processing plant and drop-off centre are discussed below and will be the minimum requirements for a private operator.

4.1 Facility Requirements

The following will be required at the facility;

4.1.1 Access Control

The entire site or individual sites will be fenced with a 2.1m high fence with perimeter vegetation to reduce the visual impact of the site. A gated entrance will be controlled from a gatehouse and all vehicles entering the site will first be weighed on a weighbridge. By weighing the incoming material a control on the quantities of bulking material can be maintained to ensure the correct ratio of mixed materials.

4.1.2 Composting Receiving and Primary Treatment (shredding) areas

These areas will consists of a compacted slightly sloped gravel surface in order that leachate can drain off the area, collected in a concrete side drain and conveyed to a detention facility.

4.1.3 Active Compost area

The active compost area will be a compacted gravel surface and will be graded to one side at a slope of between 1% and 4% in order that leachate can drain off the area, collected in a concrete side drain and conveyed to a detention facility. Platforms may need to be created depending on the natural slope of the site.

4.1.4 Composting Curing Area

The curing area will comprise a compacted gravel base graded to one side as for the active compost area.

4.1.5 Composting Loading Area

The loading area is where the final product will be stored and loaded on trucks for distribution. The loading area will comprise of a 450m² open steel shed with a concrete slab and a surrounding compacted gravel base in order that the final product is not contaminated with underlying soils.

4.1.6 Offices, Ablutions, Stores and Laboratory

A building will be provided for office/admin space, ablution facilities and to store additives and equipment as well as housing a laboratory for the ongoing testing of the process and materials.

4.1.7 Contaminated Wastes

Sealed containers will be maintained on site for the disposal of any contaminated wastes that are removed from the process. Contaminated wastes will generally be inorganic materials such

as plastics, glass or metals which have been brought in with the bulking materials. These materials are normally inoffensive and will be removed regularly from the facility to landfill.

4.1.8 Detention Pond

A lined leachate detention pond will be constructed to contain runoff from the composting area. The pond has been sized to cater for a 1:25 year 24 hour storm. The pond will be lined with 2mm HDPE and provision for an emergency outlet to the Qwaing sewage works. Under normal operations the contents of the pond will be used to provide moisture to the composting process.

4.1.9 Builders Rubble Processing Plant

A cleaned level area will be provided. Processed builders rubble can be used to create an all-weather surface.

4.1.10 Drop-off facility

A split-level concrete paved area with provision for six open bin holding bays will be provided.

4.1.11 Access road

The access road will be paved to reduce maintenance and dust.

4.1.12 Internal roadways

Internal roads will be constructed with gravel surfacing.

4.1.13 Landscaping

The perimeter of the site will be landscaped and a vegetative screening provided as a buffer to noise and dust.

4.2 Surface Drainage

All rainwater from roofs, roadways and paved surfaces will be collected in a piped stormwater system and discharged either to open land. The active composting and compost curing areas are sloped and runoff will be collected and discharged to the detention pond. Berms and cut-off drains around all the composting areas will ensure runoff cannot enter or leave the composting area.

All surface water and roadway water is collected and discharged away from the facility and it is extremely unlikely that the plant will be affected by flooding.

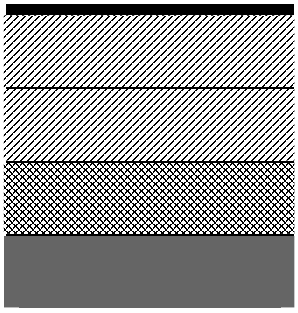
4.3 Leachate Management

The leachate system has been designed to collect all liquids from the composting areas and convey it away to a leachate detention pond facility. The active composting area is expected to be the main source of contaminated water and is therefore constructed in a hardened surface to provide a barrier to the underlying soils.

The detention pond has been sized to cater for a 24 hour, 1 in 25 year storm. The pond contents will be used for providing moisture to the composting process. In the event of the detention pond reaching capacity provision will be made for connecting to the Qwaing sewage works.

The detention pond will have the following characteristics;

Area	1400 m^2
Depth	3 m
Volume	2500 m^3
Freeboard	500 mm



2 mm HDPE lining

300mm Compacted clay material (in 2x150mm layers)

150mm Base preparation layer

Insitu soil

5 Operating Plan

5.1 Access Control

The entire site is security fenced and access to the site is controlled a manned gate house. All incoming waste vehicles will be weighed and all other vehicles security checked. Access to the site will be locked after hours.

Daily records will be kept of all waste entering the site. The following criteria will be monitored at site access

- Details of vehicle and owner
- Waste type, origins of waste and weight

A noticeboard at the access gate will indicate the following:

- Names, addresses and telephone numbers of permit holder and site superintendent
- Hours of operation
- Types of waste disposal permitted
- Emergency telephone number

5.2 Hours of Operation

The facility will operate between 07h00 and 18h00 on weekdays, Saturdays and most public holidays for receiving of waste. The facility will be closed on Sundays, Christmas Day and Good Friday.

5.3 Staffing

The facility will be staffed with persons skilled in the composting and the recycling of builders rubble processes. A fulltime manager will be employed to oversee the facility.

Staff training will be implemented to ensure that all operators of mobile plant and other equipment are skilled at undertaking all the tasks required of them and personnel who inspect incoming organics are skilled at identifying organics that are unacceptable and can record data accurately.

5.4 Fire Control

Sufficient fire-fighting capacity will be provided by developing a fire-management strategy to minimise the incidence and impact of fires. Adequate fire-fighting equipment will be available and staff will be trained to manage and contain fire outbreaks. The facility will have adequate buffers between the composting and builders rubble processing areas and surrounding land-use to act as an appropriate firebreak.

No fires will be permitted within the facility and all necessary and proper precautions taken to see that all materials handled in the course of the operations are treated in such a manner as to prevent fire from breaking out at the facility.

In the event of fire the operator shall cooperate fully with the regional fire services.

5.5 Odour Control

The process will be closely monitored to ensure that odours are kept to an acceptable level.

The following practices will ensure good odour control.

- Maintain moisture content of windrows below 60%.
- Regular turning of windrows to maintain aerobic conditions.
- Bulking material shall not be stockpiled for more than a week.
- Covering of active windrows if moisture content is excessive.
- Covering of active windrows with curing compost if odours become unacceptable.

5.6 Pest controls

Experience at existing composting sites show that birds are not attracted to the facility as the feedstock used does not constitute a food source. Controls to be implemented to control the proliferation of other pests and nuisances shall include;

- Minimise stockpiling of feedstock as for odour control.
- Ensure that surfaces are adequately drained to prevent ponding of surface waters.
- Maintain eradication measures on site.

5.7 Litter Controls

The following procedures shall be introduced to contain wind-blown litter;

- Clear all fences and gates of litter, preferably on a daily basis or as required.
- All litter that leaves the site shall be retrieved on a daily basis.

5.8 Dust Controls

Dust should not be an issue in the composting facility where material moisture contents are maintained at levels above those at which dust is generated (less than 30%). In order to maintain these levels, the levels shall be monitored to prevent the waste drying out. The following measures will be implemented;

- Shredding, screening, turning windrows and crushing of builders rubble will be avoided during extreme windy condition

- The windrow turner will incorporate water sprays during operations in windy conditions
- All the working areas will be regularly damped to suppress dust
- The access road will be paved.
- The builders rubble crushing area will be located with the prevailing wind directions taken into account and a vegetative screen will be provided.

5.9 Noise Controls

Noise controls will include:

- Ensuring vehicles and machinery are fitted with silencers
- Erecting acoustical barriers such as earth mounds and vegetation where required
- Limiting hours of operation to normal weekday working hours.

5.10 General Management

The general management of the facility will ensure the control of nuisances and the following measures will be taken;

- There will be no unauthorised discharging of waste at the facility
- Incoming feedstock and materials will be sorted and introduced into the process immediately.
- Roadways and other surfaces will be cleaned immediately where necessary.

5.11 Safety

The plant will be operated within the provisions of the Occupational Health and Safety Act of 1993 and the regulations promulgated thereunder.

The plant shall operate under the constant supervision of a competent employee of the management contractor who will be appointed in terms of the Act.

6 Monitoring Plan

6.1 General

The Monitoring Plan will be implemented to ensure that the site conforms to the licence requirements. The Monitoring Plan addresses the following aspects

- Internal Monitoring
- External Auditing
- Process Monitoring

The Permit will determine the frequency of monitoring.

6.2 Internal Monitoring

The facility operator will implement an internal monitoring program in accordance with Councils requirements.

The critical aspects to be monitored are;

- Types of incoming waste
- Correct sorting of waste
- Excessive leachate production and
- Cleanliness and odours

The monitoring of incoming waste is discussed in 5.1 above.

In addition the equipment shall be monitored during use to ensure it is in good running order and a program of preventative maintenance will be implemented.

6.3 External Auditing

Auditing of the site will by carried out at intervals stipulated in the licence by the regulatory authorities.

Issues that will be assessed are:

- site security
- management
- safety
- cleanliness
- drainage
- litter, dust, odour and noise control
- site specific licence conditions

6.4 Process Monitoring

Although the composting and recycling of builders rubble are simple, natural processes, problems can occur if the conditions are not right.

For composting temperature is a good indication of biological activity, and is therefore key to identifying the problems. To ensure that the composting operation maintains the ongoing quality needed, periodic analysis, monitoring and reporting is required.

A laboratory will be provided on site to monitor the process and analyse a number of parameters. The following table indicates the monitoring that will be undertaken and the frequency of monitoring.

Parameters	**What to monitor**	**When to monitor**
Moisture content	Aeration	Every time after turning
Temperature	Sufficient aeration	Every day
	Composting activity	Every day during the active composting period
Oxygen	Sufficient aeration	During active composting operation
Pathogens	Log of temperature	Every other day
	Management of feedstock and compost	During handling operation
Volume	Fermentation grade	During the active composting period
Flies	Composting activities	During the beginning of the active composting period
Colour	Decomposition of organic matter	During the composting process
Stability of compost	Log of temperature	During the curing period

Builders rubble needs to be carefully sorted to remove any contaminants or unwanted materials to ensure that the processed product complies with the minimum requirements for such a product in terms of its usage.

7 Environmental Impact Control Report

7.1 General

This report is to be read in conjunction with the Operation Plan.

7.2 Environmental Impacts

The major potential impacts identified are:

a) groundwater and surface water pollution
b) odour
c) noise
d) dust

7.2.1 Ground and Surface Water Pollution

The stormwater system on the site will convey all stormwater from the roadways and roofs around the composting area and discharges to open land. Berms and cut-off drains around the composting area will ensure runoff cannot enter or leave the composting area.

The polluted water system is a closed system and collects storm water runoff from the composting area and discharges into a detention pond. In the event that pond is full overflow will be directed to the Qwaing sewage works.

In addition sewage and grey water from the staff facilities will be connected to the refuse transfer station sewage network or directly to the sewage works.

7.2.2 Odours

The facility will be located on municipal land with the surrounding land-use being future industrial on the east, Qwaing sewage works on the south and open farm land on the west and north sides. The distance to closest residential area is some 1000m.

The prevailing wind direction in the area is northwest in winter and varies between southwest and southeast during summer. Minor odour impact to the residential areas to the northeast and southeast is therefore possible but due to the distance of more than a kilometre this is highly unlikely.

7.2.3 Noise

The main source of noise will be equipment used for shredding, turning windrows, screening in the composting process and crushing of builders rubble. The plant will be operated during normal weekday business hours. Sound barriers will be provided in the form of a vegetation screen along the boundaries shared with existing industries and facilities.

7.2.4 Dust

The main source of dust will be from the shredding and crushing processes and vehicle traffic on gravel roads. The access road will be paved and all the travelled gravel surfaces will be damped to suppress dust. Vegetative screening will be provided where needed.

7.3 Environmental Consequences of Failure Assessment

There are three possible pathways for pollutants to escape into the surrounding environment:

- surface water
- groundwater
- air/wind flow

7.3.1 Surface Water

Surface water will be diverted around the composting facility. In the event that surface water enters the composting area it will collected by the drainage system and conveyed to the detention pond.

7.3.2 Groundwater

Measures are required to prevent polluted water and contaminated stormwater from entering the surrounding environment. Possible sources of leachate and contaminated stormwater are rainfall and operational water runoff from the composting area

The facility is provided with a closed drainage system. The system comprises the following:

Receiving and Shredding Area – the apron is a constructed gravel surface and slopes towards a concrete longitudinal drain along the southern boundary of the area which discharges into the detention pond.

Active Composting Area – the apron are constructed gravel terraces about 20m wide and sloping towards a concrete longitudinal drain along the southern boundary of the terrace which discharges in to the detention pond.

Compost Curing Area – the aprons are constructed gravel terraces about 20m wide and sloping towards a concrete longitudinal drain along the southern boundary of the terrace which discharges into the detention pond.

Loading Area – the apron is a concrete slab and slopes towards catch pits which discharge in to the detention pond.

7.3.3 Air/wind flow

Odours could be generated during the composting process

Windrows will be turned on a daily basis and windrow condition i.e. temperature, moisture and oxygen will be monitored and maintained at optimum. In the event that unacceptable odours occur the windrows will be covered with a minimum of 150mm of final product.

7.4 Response Action Plan

A number of events have been identified which will affect the operation of the facility and may have an environmental impact. These are namely

- building or equipment failure
- excessive rainfall

The following actions will be taken in response to situations that stop the operation of the composting facility for a period of time.

7.4.1 Short term Delays (< 2 weeks) due to Failure or Malfunction of Mechanical Equipment

- Green waste stored on lined demarcated area. Maximum storage period of 2 weeks.
- Chipped green waste stored on lined demarcated area. Maximum storage period of 2 weeks.
- Builders rubble will be sorted and stored in heaps on the levelled working area. Maximum storage period of 1 month.

7.4.2 Medium to Long Term Delays (> 2 weeks)

In the event of delays longer than two weeks, the facility operator will immediately notify the George Municipality.

- Waste is to be redirected to an alternative composting facility or waste disposal facility.
- Chipped green waste stored on lined demarcated area to be removed after a period of 2 weeks.
- Active windrows still to be turned or covered with a minimum of 150mm of final product.

8 Socio-Economical Impact of the Facility

8.1 Development of the Facility

The following infrastructure will be developed:

- Security fence around the site
- Security gate and gate house
- Weighbridge (if weighbridge of the refuse transfer station cannot be used)
- Working platforms for all processes
- Paved access road and gravel internal roads
- Building for offices, laboratory, ablutions
- Open shed for storing equipment and packaging, storing and dispatching of compost
- Water, sewage and electricity
- Leachate detention pond
- Leachate catchments system
- Stormwater catchments system
- Split level drop-off facility with capacity for six open bins

The total estimated cost for the development of the infrastructure is R 8.68 million including VAT. The expected value of the labour component for the infrastructure construction is about R1,000,000 and of this amount R800,000 will be paid to previous disadvantaged individuals over the construction period of about 5 months. It is further estimated that 30 new work opportunities will be created.

8.2 Management of the Facility

The management of the facility will be outsourced on a five year contract basis. The management contractor of the facility will have to provide his own equipment and labour to operate all the facilities.

It is expected that 20 permanent work opportunities will be created during the management of the facility at a total present cost of R2 million per year. Approximately R1.8 million of this amount will be paid to previous disadvantaged individuals.

Appendix A
Drawings

TG964 R01 – Location of Candidate Sites

TG964 R02 – Site 1 General Layout of Facilities

TG964 R03 – Site 1 Composting Facility Layout

TG964 R04 – Site 1 Composting Facility Sections and Details