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Saldanha Bay Municipality

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Organic Waste Diversion Plan

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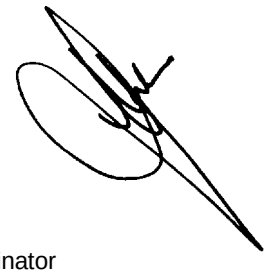
Revision Control

Version	Date	Summary of Changes
0	15 September 2021	First Draft
1	25 November 2021	Second Draft Incorporation of SBM comments
2	14 December 2021	Final with SBM corrections and comments
3	24 May 2022	Final with DEAD&P comments addressed.

Signatures



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ABBREVIATIONS

AD	Anaerobic Digestion
AWTT	Alternative Waste Treatment Technologies
CoCT	City of Cape Town
CSIR	Council for Scientific and Industrial Research
DEA&DP	Department of Environmental Affairs and Development Planning
DFFE	Department of Forestry, Fisheries and Environment
DNA	DNA Composting Facility
IC&I	Industrial, Commercial and Institutional
IPWIS	Integrated Pollutant and Waste Information System
IWMP	Integrated Waste Management Plan
N&S	Norms and Standards
NEM:WA	National Environmental Management: Waste Act (Act No. 59 of 2008)
NEMA	National Environmental Management Act (Act No. 107 of 1998)
OW	Organic Waste
PPPs	Public-Private-Partnerships
POWS	Provincial Organic Waste Strategy
SBM	Saldanha Bay Municipality
T	tonnes
t/a	tonnes per annum
WC	Western Cape
WCD	West Coast District
WCDM	West Coast District Municipality
WCG	Western Cape Government
WML	Waste Management Licence

1. Introduction

Saldanha Bay Municipality (SBM) (WC014) is a local municipality located on the West Coast of South Africa, approximately 140 kilometres north of Cape Town. It forms part of the West Coast District Municipality (WCDM) (DC1), situated in the Western Cape Province. It abuts on the Bergrivier Municipality to the north and the Swartland Municipality to the east and south.

The SBM covers an area of 2 015 km² and has a coastline of 238 km. In total 6.5% of the geographical land is urban land and 93.5% rural land. Overall SBM constitutes 6.4% of the entire West Coast geographical land making it the smallest municipal area in the district. Saldanha Bay has the largest natural port in Africa and the area is earmarked as a regional develop node for industrial and economic development of the Western Cape Province and the west coast.

The main municipal office is located in Vredenburg, with satellite offices in Hopefield, St Helena Bay, Paternoster, Saldanha and Langebaan.

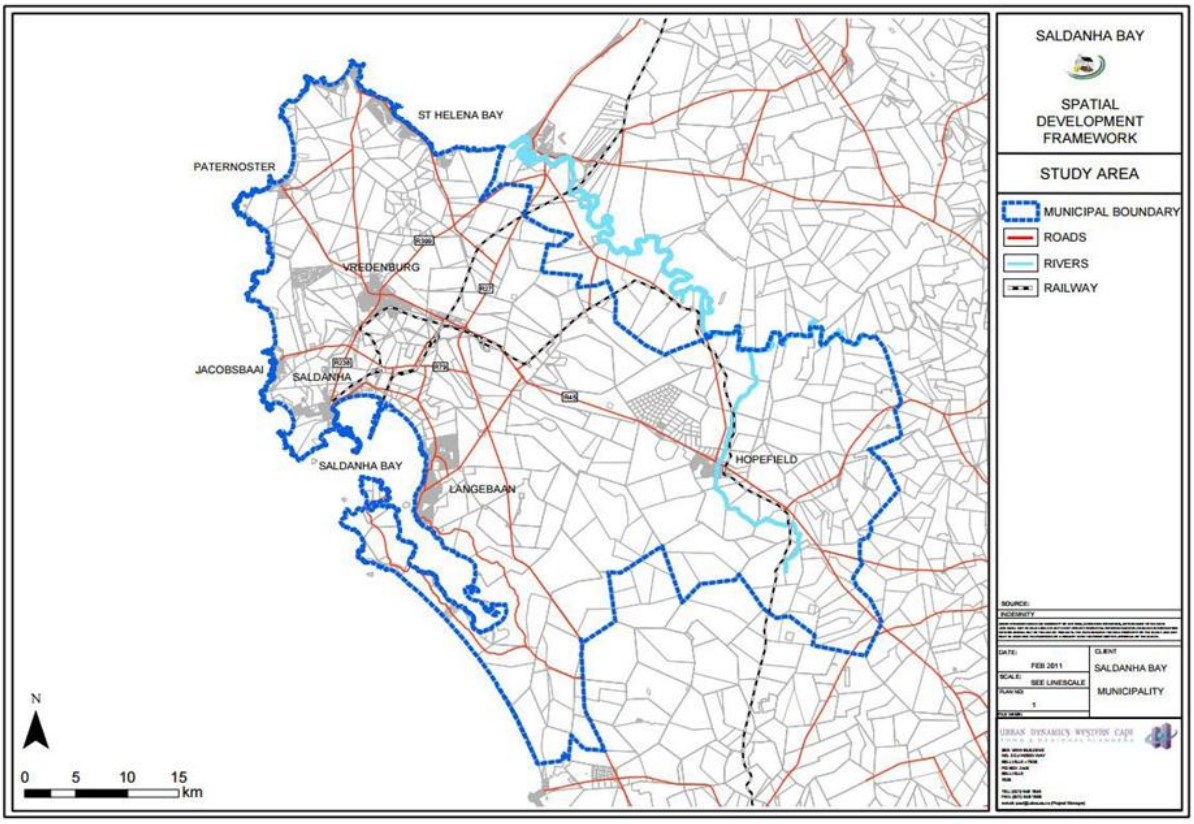

Figure 1 - Saldanha Bay Municipality - Study Area

SBM operates a landfill located in Vredenburg, a transfer station in Langebaan and 6 drop-off sites located in Paternoster, St Helena Bay (Stompneus Bay and Laingville), Saldanha (Kalkrug and Diazville) and Hopefield. All the facilities receive general waste, builder's rubble and garden waste.

SBM prepared an interim Organic Waste Diversion Plan (OWDP) in alignment with the Integrated Waste Management Plan (IWMP) of 2017 as a prerequisite of the Waste Management License Variation of 17 March 2018 as issued by DEAD&P Waste Management. The conditions of the WML state that an OWDP;

a) be submitted within a prescribed time frame and annually thereafter;

b) Include a status quo of current organic waste sources and volumes disposed at the municipal waste disposal facilities, and current rates and procedures of organic waste diversion from Waste Disposal facilities;

c) Set annual targets and identify procedures from 2018 that will be implemented to meet these targets, for the diversion of organic waste from municipal WDF's, in order to reach a 50% diversion by 2022 and 100% diversion by 2027.

1.1. Demographics

1.1.1. Population

The population of SBM is estimated at 121 939 in 2020, making it the second most populated municipal area in the WCDM . Population is expected to grow to 132 483 by 2024, equating to an average annual growth rate of 2.1 %.

1.1.2. Household sizes

Household size refers to the number of people per household. The actual size of households is on a downward trend from 3.4 people per household in 2020 to 3.2 in 2024. Contributing factors to a stagnation in household size growth could include, but are not limited to, lower fertility rates, occurrences of divorce, ageing population, etc.

1.1.3. Population density

Amidst rapid urbanisation across the Western Cape, population density figures will aid public sector decision makers to mitigate environmental, individual health and service delivery risks. In 2020, the population density of the West Coast District (WCD) was 15 persons per square kilometre. In order of highest to lowest, the various local municipal areas in the WCD compare as follows with Saldanha Bay being the most densely populated municipal area at 61 people/km^2.

1.1.4. Wards

The SBM is comprised of fourteen wards, which are listed in below.

WARD	AREAS/TOWNS
1	Middelpos & Diazville West
2	RDP Area
3	White City
4	Diazville / RDP Area
5	Saldanha Town, Blue water Bay & Jacobs Bay
6	Langebaan South
7	Hopefield & Koperfontein
8	Vredenburg North, Langebaan Air Force Base & Green Village
9	Ongegund, George Kerrige & Smarty Town
10	Vredenburg South & Louwville North
11	St. Helena Bay & Paternoster
12	Laingville
13	YSKOR & Part of Louwville
14	Langebaan North

Table 1 – Saldanha Bay Municipality Wards

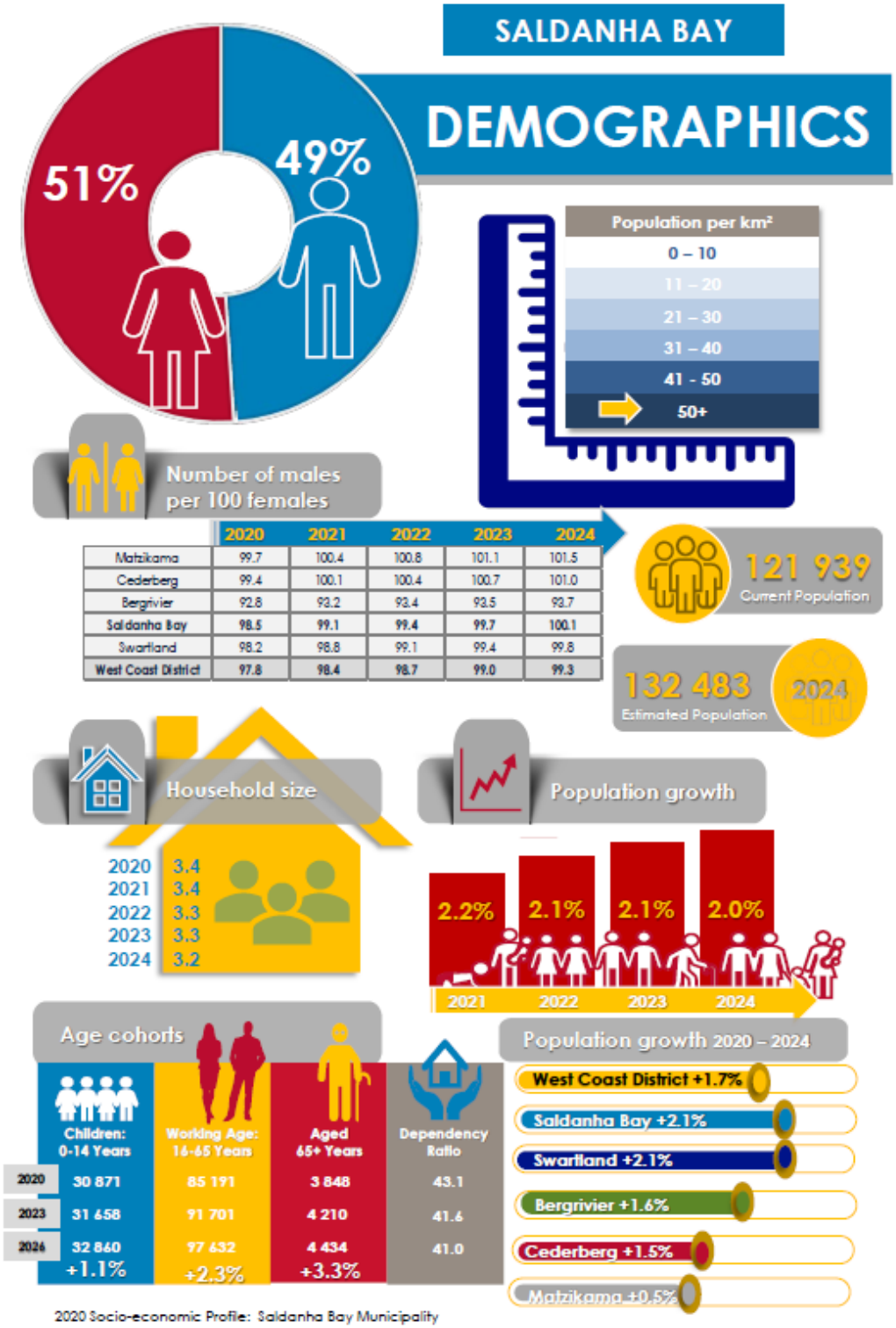

Figure 2 - 2020 Socio Economic Profile (SBM IDP)

1.2. Overview of towns

The area of SBM includes a number of large rural areas, as well as the following towns:

1.2.1. St Helena Bay

St. Helena Bay is one of the world's principal fishing centres. The cold Benguela current surges upwards along this part of the coast and bring to the surface large concentrations of nutrient salt. Huge shoals of anchovies and pilchards (before they were depleted by overfishing) fed in the area on the plankton which flourished on the nutrient salts.

The Southern Right whales come annually from the Sub-Antarctic regions to calve and mate during the months of June to November. Humpback whales may be sighted during the months of October and November as these animals migrate south from their breeding grounds in tropical West Africa to their feeding grounds in the Antarctic. The bay is also popular for the dolphins; schools of over 1 000 have been sighted at times. The bay also hosts a variety of marine birds, penguins and large colonies of seals.

1.2.2. Jacobsbaai

Jacobsbaai is an isolated bay a few kilometres north of Saldanha Bay with a sea frontage of about 2 km. Its interesting coastline has peninsulas, rocky and sandy bays with cosy beaches and an abundance of seafood, crayfish, fish, mussels and abalone. The residential development at Jacobsbaai is taking place according to strict architectural guidelines in an effort to create a typical West Coast town character.

1.2.3. Paternoster

Life in Paternoster is still very much associated with the sea and fishing industry (Paternoster Fisheries). The town is a popular weekend destination for tourists from Cape Town and boast several rebound restaurants and bars.

1.2.4. Saldanha

Saldanha Bay is an important seaport and the prominent iron ore terminal and quay extends into the bay and regularly hosts foreign bulk cargo vessels docked to onload iron ore and other minerals transport to the ore terminal from the North Cape mines. The bay is home to a large variety of fishing vessels, a busy fishing harbour and several aquaculture industries. Saldanha Bay is the largest natural bay in South Africa. Its sheltered harbour plays an important part in the Sishen- Saldanha iron ore project. The flagship project, the Arcelor Mittal steel mill was however closed in 2020. The development of the Saldanha Bay Industrial Development Zone is progressing well and is expected to bring relief to the subdued economy of the region.

1.2.5. Hopefield

The town, 120 km north from Cape Town, is situated on the R45 and can be reached by either the West Coast R27 or N7 highways. Today the town serves the grain, dairy, meat, honey and “waterblommetjie” farmers of the area. It also boasts excellent education facilities and a modern retirement centre.

1.2.6. Vredenburg

Vredenburg is the largest administrative and commercial centre on the West Coast. In 1975, by government decree, Vredenburg and Saldanha were united as the Vredenburg-Saldanha Municipality.

1.2.7. Langebaan

Just over 100 kilometres from Cape Town, next to the scenic Langebaan Lagoon, lies the town of Langebaan, often described as the jewel of the West Coast. The town hosts various resorts including

the Langebaan Country Estate with its internationally recognized 18 hole golf course and Mykonos with its marina, casino, restaurants and conference facilities.

Langebaan lies directly adjacent to the 30 000 ha West Coast National Park, well known for its birding and autumn flower display, both attracting domestic and international tourists. The town has of late also become one of the preferred destinations for the wind and kite surfing fraternity, also drawing visitors from abroad, all contributing to the local economy.

1.3. Climate

The SBM area experiences a Mediterranean Climate with mild wet winters and warm dry summers. The monthly average air temperature and monthly rainfall distribution, monthly median rainfall and evaporation distribution for the Saldanha area (Schulze, 2009) is shown below. The long term (1950 – 2000) mean annual precipitation for the Saldanha area is 324 mm/a. The rainfall only exceeds evaporation in the winter months of May to June, during which groundwater recharge is expected to be most prevalent.

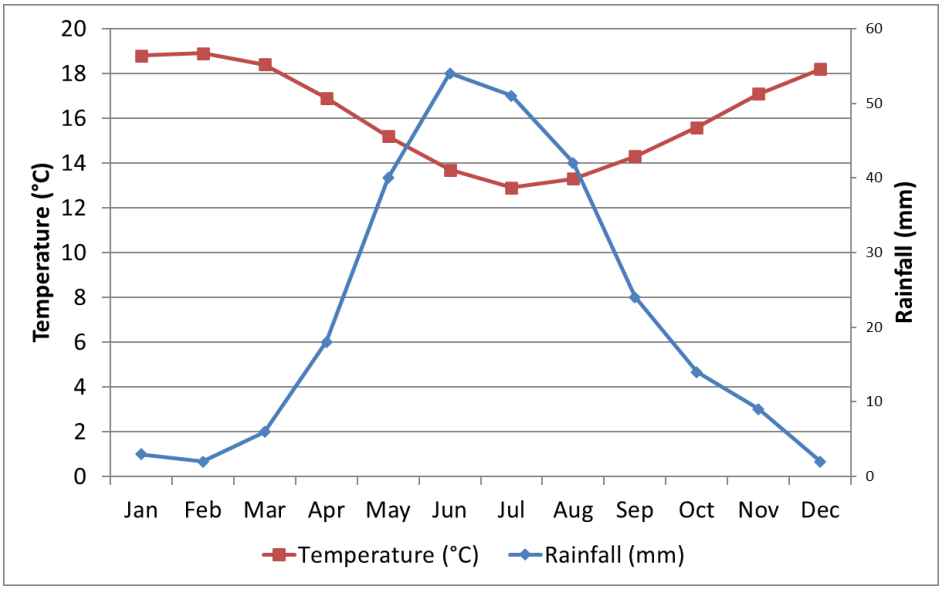

Figure 3 - Monthly average rainfall and temperature

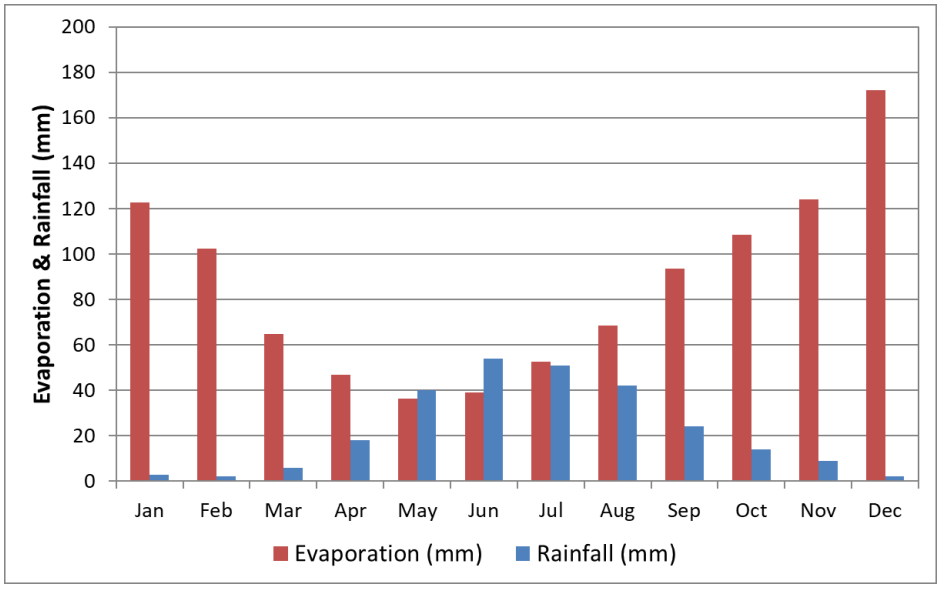

Figure 4 - Monthly median rainfall and evaporation

2. Status of Organic Waste in Saldanha Bay Municipality

2.1. Current sources of organic waste

Garden waste
Green organic waste such as garden refuse is produced from cleansing of residential erven and municipal open spaces. Applicable to all towns in SBM.

Organic household waste
Refuse removal is completed according to a weekly schedule for households, commercial properties and industries. Applicable to all towns in SBM.

Agricultural Waste
Agricultural wastes can be defined as the residues from the growing and first processing of raw agricultural products such as fruits, vegetables, meat, poultry, and crops. This includes natural (organic) and non-natural wastes produced from farming activities such as dairy farming, horticulture, seed growing, livestock breeding, grazing land, market gardens, nursery plots and forestry. Applicable to farming areas in SBM.

Aquaculture waste
Fishing factories (Sea Harvest) can be found at Saldanha Bay, Paternoster and St Helena Bay which produces waste such as heads, bones, skin and viscera. Extensive aquafarming of mussel and oysters is undertaken on some 30 farms in zones known as Small Bay, Big Bay and Outer Bay North in Saldanha Bay. Shell waste is generated from processing factories in Saldanha.
This sector is expected to grow significantly in the near future and the associated organic waste volumes also.

Other organic wastes
This category of waste would include abattoir wastes, condemned food etc.
This will be applicable to SBM where a large abattoir is located and local supermarkets disposal of condemned food.

Waste water sludge

The residue that accumulates in sewage treatment plants is called sludge (or biosolids). Sewage sludge is the solid, semisolid, or slurry residual material that is produced as a by-product of wastewater treatment processes.

This will be applicable as there are a number of Wastewater Treatment Works operated by SBM.

The following sources have been identified as producing significant quantities of organic wastes within the SBM area.

Organic Waste Type	Source	Current management
Food waste	In Municipal Collections	Direct to landfill. A pilot project for home composting is currently in progress.
Garden Waste	In Municipal Collections	Direct to landfill.
	Garden services and residents to drop offs.	Chipped at Vredenburg landfill and Langebaan Transfer Station and sold. Natgro purchase a portion for composting. Mixed or contaminated garden waste is sent to landfill.
Mussels, oysters, biofouling (aquaculture waste)	Mussel and oyster processing farms	Was transported to DNA composting in Malmesbury by Green Bin. Currently being disposed of at Vredenburg landfill until January 2022. Will go the Natgro compost facility from January 2022 onwards.
Condemned foodstuff	Collected by SBM from local supermarkets	Landfilled with social issues such as scavenging.
Wastewater sludges	Municipal wastewater treatment plant	Treated dry sludge is removed and used to rehabilitate agricultural land,
Abattoir	Cartol Abattoir	Self-compost and used for agriculture.
Fishing	Fish factories in Saldanha	All waste is treated to produce fishmeal and oil.

Table 2 - Organic Waste Sources

2.1.1. Waste Flow Chart of Solid Waste process and disposal at Saldanha Bay Municipality

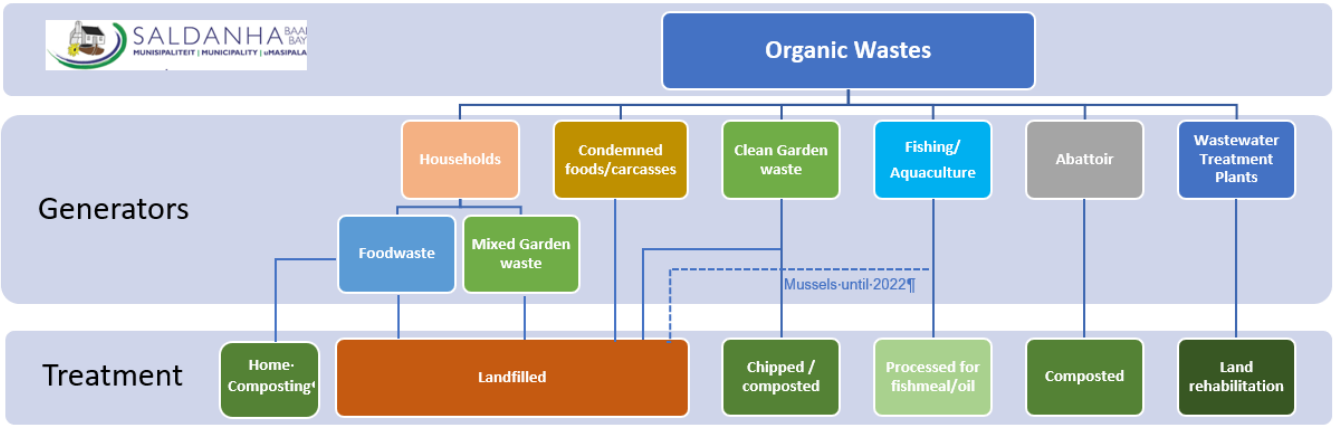

Table 3 - SBM Organic Waste Process Flow Chart

2.1.2. Current treatment processes

The majority of organic wastes that are treated in the SBM use chipping and composting as the principle process.

- Natgro Organics recently registered a compost facility adjacent to the Langebaan transfer station with DEAD&P in terms of the Norms and Standards. The facility buys in the order of 1 to 2 tons per week chipped garden waste, at present, with the capacity to increase to 50 tons per week. The facility also receives in the order of 10 tons/week of oyster and mussel shells which are crushed and processed for feedstock for chickens. The Natgro facility will receive all aquaculture waste going to landfill, from January 2022 onwards.
- DNA Composting in Malmesbury receives mussel waste from Green Bins, company contracted to collect and dispose of the mussel and oyster wastes, however a moratorium on disposal to landfill has been lifted until January 2022, by DEAD&P and all waste is currently going direct to Vredenburg landfill. Thereon these wastes will have to revert to composting or another acceptable method of treatment.
- Clean garden waste received from garden services and residents at the Vredenburg landfill and the Langebaan transfer station is chipped and sold to the public or used by Parks. At these facilities the diversion of garden waste for chipping was a relatively small percentage of the incoming garden waste, 2,5% in 2020, the remainder being landfilled, however the diversion rate has progressively increased since the beginning of 2021.
- Abattoir waste is composted on-site by the Cartol abattoir and used on their agricultural land as a soil enhancer. In the order of 7 – 8 tons per day is composted.
- Wastewater treatment sludges are dried, stockpiled at the various wastewater treatment works and removed by Kobus Lock Transport on an ad-hoc basis and used to rehabilitate agricultural land in the region degraded by mining past activities. Wastewater treatment sludges are tested annually in accordance with the Water Use Licence and have been classified as safe for agricultural application.
- Fisheries waste is fully processed for fishmeal and oil. The largest fishing concern in Saldanha reports that offcuts and trimmings from fresh fish processing are taken to Malmesbury daily and then cooked and mixed with other ingredients to create fishmeal. In 2020 some 175 tons were removed monthly. Waste from the added value processing of the fish product is removed weekly and is sterilized, cooked, and mixed with other ingredients to also create fishmeal. In 2020 in the order of 35 tons was removed monthly. Waste Canola Oil from the added value

processing is removed off-site monthly and used for the production of biofuel. In the order of 3.4 tons a month was removed in 2020. No organic wastes generated in the fish processing industry is taken to landfill.

- In 2019 the SBM introduced a pilot home composting project and have since then distributed 150 litre prefabricated composters to some 560 households in various towns within the Municipality. The responses to a recent survey of households using the composters was positive and is seen as having a long term potential for the diversion of household organic wastes.

It is understood that all treatment processes in place are compliant in accordance with National Norms and Standards where more than 10 tons a day is treated or processed.

2.2. Estimation of quantity of organic wastes generated within the SBM area

Data on waste generation, waste collections, disposal and treatment was obtained from the major generators of organic wastes in the SBM.

The SBM maintains a record of all wastes collected from households and commercial enterprises and disposed of at Vredenburg landfill either directly by collection vehicles or transferred from the satellite drops offs in the key towns. The records include:

- municipal waste generated — landfilled and diverted
- construction & demolition waste — landfilled and diverted
- garden waste — landfilled and diverted
- organic waste (mussels and oyster shells, condemned foods and animal carcasses) — landfilled

The records are summarised into monthly figures and were provided from January 2017.

The last category, organic waste fraction, was determined as being 49% of the total municipal waste collected, a percentage obtained from a waste characterisation study undertaken in 2016.

2.2.1. Waste characterisation

A waste characterisation study was completed in October 2021 and 897 households and commercial enterprises in the key towns in the SBM were sampled. Household organic wastes and garden waste were two of the categories sorted and weighed, from low, middle and high-income suburbs.

The results of the study pertaining to the organic waste fractions in household waste are presented in the table below.

	Food waste				**Garden waste**			
	L	M	H	C	L	M	H	C
Vredenburg	15.7%	18.1%	15.8%	11.4%	10.2%	14.8%	24.6%	2.8%
Saldanha	19.5%	16.8%	23.0%	1.6%	6.5%	19.7%	15.2%	3.5%
Jacobsbaai			16.1%				4.3%	
Langebaan	12.2%	23.1%	23.9%		11.2%	11.8%	12.1%	
Paternoster	10.2%	8.6%	36.2%		12.9%	7.3%	5.0%	
St Helena Bay	25.7%	19.3%	15.8%		6.6%	18.3%	11.0%	
Hopefield	21.5%	19.0%	7.9%		13.1%	12.6%	5.1%	
Total SBM	16.9%	18.3%	18.9%	6.3%	9.4%	16.5%	11.5%	3.2%

Note: Total SBM are the results of all seven towns combined for each income group.

Table 4 - Results of 2021 Waste Characterisation Study for Food waste and Garden waste

The percentages of food waste and garden waste found in household waste for each town is shown graphically below.

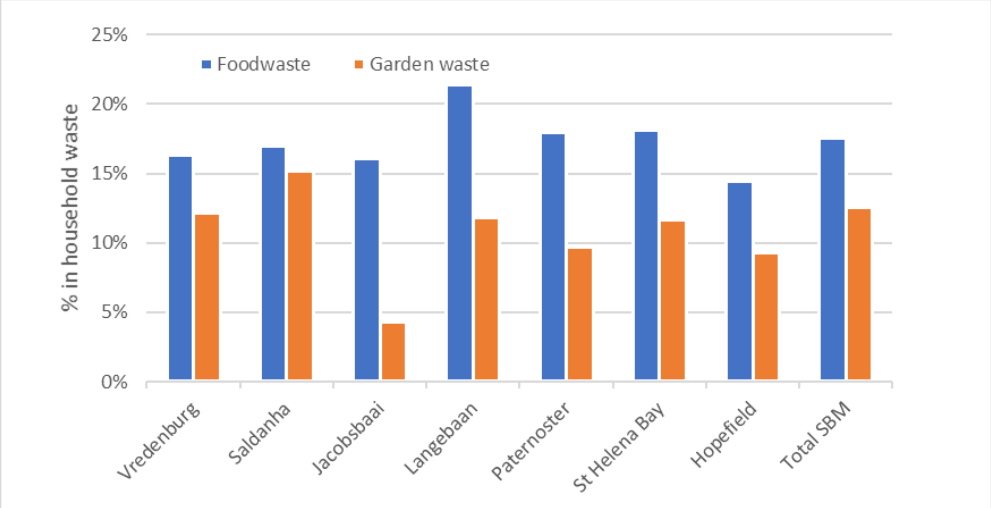

Figure 5 - Percentage of food waste and garden waste for each town in SBM

The percentage of food waste in the total household and commercial waste collected in SBM and landfilled is calculated to be in the order of 18% and for garden waste 13%. Thus the percentage of total organics in household waste collections is in the order of 31%, which is some 18% less than previously determined, 49% in 2016, which would indicate a significant reduction in organics being disposed of to landfill.

Based on an average monthly household collection of 3,073 tons, some 540 tons and 385 tons for food waste and garden waste respectively, is being generated in the SBM monthly. It should be noted that clean garden waste which is taken to landfill directly by residents and contractors is recorded separately in the SBM's data.

The study sampled commercial enterprises in Vredenburg and Saldanha and the results indicated that food wastes and garden waste were 6.3% and 3.2% respectively of weight of commercial waste sampled and combined was about 1.3% of all organic wastes captured in the characterisation study.

It should be noted that the SBM also collects condemned food from supermarkets separately and this is recorded as Organic Waste in the collection records. Data for the last year indicates a monthly average of 12 tons is recorded at the landfill.

2.2.2. Organic waste generation quantities and diversion

The estimated quantity of organic waste generated within the SBM area is presented in the table below as well as the current quantities diverted from landfill.

	Landfilled (tonnes)	Diverted (tonnes)	Total (tonnes)
Food waste in collections	540		540
Garden waste in collections	385		385
Clean garden waste	608	126	734
Animal carcasses / condemned food	13		13
Aquaculture/ fishing	20	326	346
Abattoir		165	165
Wastewater Treatment Sludge		458	458
Tons/month	**1566**	**1075**	**2641**
	59.3%	**40.7%**	

Table 5 - Monthly organic waste generated (Dec 20/Nov21)

The above table is the average for the last 12 months from December 2020 to November 2021 and includes for the disposal of mussel and oyster shells to landfill as allowed for by DEAD&P up until January 2022.

In addition, the Clean Garden waste portion diverted to landfill has decreased substantially since April 2021 as it was being incorrectly classified with other materials and is now in the order of 325 tons/month. There has also been an increase in the diversion of clean garden waste, and it is SBM's approach to continue increasing the diversion rate of garden waste.

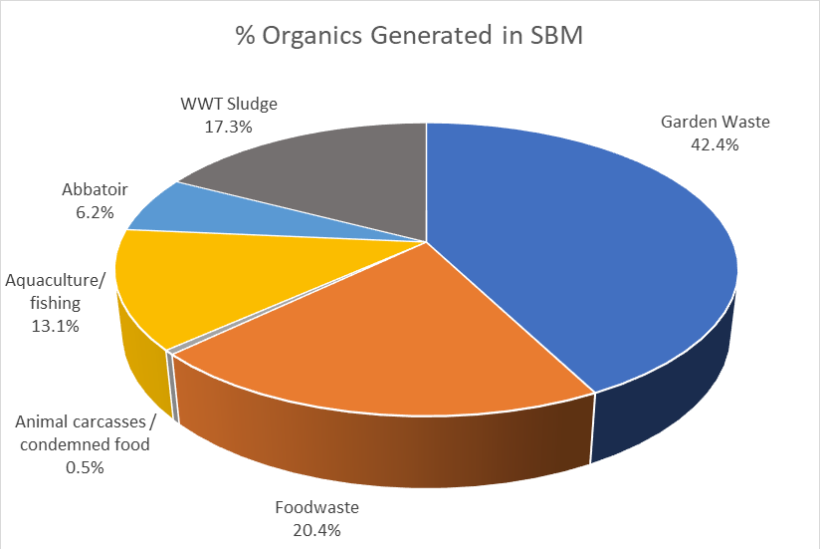

Figure 6 - Breakdown of organic waste generated in SBM (2021)

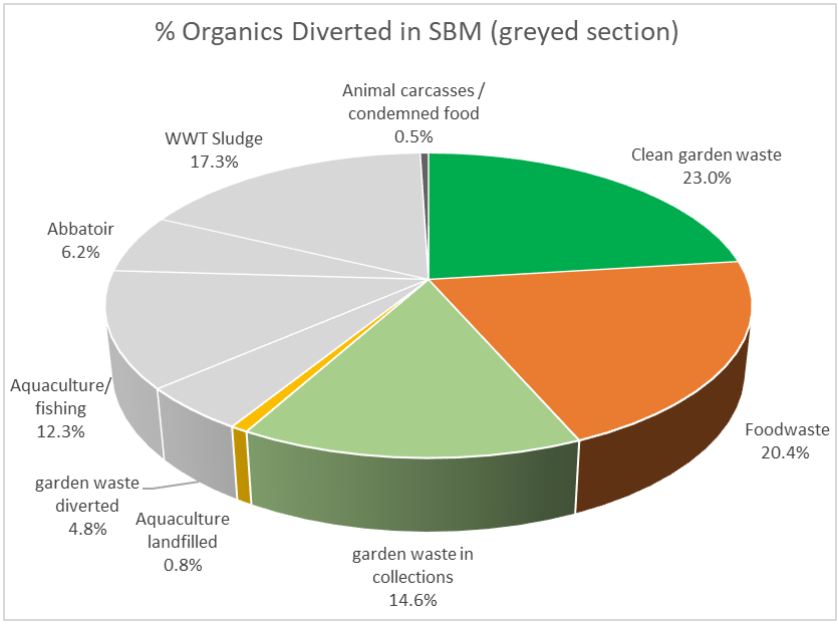

Figure 7 - Current diversion rates based on year-to-date data (2021)

(Grey hatch indicates diverted wastes)

The graph above indicates that 40.7% of organics generated in SBM are currently being diverted from landfill based on the average year-to-date data.

The table below gives an indication of a more likely scenario for the organic diversion rate when the moratorium of landfilling of mussels and oyster shells is reinstated in 2022 and the correction to the incoming clean garden waste quantity, which came into effect in April 2021, is taken into account. The data is from April 2021 to November 2021.

Category	Total (tons/m)	Landfilled	Diverted	% Landfilled	% Diversion
Food waste in collections	556	556	-	100%	0%
Garden waste in collections	397	397	-	100%	0%
Clean garden waste	468	325	143	69%	31%
Animal carcasses / condemned food	12	12	-	100%	0%
Aquaculture/ fishing	346		346	0%	100%
Abattoir	165	-	165	0%	100%
Wastewater Treatment Sludge	458	-	458	0%	100%
Total (tons/month)	**2,402**	**1,290**	**1,112**	**53.7%**	**46.3%**

Table 6 - Estimated monthly generation and diversion of organic wastes in 2022

Thus the estimated organic waste diversion rate in the SBM will be in the order of 46%. Food waste in the household collection is in the order of 23% of the total organic waste generated and garden waste to landfill is some 30%.

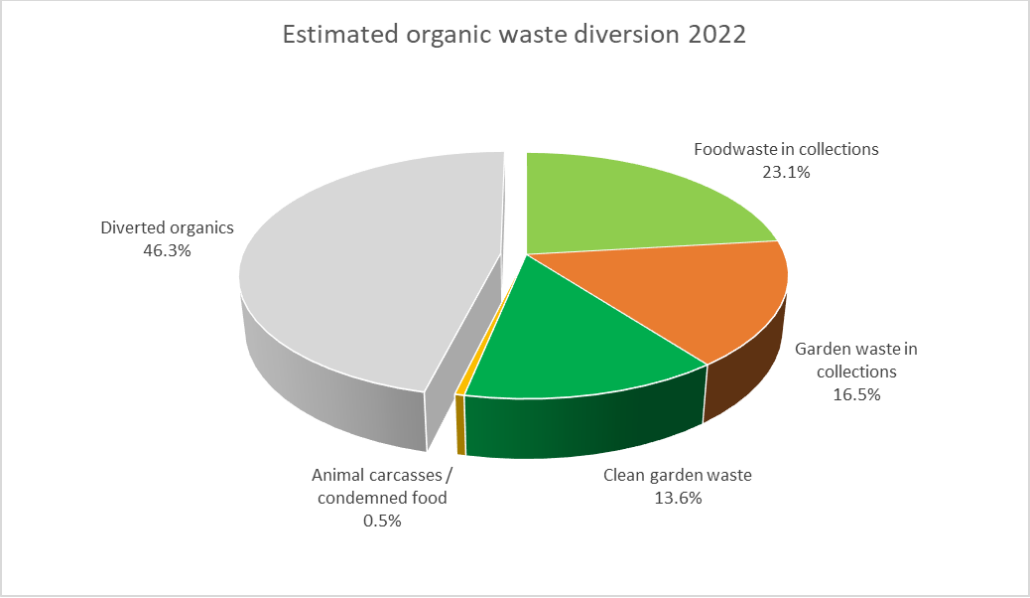

Figure 8 - Estimated organic waste diversion in 2022 in SBM

The diverted portion of 46.3% includes fishing waste, mussel/oyster shells, abattoir wastes, chipped clean garden waste and wastewater treatment dry sludges.

2.2.3. Organic waste growth

An estimate for the growth of organic wastes in the SBM has been calculated based on the annual population growth of 2,1% proposed in the IDP. This growth rate is simply applied to the food wastes green waste and animal carcasses / condemned food waste components. The table over indicates the annual estimated quantities up until 2040.

	2021	2025	2030	2035	2040
Food waste in collections	6,672	7,250	8,044	8,925	9,903
Garden waste in collections	4,764	5,177	5,744	6,373	7,071
Clean garden waste	3,900	4,238	4,702	5,217	5,788
Animal carcasses / condemned food	144	156	174	193	214
Total annual tonnage	**15,480**	**16,822**	**18,664**	**20,708**	**22,975**

Table 7 - Estimation of annual tonnages of municipal organic waste generated between 2021 and 2040

2.2.4. Sewage sludges

The Sewage Sludge Status Quo Report 2020/21 of the Western Cape Government investigated the current management practices as well as identifying the challenges and opportunities that exist at municipalities with regards to sewage sludge management. The study received data on sludge management from all the municipalities within the Western Cape and the information on SBM is tabled below.

Municipality	Name of WWT Works	Effluent sources
Saldanha Bay	Langebaan	Residential
	Saldanha	Residential/Industrial
	Vredenburg	Residential/Industrial
	Laingville	Residential
	Shelly Point	Residential
	Paternoster	Residential
	Hopefield	Residential

Table 8 - SBM Wastewater treatment plants producing sludges (source PGWC)

The data received from SBM for this plan indicates that some 5,490 tonnes of dry sludge was produced in 2020 from the 7 wastewater treatment works and has been relatively consistent over the last 5 years as shown in the table below. The SBM has confirmed that no sludge is going to landfill and that currently it was being taken by the agriculture sector as soil enhancers. Sludges are tested annually in accordance with the Water Use Licence and are classified as safe for agricultural application. The majority of the sludge is being collected by Kobus Locks Transport and it was confirmed by them that they were using the sludge to reclaim degraded land from mining activities, and they see a long-term need for the sludge.

	2016	2017	2018	2019	2020
Langebaan WWTW	1,059	1,042	933	1,017	1,044
Saldanha WWTW	1,301	1,409	2,316	1,157	2,243
Vredenburg WWTW	1,964	1,698	1,523	1,513	1,135
Hopefield WWTW	201	205	167	208	195
Paternoster WWTW	151	150	115	148	155
Laingville WWTW	682	640	516	667	648
Shelly Point WWTW	83	76	63	69	71
Total dried sludge(tons)	**5,442**	**5,221**	**5,633**	**4,778**	**5,491**

Table 9 - Dried sludge tonnages generated at the WWTW's in SBM

Although currently the sludges produced in SBM are being diverted for the foreseeable future there will need to be a backup plan for an alternative arrangement should sludge stockpiling become a problem.

2.3. Gap and Needs Analysis

The aim of the gap and needs assessment is to identify shortcomings in the current organic waste diversion practices in the SBM and the needs are the first step in the identification of actions to address the gaps.

Item no	Current status	Desired status	Gaps	Actions required
1	Pilot project for the separation at source of organic waste from households	All households have composting bins and are only placing non-organics in their refuse bins. Potentially 23% of organic wastes generated in SBM	Assessment and further development of the program and awareness campaign, including multi-residential blocks.requirements.	Develop a long-term plan and continue rolling out the supply of composting bins and monitoring the results
2	Businesses are not separating their organics waste from dry waste and their waste is disposed directly to landfill	All businesses are separating their organics and ensuring that it is beneficiated	The need for a system of incentives/ disincentives to encourage businesses to separate their organic waste at source and take responsibility to beneficiate it	Develop incentive and disincentives for businesses to separate their organics and beneficiate it Communication plan to make businesses aware of scheme
3	Some 17% of clean garden waste diverted from landfill is chipped at Vredenburg and Langebaan and sold on	All clean garden waste is diverted to chipping and sold on for use as mulch or composting. Potentially 14% of organic wastes generated in SBM	Need for additional equipment and for better separation at drop-offs/mini transfer stations.	Continue increasing the amount of clean garden waste chipped at the landfill and transfer station. Review option to chip at the mini-transfer stations where feasible
4	The infrastructure for composting of organic wastes is owned and operated by private businesses but is unlikely to be adequate for a significant increase in diversion	Sufficient processing facilities conveniently located for access by the public to dispose of garden wastes	Need to identify potential sites and private contractors desire to receive and process garden waste and other organics	Develop a plan to increase organic processing facilities within the SBM with PPP potential
5	Condemned foods from supermarkets are currently collected by the SBM and disposed to landfill causing social and health issues with scavenging	Condemned foods are diverted from landfill and correctly treated	Although the quantities are relatively small there are no facilities that can receive condemned food	Develop an incentive for producers of condemned food to retain responsibility for the safe treatment of wastes. Review existing composting facilities and their capacity to accept condemned food wastes

Table 10 - Gap and Needs Analysis

Generally, the SBM and the major industry generators have been very pro-active in developing and implementing organic waste diversion systems with the diversion of green waste from landfill, diversion of wastewater sludges to land rehabilitation, diversion of fish product waste to feedstock and oils and abattoir waste to composting.

The SBM and its local industries should be encouraged to continue increasing the diversion rate of organic wastes. However it must be noted that funding for organic waste diversion will compete with all other municipal basic services and is not necessarily seen as a priority and some wastes become increasingly difficult to treat without a **significant financial impact**.

3. Legislative overview

There is key legislation in South Africa which governs recycling and waste minimisation as well as a number of national and provincial strategies which should be considered in the development of an organic waste diversion plan.

3.1. National Environmental Management Act (No. 107 of 1998)

The NEMA provides for co-operative environmental governance by establishing principles for decision making on matters affecting the environment, institutions that will promote co -operative governance and procedures for co-ordinating environmental functions exercised by organs of state; and to provide for matters connected therewith.

> In chapter 1 (National Environmental Management Principles) in the National Environmental Management Act 108 of 1998 the following should be adhered to: Principles;
>
> "(i) That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and
>
> remedied".
>
> "(iv) that waste should be avoided altogether, should be minimised, reused or recycled wherever possible."
>
> In chapter 7 (Compliance, enforcement and protection) in the National Environmental Management Act 108 of 1998 the following should be adhered to: Duty of care and remediation of environmental damage;
>
> "(1) Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing, or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment."

3.2. The National Environmental Management: Waste Act, No. 59 of 2008 (NEM:WA) and the National Environmental Management: Waste Amendment: Waste Amendment Act of 2014 .

The two acts mentioned above stipulates controls for the management and recording of waste, including the issuing of licences.

In chapter 3 (Institutional and planning matters) in the National Environmental: Waste Act, No. 59 of 2008 the following should be adhered to: Certain organs of state to prepare integrated waste management plans.

> "4) (a) Each municipality must—
>
> (i) submit its integrated waste management plan to the MEC for approval: and
>
> (ii) include the approved integrated waste management plan in its integrated development plan contemplated in Chapter 5 of the Municipal Systems Act."
>
> In the amendment of section 11 of Act 59 of 2008 –
>
> "(1) The [Department and the] provincial departments responsible for waste management must prepare integrated waste management plans.
>
> (i) submit its integrated waste management plan to the MEC for endorsement; and

(ii) include the endorsed integrated waste management plan in its integrated development plan contemplated in Chapter 5 of the Municipal Systems Act."

3.3. The National Waste Management Strategy (2020)

The goals and targets of the 2020 National Waste Management Strategy (NWMS) related to recycling and waste minimisation are provided below. The NWMS clearly shows the intention of DFFE to prioritise diversion of waste from landfill sites and increasing the beneficiation of waste through recycling, organic waste beneficiation (mainly composting).

The NWMS places the responsibility on the Municipality (with National and Provincial support in certain cases) to educate, provide vessels (bins), collect, process and dispose (composting facility) of organic waste. Municipalities must make provision in their IWMP or waste management strategy to manage green waste when generated in large quantities.

The NWMS is structured around a framework of three pillars each with their respective goals. The goals along with their respective targets are to be achieved by dates (year) indicated in the NWMS. These are indicated in the table below and will guide the implementation of target projects as detailed in the implementation plan for the WMP. The 2020 NWMS has three strategic pillars to improve the waste management in South Africa:

- Waste minimisation
- Effective and sustainable waste services
- Compliance, enforcement and awareness.

The goal is to prevent waste, and where waste cannot be prevented, divert 40% of waste from landfill within 5 years; 55% within 10 years; and at least 70% of waste within 15 years leading to Zero-Waste going to landfill through reuse, recycling, and recovery and alternative waste treatment.

3.4. The National Waste Information Regulations (13 August 2012, GNR 625, 2012)

Section 5 (1) & (2) deals with the registration of people on the South African Waste Information System ("SAWIS") Section 8 deals with the reporting or submission of information. Annexure 1: List of persons conducting the following activities must register on the SAWI/IPWIS in terms of regulation 5:

- Recovery or recycling of waste (b), (c), (e)
- Treatment of waste (g)

Annexure 2: Reporting requirements in terms of regulation 8 (1) Annexure 3: General Waste types for reporting to the SAWIS, requires the reporting of garden waste as follows:

- Level 1 General Waste types (GW)
- Level 2 Major Waste Type: Organic GW20
- Level 3 Specific Waste Type: Garden Waste (01). Garden Waste must be reported under GW2001

3.5. National Norms and Standards for the disposal of Waste to Landfill (23 August 2013, GG No. 36784 GN No. 636)

Waste is evaluated in terms of the Norms and standards for the Assessment of Waste for Landfill Disposal set in terms of Section 7(1) of the NEM: WA. Waste Disposal Restriction provides prohibitions and restrictions on the disposal of waste to landfill and accompanying compliance timeframe.

Section 5 (1) (q) the regulations states waste which has an angle of repose of less than 5 degrees or waste with a moisture content of less than 40% has been enforced by August 2019 which forces food waste diversion from landfill due to leachate production, (t) 25% diversion of separated garden waste must take effect within 5 years, and 50% diversion within 10 years i.e. from 2018 to 2023. and (u) indicates that infectious animal carcasses and animal waste are prohibited and/or restricted from landfills with immediate effect, implying that treatment is needed before disposal at Class B sites.

3.6. Regulations regarding Fertilizer (GN N0. 250, 23 March 2007)

In the regulation regarding fertilizer, it gives the requirements for the registrations of fertilizers in South Africa and the general requirements for fertilizers (including compost, municipal compost, sewage sludge, etc.)

3.7. The National Organic Waste Composting Strategy: Final strategy report April 2013

This strategy assists in providing a direction and clear, structured planning towards a common goal viz. to ensure (where viable) that organic waste generated within South Africa is diverted from landfill sites.

3.8. NEM: WA National Norms and Standards for Organic Waste Composting

Provides a uniform approach relating to controlling the composting of organic waste at a facility that falls within the required threshold.

The norms and standards are applicable to the following activities:

- Recycling of organic waste at a facility that has an operational area in excess of 500m^2
- Recovery of organic waste including the refining, utilisation or co-processing of organic waste in excess of 10 tons but less than 100 tonnes per day
- Construction and operation of any organic waste facility that has the capacity to process in excess of 10 tonnes but less than 100 tonnes of organic waste material per day
- Construction of any organic waste facility where the capacity of the facility is able to process in excess of 10 tonnes but less than 100 tonnes per day
- Construction and operation of any organic waste facility processing animal matter not intended for human consumption for installations handling in excess of 1 ton of raw material per day
- Construction and operation of any organic waste facility used applied heat (thermal treatment) in the treatment of general waste exceeding 10kg per day.

The Norms and Standards provide guidance acceptable treatment options for different types of organic waste. An organic waste treatment facility needs to be registered with the licensing authority 90 days before the commencement of construction. The design requirement for a facility are specified in the Norms and Standards.

3.9. National Norms and Standards for the Sorting, Shredding, grinding, Crushing, Screening, or baling of General Waste (NO. 243 of 2017)

The purpose of the norms and standards is to provide a uniform national approach relating to the management of facilities that sort, shred, grind, crush, screen, or bale general waste.

3.10. Western Cape Provincial Organic Waste Strategy

The Western Cape Waste Provincial Organic Waste Strategy was released by DEA&DP in March 2020. The strategy was developed as a guideline for the development of organic waste diversion from landfill and implementation of initiatives for the reuse or recovery of this organic waste. The focus of the Strategy is to comply with national legislation, limit greenhouse gas emissions and its negative impact on the climate and ensure organic waste diversion from landfills (Western Cape Government Department of Environmental Affairs and Development Planning, 2020). The strategy also identifies the mechanisms to ensure the organic waste is available as a resource, the development of the infrastructure for the recovery of the organic waste and strategies to support the uptake and beneficiation of this resource.

The strategy emphasises that good information management and public awareness buy-in are two critical elements to ensure the success of the interventions detailed in the strategy as many of the identified initiatives require the separation, diversion or the reuse (e.g. composting) of organic waste at source. The strategy also emphasises the importance of collaborations between local governments, the

private sector and other agencies to work towards a fully integrated system to ensure the diversion and recovery of organic waste generated in the Western Cape.

3.11. DEA&DP Guideline: Developing a Generic Organic Waste Diversion Plan

In order to assist local municipalities to meet national and provincial organic waste diversion targets DEA&DP has developed a guideline for the development of an organic waste diversion plan.

The guideline identifies five steps to the development and implementation of an organic waste diversion plan

- Know the status of organic waste in your municipality
- Review legislation and provincial strategic documents
- Design your system and resource requirements
- Get traction
- Implementation

This OWMP for Saldanha Bay Municipality has been developed in line with this guideline.

Organic waste diversion plans are a license condition for all the waste management licenses for landfill sites in the Western Cape.

3.12. Saldanha Bay Municipality Integrated Waste Management By-Law

The SBM has developed an IWM By-Law in line with the Provincial model which empowers it to implement effective waste minimisation strategies like the diversion of organic waste.

Clause 18. Composting

The owner or occupier of premises on which garden waste is generated may compost garden waste on the property, provided that such composting does not cause a nuisance nor has a detrimental impact on human and environmental health.

Clause 19. Removal and disposal of garden waste

(1) The owner or occupier of premises on which garden waste is generated must remove and dispose of it within a reasonable time after generation of the waste at a waste handling or waste disposal facility determined by the municipality.

(2) At the request of the owner or occupier of any premises, the municipality may remove garden waste from premises subject to the payment of the charge and the conditions determined by the municipality.

(3) Garden waste must be separated from other waste types before disposal.

Part 8 Agricultural and Farm Waste

31. Disposal

(1) An owner or occupier of farmland may subject to subsections (2) and (3) use on-site disposal of waste but burning of waste is strictly prohibited unless authorised by the Chief Fire Officer in terms of the Fire Safety By-law of the authority responsible for the function at the time.

(3) An owner or occupier of farmland may dispose of general waste, which may include agricultural and farm waste, to the land provided this is done in accordance with applicable legislation, national standards and SANS Codes and, if the quantity of waste requires it, authorisation thereof by a valid waste management license.

4. Organic waste treatment options

4.1. Treatment requirements

The need for alternative waste treatment options such as anaerobic digestion and composting is becoming increasingly important as landfill airspace becomes scarcer and diversion of organic wastes from landfill is now mandatory.

The Provincial Organic Waste Strategy 2020 (POWS) notes that there are challenges for the establishment of any treatment facility ranging from environmental authorizations, permitting, licencing and social issues. In addition the **capital expenditure and maintenance costs** of technologies for treating waste are high and landfill still remains the most affordable option. Furthermore the resources to ensure quality of feedstock as well as a sustainable supply of materials limits the treatment options for organic wastes.

The POWS has developed a food waste management hierarchy which requires certain interventions for effective implementation and includes[1];

- Waste prevention by better management of produce on-site such as cold storage to prolong lifespan of edible produce; donating edible food to food banks etc.
- Repurposing and recycling methods for animal feed or can also be used for composting.
- Effective separation at source methods and distribution networks i.e. collection, storage and transport etc.
- Waste minimization (reducing waste, reusing, sorting and recycling)
- Transport and Transfer (e.g. food distribution)

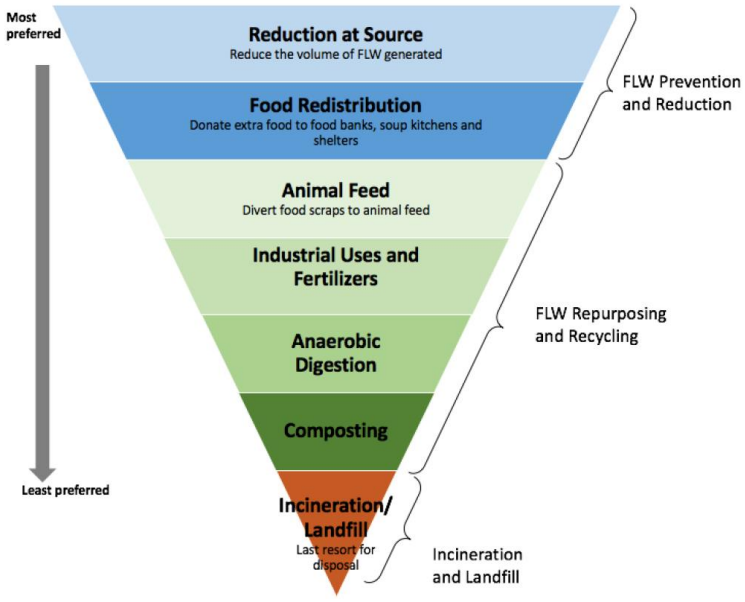

Figure 9 - Hierarchy diagram for managing of food waste

The POWS further states that chipping, mulching and processing at composting facilities is currently the treatment option of choice in the Western Cape. Anaerobic digestion is a possible option for treating organic waste; however organic material generated within the municipality is unlikely to be of sufficient quantity to make a project viable, unless considered at a regional scale.

Apart from the quantity, other aspects also need to be considered for the treatment of organic waste, such as transporting of the waste, space constraints at facilities as well as the quality of the waste

[1] Summarised from POWS

received. These facilities need to be more strategically placed to ensure that they are in proximity to the waste source.

Although there are a number of challenges, these have been relaxed to a certain extent with the promulgation of the Norms and Standards for Organic Waste Composting, which allows for the construction and operation of a facility up to 100 tons/day without requiring a Waste Management Licence (WML). The purpose of these norms and standards is to provide a “best practice” approach to the composting of organics that prevents / minimises negative impacts on the bio-physical, social and economy environment.

The Norms and Standards do not apply to;

- Any infectious animal waste or mortalities classified as hazardous;
- Raw sewage
- Sewage sludge that does not meet the minimum quality standards for sludge as determined by the National Water Act: National Norms and Standards for Domestic Water and Sanitation Services of September 2017

4.2. Overview of Composting Process

Composting is one of several methods for treating green organics to create a marketable end product that is easy to handle, store, and use. The end product is usually a humus-like material without detectable levels of pathogens that can be applied as a soil conditioner and fertilizer to gardens, food and feed crops. This compost provides large quantities of organic matter and nutrients (such as nitrogen and potassium) to the soil, improves soil texture, and elevates soil cation exchange capacity (an indication of the soil’s ability to hold nutrients), all characteristics of a good organic fertilizer.

Aerobic composting is a biological process in which aerobic microorganisms use oxygen in the breakdown of organic materials to form a stabilized material known as compost. The two main phases of composting are the initial high-rate phase, during which biological activity is at its highest, and the low-rate curing/finishing phase, when biological activity is lower.

The two main methods of composting, windrow and in-vessel differ primarily in whether the high-rate phase of composting is contained inside a vessel (or building) or not. Each method presents unique advantages and disadvantages, which generally translate to different siting implications and requirements.

Windrowing is a proven technology in the composting industry and compost of a high quality is now being produced from the process. It is well suited to relatively dry wastes such as green waste. It does have limitations though and high moisture content wastes such as food wastes can lead to smells that are hard to control in an open windrow.

The most appropriate composting system has to be selected based on its technological feasibility, economic costs, and social and environmental impacts.

4.2.1. Process Methods

There are a number of technologically mature methods for the biological treatment of organics available which are appropriate for the processing of green wastes.

4.2.1.1. Static pile

This is a simple stacked pile of organic waste in which biological breakdown occurs. The air incorporated into the pile when it is constructed determines the rate at which initial breakdown and temperature rise occurs. Breakdown occurs slowly and at low temperatures compared with other systems and the surface layer of the pile tends to dry and acts as an insulating layer.

This is a very basic low cost method, but there is very little control over temperature and in turn odours and therefore is not considered appropriate for a medium to large scale facility.

4.2.1.2. Windrow (uncovered)

This is probably the most common type of system in use in South Africa and internationally for green waste. The green waste is pre-processed with chipping and sorting prior to being placed in windrows where microbial activity causes the temperature of the mixture to rise during the “active composting” period. The windrows are regularly turned, mixing the waste, to ensure adequate porosity and natural convection within the pile. The system lends itself to mechanisation and in a typical operation the windrow is formed in a line with new material added at one end and final composted material taken out at the other end. The turning and mixing operation is undertaken at least on a weekly basis but may be undertaken more frequently. Such turning is used to progress waste down the windrow. Open windrows can dry out and the addition of water to maintain a balanced moisture content is required, sometimes using recirculated leachate. After active composting, the material is cured and then prepared for distribution.

Being uncovered the system may be influenced by weather condition. Excessive rain or very long periods of low temperatures may slow down the process but is unlikely to stop the composting process.

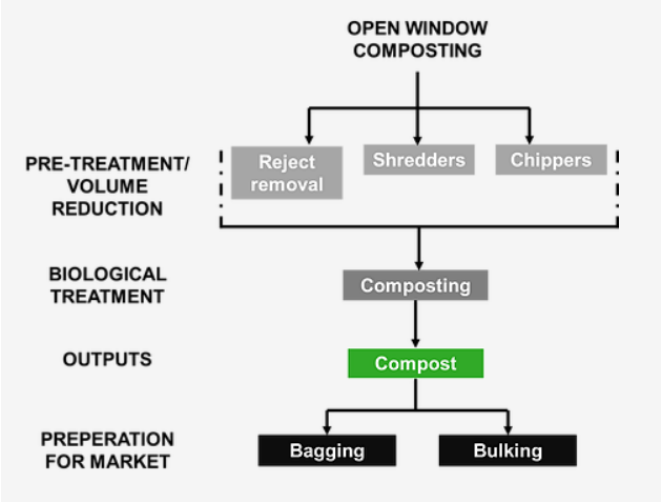

Figure 10 - Process flow chart for open windrow composting

(source DFFE AWT Guide website)

4.2.1.3. Aerated Static Windrows

This system is a variation of the windrow method and is also known as “forced-air aeration” system. Air is blown into the windrow from beneath or drawn through the pile by a vacuum. A feature of the suction mode of forced aeration is the ability to pass the exiting air through an emission treatment device. Such a device could be a biological filter consisting of a mass of stable organic matter. In the absence of an excessively high moisture content, aerobic conditions can be maintained at a satisfactory level in a static windrow. Because of its dependence upon several variable factors, the specific requisite rate of air input for a particular operation needs to be determined experimentally.

4.2.1.4. Enclosed Composting

Controlled atmosphere and moisture conditions are used in these technologies to improve the rate of organic waste decomposition and to control odours. The technologies introduce the use of drums, boxes, tunnels, silos or vessels into the process. System controls provide for input of potentially odorous waste including food, sewage sludge and garden wastes, to produce good quality compost. The use of slowly rotating drums provides aeration and odour containment. In-vessel treatment may require from 1 to 12 days after which open windrowing, generally in a containment building to control odours, completes the composting process over some 6 to 12 weeks, with turning of windrows every few weeks.

4.2.1.5. Windrow Composting vs Enclosed Composting

A comparison of the two methods was presented in the Department of Environmental Affairs National Organic Waste Composting Strategy – Status Quo Report of November 2012 and the salient points are tabled below.

	Windrow composting	Enclosed composting
Description	A "windrow" is an elongated compost pile, designed to allow for better air flow. Materials need to be physically turned in order to introduce air into the process. Turning can be manual, i.e. spades, or with the use of a compost 'turning' machine.	"In-vessel" composting: Involves composting in enclosed structures or containers. Being enclosed, these systems offer a high level of odour, nuisance, pest, and leachate control. Exhaust air from these systems is typically treated in a biofilter.
Level of Technology	Low	High
Output product	Compost, soil conditioner	High-quality & high-demand Compost, soil conditioner.
Advantages	1. moderate cost; 2. labour intensive; 3. ability to use a front-end loader and other generic types of equipment; and 4. generally satisfactory quality and marketability of the final product.	1. provides containment which offers a high level of odour, nuisance, pest, and leachate control. 2. their turnkey nature i.e. a complete set-up that is ready for immediate use
Disadvantages	1. More difficult to achieve consistent results; and 2. Potential for odours.	1. cost. 2. the compost they produce may require additional curing which means additional space
Space	Can be space intensive	Very space efficient
Capital costs	Low, depending on any structural requirements	High
O&M costs	Low	High
Skill required for operation	Generally more labour intensive per cubic metre of compost produced. Skilled personnel depending on size of operation.	Extensive and specific, certain systems become automated
Management	Could be simply operated and managed by a municipality	Predominantly private sector technology and skill

Source National Organic Waste Composting Strategy: Status Quo Report, Department of Environmental Affairs.

Table 11 - Windrow composting comparison with enclosed composting

4.3. Overview of Anaerobic digestion (AD)

Anaerobic digestion is a biological process in which microorganisms break down biodegradable material through a series of processes in the absence of oxygen.

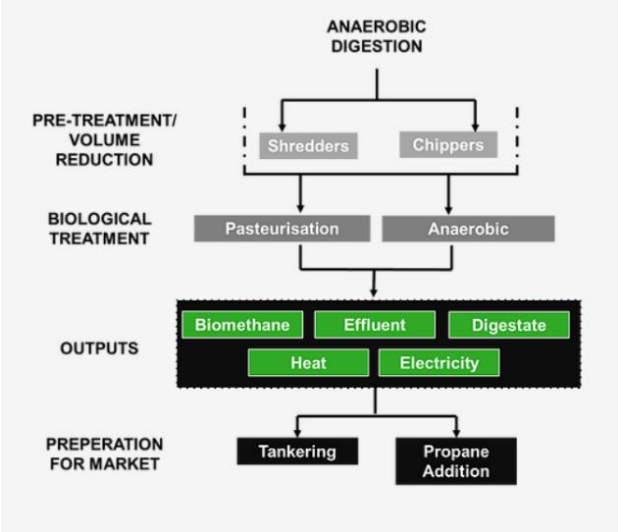

Figure 11 - Process flow chart

(source DFFE AWT Guide website)

Waste streams accepted	Putrescible / organic waste, garden / food waste collections, slurries, energy crops
Input capacity ranges	5,000-150,000 tonnes per annum
Typical outputs	Biomethane, heat and electricity, nutrient rich digestate
Purposes	Recover biodegradable waste into a digestate for land application / soil improvement and recover energy as either gas or heat and power
Indicative operational cost	High
Life span	20-30 years
Skills requirements	High
Job creation opportunity	Low

Table 12 - Overview of anaerobic digestion (source, DFFE AWT Guide website)

Advantages:	Disadvantages:
• AD has potential for treating a variety of organic waste streams	• Requires on-going management and monitoring
• Greenhouse gas and harmful gases are prevented	• Health and safety issues can arise at AD plants
• AD has the potential for energy production	• Significant odour issues
	• Quality is often insufficient for the digestate to be used as soil enhancer

Table 13 - Advantages and disadvantages of Anaerobic Digestion

The DFFE guide indicates that an annual quantity in excess of 190,000 tonnes would be required to ensure the viability of an AD system. The total quantity of organic wastes generated in SBM is in the order of 28,810 tonnes per annum (refer **section 2.2.2 Table 6** for monthly quantity), including sewage sludge, abattoir waste and aquaculture/fishing wastes, which account for some 11,600 tons and are already diverted from landfill. would put the viability of this treatment technology in doubt for SBM. In addition the cost of the technology is roughly two times more than windrow composting.

Even at a regional scale, proving an AD system to be viable may be difficult, with SBM providing some 30% of households within the West Coast District Municipality.

4.4. Overview of Vermicomposting

According to a study published by the WWF in 2017, approximately a third of all food produced in South Africa is never consumed and ends up in the waste stream. This relates to approximately 10 million tonnes of organic waste per annum from the food sector alone. It is estimated that some 5,000 tonnes is generated annually in the SBM area.

To this extent alternative methods to composting have emerged, with vermicomposting increasingly being adopted worldwide by businesses, institutions, farms, and municipalities for managing organic waste.

Vermicomposting is a process that relies on earthworms and microorganisms to help stabilise active organic materials and convert them to a valuable soil amendment and source of plant nutrients. Earthworms will consume most organic materials, including food preparation residuals and leftovers, scrap paper, animal manure, agricultural crop residues, organic by-products from industries, and yard trimmings. Vermicompost, apart from supplying nutrients and growth-enhancing hormones to plants, improves the soil structure leading to an increase in water and nutrient holding capacities of soil.

4.4.1. Vermicomposting compared to traditional composting

Although there are similarities between traditional composting and vermicomposting there are quite distinct differences that can make it suitable and advantageous for municipal application.

The main advantage is that it mainly processes food waste, which will actively reduce the food waste component reaching landfill. Furthermore, it can be implemented through various methods and can easily be implemented on a small scale and expanded as the demand increases.

4.4.2. An overview of vermicomposting systems

Although there are numerous vermicomposting systems, they are categorized into three basic types that will be highlighted for the purpose of this report, with each type having a number of variants:

- Windrows
- Beds or bins
- Flow-through reactors.

Windrows and bins can be either batch or continuous-flow systems, while all flow-through systems, as the name suggests, are of the continuous-flow variety.

Compost worms need five basic things:

1. A hospitable living environment, usually called “bedding”;
2. A food source;
3. Adequate moisture (greater than 50% water content by weight);
4. Adequate aeration;
5. Protection from temperature extremes.

4.5. Home composting

The SBM initiated a home composting project in 2019 in which households were encouraged to receive a 150 litre prefabricated composter at no cost and to be used to divert household food wastes and green to be composted and used in the garden.

The system is relatively simple and requires very little maintenance other than to mix up the compost every few weeks to keep aerated and hot. The process takes in the order of three months before compost is harvested. The next cycle can then begin with a starter layer of some of the previous compost.

The uptake to date is in the order of 560 households in various towns within the Municipality. A sample of the households using the composters were recently surveyed by email and the response, although relatively low, was overwhelmingly positive and is seen as having a long-term potential for the diversion of household organic wastes.

The 2021 waste characterisation study results indicated that of the 900 households sampled the average food waste generated was 1,71 kg/week or 89 kg/year. A 150 litre composter is estimated to produce in the order of 51kg every three months or 204kg/annum. Thus it can be expected that all food waste generated in a household can be composted with spare capacity for small amounts of greens.

4.6. Conclusions

Other technologies which can be used for the treatment of organic wastes, such as incineration, mechanical biological treatment, pyrolysis are not considered as they clearly would not be viable for SBM due to the low quantities generated and the capital and operating costs of the technologies.

Based on the quantity of organics generated in SBM which still need to be diverted and costs, the preferred option for treatment of organic green wastes should be windrow composting with the addition of home composting for separated household food wastes at source. The option of vermicomposting can be considered as a medium to long term goal and would require further investigations and piloting. The small amounts of condemned foods, some 0.4% of total organic wastes generated in SBM, can also be composted under controlled operations.

The quantity of green waste currently being generated in SBM is in the order of 10,380 tons/annum or 40 tons/day of which some 6,5 tons/day is already being diverted by chipping and composting. As the quantity of green waste is less than 100 tons/day the Norms and Standards are applicable, and a treatment facility needs only be registered with DEAD&P 90 days prior to construction.

The areal requirements for a compost facility to treat some 40 tons/day would be in the order of 3 hectares and the addition of say a 25 m buffer would double the size requirement. This facility should ideally be located at Vredenburg, where the bulk of green waste is generated or received from the mini transfer stations.

Furthermore, the separation of organic wastes in the commercial sector such as food wastes, condemned food etc, should also be strongly encouraged.

The development and operation of a composting facility can be undertaken either by the municipality or the private sector. The privately owned and operated compost facility at the Langebaan transfer station has been registered under the Norms and Standards and is currently buying in the order of 30 tons/month of chipped greens from SBM and has the capacity of some 200 tons/month.

Currently the SBM undertakes the chipping of garden waste at Langebaan and at Vredenburg (under contract) and the option of outsourcing the entire management of green waste should be seriously considered. The service provider would be responsible for chipping, transportation and composting of all green waste generated in the SBM, developing a market for the end product and ensuring that the diversion rates for green wastes is sustained.

5. Organic Waste Diversion Plan

5.1. Goals and objectives

The Status Quo and Gap Analysis now provides the opportunity to develop an OWDP, prioritised in accordance with resources and budgetary constraints.

The OWDP will endeavour to achieve the following goals with objectives;

Goal 1:	Waste Prevention - Reducing the Generation of Organic Waste	**Objective 1:** Reduce and prevent all organics waste going to landfill in accordance with national directive **Objective 2:** Develop research and capacity for commercial sector reduction of food wastes. **Objective 3**: Improved waste minimisation strategies for diversion at source.
Goal 2:	Recover resources from the organic waste stream	**Objective 1**: Regulating and enforcing organic waste management with bylaws. **Objective 2:** To develop incentive schemes to encourage diversion of organic wastes at source. **Objective 3**: To promote and support private resource recovery initiatives. **Objective 4**: Develop partnerships within SBM departments to manage and recover organic waste from waste stream effectively.
Goal 3:	Support resource recovery infrastructure	**Objective 1**: To maintain and improve existing resource recovery infrastructure. **Objective 2**: To identify future needs and plan accordingly **Objective 3**: To promote and support private organic waste treatment process initiatives.
Goal 4:	Improving waste information management	**Objective 1**: Maintain systems for identifying and measuring the generation of organic waste. **Objective 2**: To establish a system to accurately determine the diversion and beneficiation of organic waste **Objective 3:** : Developing reporting protocol for large industrial and commercial generators of organic wastes
Goal 5:	Promoting awareness and education	**Objective 1**: Improved public awareness and education ultimately leading to behaviour change. **Objective 2:** To build capacity within the SBM to implement and monitor the OWDP

Table 14 - SBM OWDP Goals and Objectives

The Provincial directive of 2018 required a 50% diversion of organic waste from landfill by 2022; and a landfill ban on organic waste to landfill by 2027. One of the strategies to achieve the ban was done through the variation of the waste management licences for landfills the addition of the following conditions:

- "2.6. Organic waste is allowed to be disposed of at the Facility but must be in accordance with the Organic Diversion Plan, targets and procedures referred to in condition 18.10 and 18.11 of the Licence.
- 18.10. The Licence Holder must submit an Organic Waste Diversion Plan to the Director 90 (ninety) days after the issue of this Licence and annually thereafter.
- 18. 11. The information within the Organic Waste Diversion Plan must:
  - Provide a status quo of current organic waste sources and volumes disposed at municipal WDFs, and current rates and procedures of organic waste diversion from WDFs: and
  - Set annual targets and identify procedures from 2018 that will be implemented to meet these targets for the diversion of organic waste from municipal WDF, to reach a 50% diversion by the year 2022 and 100% diversion by the year 2027."

The average quantity of organic waste being generated over the last year in SBM is estimated at 28,810 tonnes per annum of which 41.4% or some 12,900 tons is already being diverted. At the beginning of 2022 when aquaculture waste will not be accepted at landfill, the overstated quantity of clean waste to

landfill is revised and the current increased rate of chipping of clean garden waste continues the diversion rate is expected to be at 46%.

In order to meet the diversion rate of 50% by 2022 a further 4,0% of organic waste must be diverted. This amounts to some 1,200 tons/annum and could be best accomplished by increasing the chipping of clean garden waste from the current quantity of 1,713 tonnes/annum to about 2,913 tonnes/annum.

5.2. High level Costing

A high level costing of the various options that have been proposed is presented below based on similar projects. In addition the indicative costs of some of the medium and advanced waste treatment technologies have been extracted from various reports[2] and are tabulated in order of magnitude of cost per tonne to be treated.

5.2.1. Compost Facility

An open windrow system to process 11,000 tonnes per annum, requiring in the order of 4,3 hectares excluding buffer. Providing for equipment including chipper, small compost turner, screen and bagging system.

Capital Cost	R	20,250,000
Equipment Cost	R	3,400,000
Total	**R**	**23,650,000**
Annual Operating Cost	R	1,200,000

Table 15 - High level cost for development and operation of a compost facility

5.2.2. Home composting

The home composting costs are primarily the cost of the prefabricated compost unit and distribution. An estimated cost of the savings that would be made from avoiding collection and landfilling of the waste has been made using a global rate from previous projects. A simple write-off over 8 years will cover the cost of the unit. A target has been set to cover all middle and high income households within 7 years i.e., by end of 2028, that is 2,500 households per annum. This is ambitious but does give an indication of the capital costs.

Item	Unit Cost	Unit
Composter unit	R 750	each
Average quantity of organic diversion	200	kg/year
Cost of transport and disposal to landfill *	R 500	/ton
Savings on diversion	R 100	/year
Return period on investment	8	years
Target number of households	17,500	no
Program duration	7	years
No. of households per annum	2,500	no
Additional diversion per annum	500	tonnes
Capital cost per annum	**R 1,875,000**	

* The average cost of transport and disposal is estimated from the cost of transport and the cost of landfilling should the waste be collected and taken to landfill.

Table 16 - High level Cost for implementation of home composting system

5.2.3. Public Awareness

Public awareness programmes are generally undertaken by internal staff in a municipality and the cost would already be provided for, however for the purposes of this report an estimate of the cost has been made. Reference should also be made to the IWMP. The costs are based on a fulltime communication officer;

[2] *Appropriate Technology for Advanced Waste Treatment-Guideline, Department of Environmental Affairs – 2014 and George Local Municipality Waste Minimisation Plan , 2021, Gibb.*

- preparing and presenting awareness campaigns at schools, at community level, businesses and on specific days dedicated to the environment.
- follow up surveys to determine the level of knowledge of the campaigns and their efficacy.
- preparing of leaflets and pamphlets and reporting,
- align with integrated waste minimisation campaigns and provide updates on social media, including recycling tonnages reports or hints and tips on waste minimisation and recycling in the home.

The estimated cost is in the order of R500,000 per annum.

5.2.4. Indicative costs of alternative technologies

Technology	Indicative cost/ton
Windrow Composting	R 464
Home composting	R 469
Enclosed composting "in vessel"	R 675
Anaerobic digestion	R 6,700
Incineration	R 19,640

Table 17 - Indicative costs of alternative technologies

5.3. Implementation Plan

The implementation plan is presented over in a table format. A timeline and priority have been assigned to each task. These tasks should be reviewed annually by the SBM and amended or adjusted accordingly.

There are five tables as follows, each with a set of tasks with suggested timeline and priority.

Table 1	Reducing the generation of organic waste
Table 2	Recover resources from the organic waste stream
Table 3	Support resource recovery infrastructure
Table 4	Improving waste information management
Table 5	Promoting awareness and education

Table 18 - Implementation Plan Tables

- In order for the SBM to be able to meet the target of 50% by 2022 it will need to increase the current diversion (chipping) of clean garden waste to 52%, and thereafter this rate will have to be increased to 100% by 2027.
- The remaining 40% comprises garden waste and food waste in the collections and will need to be addressed in the plan in order to get to zero organics to landfill by 2027.
- The reduction of garden waste in collections will require more public awareness and possibly disincentives that penalise disposing of garden waste into the household bin. An option would be to get households to mix with their food waste in the home composter. It's estimated that some 63kg/annum of garden waste is placed in the collection bin per household.
- The diversion of food wastes is expected to be a medium to long term goal requiring public awareness and education for separation at source and home composting. The home composting system is considered to have excess capacity and could absorb the garden waste households are currently placing in their collection bins.
- The small quantities of nuisance wastes (animal carcases) and condemned food, 0.5% of organics generated in SBM or 144 tonnes per annum, can be absorbed into a properly

managed compost facility. Alternatively an enclosed composting system can be considered but may not be warranted for the small tonnage being generated.

- Collaboration with the commercial sector is required to find incentives or disincentives to reduce the amount of organic waste generated and disposed of and in particular food retailers to adopt mitigating measures to avoid generating condemned foods.
- The promotion of separation of food wastes and garden wastes at household level for home composting is a commendable option and is becoming prominent in most municipalities' endeavouring to divert their organics, however it needs full cooperation from all households in SBM to be successful and this would be a long-term commitment. As an alternative consideration should be given to providing a collection system for source separated organics, similar to the current recyclable collection system. A feasibility study would look at the types of vehicles required, the type of container required at household and the areas and routing to be prioritised.

5.3.1. Constraints

There are clearly financial and resource constraints for the implementation of a number of proposals/projects that would greatly assist in the management and diversion of organic wastes. Current staff are overburdened with their day-to-day operational duties and any new projects, operations and facilities added yearly cannot be sustainable without increasing staff and budget.

The current implementation plan recognises this by trying to remain practical and be achievable, with the resources available.

A number of activities in the tables have been highlighted to indicate that without additional human resources or finances the SBM would realistically be unable to implement them within the next 4 to 5 years. The activities highlighted in indicate human resource capacity constraint and activities in indicate budget constraints.

5.3.2. Resource requirements

The SBM has identified the need for additional staffing to be dedicated to critical areas of their solid waste management system as follows;

- Awareness, communication, data management
- Special projects.
- Project implementation, monitoring and reporting

The first two tasks would require persons at a technician or senior administrative level. The third task will require a number of personnel to assist the SBM Solid Waste Managers.

Table No. 1 List of activities for the implementation and prioritisation of the REDUCING THE GENERATION OF ORGANIC WASTE over the short, medium and long term.									
IMPLEMENTATION AND PRIORITISATION PLAN									
No.	***Activity***	***Short-term***					***Medium-term***	***Long-term***	***Priority***
	TABLE 1: REDUCING THE GENERATION OF ORGANIC WASTE	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**	**2026-2030**	**2031-2040**	**High (H) Medium (M) or Low (L)**
1.1	Develop research and capacity for the commercial sector to reduce the amount of organic wastes generated including condemned foods by retaining responsibility for their waste and adopting management initiatives to avoid spoilt food. These would include; • Aquaculture harvesting methods • For condemned food waste, carefully review status and to minimise edible food going to waste and allow for distribution to the needy.								H

Table No. 2 List of activities for the implementation and prioritisation of the RECOVER RESOURCES FROM THE ORGANIC WASTE STREAM over the short, medium and long term.									
IMPLEMENTATION AND PRIORITISATION PLAN									
No.	***Activity***	***Short-term***					***Medium-term***	***Long-term***	***Priority***
	TABLE 2: RECOVER RESOURCES FROM THE ORGANIC WASTE STREAM	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**	**2026-2030**	**2031-2040**	**High (H) Medium (M) or Low (L)**
2.1	Revise and enforce the muncipal Integrated Waste Management By-law to regulate organic waste management.								**H**
2.2	Enforce regulatory requirements to ban organic wastes from landfill.								**H**
2.3	Review and determine feasibility of separation at source collections. Investigate vehicle requirements, container types, routes etc. and decentralisation of operations. Differentiate between Residential and Commercial needs and methods			R250,000 (Study)					M
2.4	Increase the diversion of clean garden waste and foodwaste from landfill by seperation at all facilities and will include the ban on disposal of organic wastes at drop-offs if not seperated at the facility.								H
2.5	The option of developing an enclosed composting system at Langebaan Transfer Station for condemned foods to be investigated, including legislative requirements for registration of a facility in accordance with N&S's								

Table No. 2 List of activities for the implementation and prioritisation of the RECOVER RESOURCES FROM THE ORGANIC WASTE STREAM over the short, medium and long term.

IMPLEMENTATION AND PRIORITISATION PLAN

No.	*Activity*	*Short-term*					*Medium-term*	*Long-term*	*Priority*
	TABLE 2: RECOVER RESOURCES FROM THE ORGANIC WASTE STREAM	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**	**2026-2030**	**2031-2040**	**High (H) Medium (M) or Low (L)**
2.6	Institute an incentive system using tariffs/penalties for receiving clean organic waste at SBM facilities.								H
2.7	Develop internal municipal partnerships with other departments to implement and monitor OWD projects.								H
2.8	To encourage the separation of food wastes by businesses for processing as animal feed. This is already implemented at a large scale by Sea Harvest. A detailed survey of businesses should be undertaken, and animal feed processing investigated.								M
2.9	Aligning with Activity 4.5 Businesses to take ownership of their organic wastes and ensure that they are properly treated. Options to consider would include on-site small scale anaerobic digestors or enclosed composting.								M
2.10	Develop and implement a pilot study for a school composting project attached to food gardens								M
2.11	To increase the participation in the home composting project (bins)			R750 000	R750 000	R750 000	R2 250 000		**H**

Table No. 3 List of activities for the implementation and prioritisation of the RESOURCE RECOVERY INFRASTRUCTURE over the short, medium and long term.

IMPLEMENTATION AND PRIORITISATION PLAN

No.	*Activity*	*Short-term*					*Medium-term*	*Long-term*	*Priority*
	TABLE 3: RESOURCE RECOVERY INFRASTRUCTURE	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**	**2026-2030**	**2031-2040**	**High (H) Medium (M) or Low (L)**
3.1	Assess advanced organic waste treatment processes and determine their viability in the SBM.								**M**
3.2	Promote and assist in the development of a compost facility to serve SBM.								**H**
3.3	Provide food waste collection bins at all public drop-offs and transfer station and develop a separate area for garden waste.								**H**
3.4	Assess infrastructural requirements for additional transfer stations if decentralisation and increased separation at source is implemented.								**M**

Table No. 4 List of activities or the implementation and prioritisation of the WASTE INFORMATION SYSTEM over the short, medium and long term.

IMPLEMENTATION AND PRIORITISATION PLAN

No.	*Activity*	*Short-term*					*Medium-term*	*Long-term*	*Priority*
	TABLE 4: WASTE INFORMATION SYSTEM	21/22	22/23	23/24	24/25	25/26	2026-2030	2031-2040	High (H) Medium (M) or Low (L)
4.1	Undertake waste characterization studies every 3 years to measure the impact of implementing the organic waste diversion plan and in particular the home composting program.								**M**
4.2	Regularly update demographics to measure the change in waste generation rates using population and quantities received at the SBM facilities.								**H**
4.3	Review compliance of OWDP's and report annually on diversion rates.								L
4.4	Establish effective procedures for logging organic waste generation in SBM and reporting including Industry reporting and registration.								**H**
4.5	Develop a protocol for large producers of organic waste in SBM to prepare Organic Waste Diversion Plans. • Develop/update a list of large producers of organic waste in the SBM • Develop a template for the organic waste diversion plans								**M**

Table No. 4 List of activities or the implementation and prioritisation of the WASTE INFORMATION SYSTEM over the short, medium and long term.									
IMPLEMENTATION AND PRIORITISATION PLAN									
No.	***Activity***	***Short-term***					***Medium-term***	***Long-term***	***Priority***
	TABLE 4: WASTE INFORMATION SYSTEM	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**	**2026-2030**	**2031-2040**	**High (H) Medium (M) or Low (L)**
	• Amend by-law to require large waste generators to prepare organic waste diversion plans • Notify business and industry of the requirement to prepare plans • Set a deadline for business/ industry to submit plans and then request annual reports on the implementation of plan								

Table No. 5 List of activities or the implementation and prioritisation of AWARENESS AND EDUCATION over the short, medium and long term.									
IMPLEMENTATION AND PRIORITISATION PLAN									
No.	***Activity***	***Short-term***					***Medium-term***	***Long-term***	***Priority***
	TABLE 5: AWARENESS AND EDUCATION	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**	**2026-2030**	**2031-2040**	**High (H) Medium (M) or Low (L)**
5.1	Review SBM Education/Awareness and Marketing strategy with specific inclusion/targeting of Organic Waste Diversion		▬						**M**
5.2	Promote the use and increase the awareness of SBM's mulch/compost program.		▬						**H**
5.3	Develop organic waste education and awareness material that can be uploaded onto the municipality's website or handed out as pamphlets.						▪ ▪ ▪		**H**
5.4	Develop a training course and training materials on how to use a home composting bin. Hold workshops with the community.						▪ ▪ ▪		**H**
5.5	Prepare marketing materials in the form of video/DVD promoting Organic Waste Diversion for the Schools program.						▪ ▪ ▪		**M**
5.6	Training municipal employees and making them aware of Organic Waste Diversion and how it is to be implemented.						▪ ▪ ▪		**M**

6. Monitoring and Assessment

The OWDP should be treated as a living document and updated to reflect changes in the status quo as well as changes in legislation.

The NWMS 2020 requires annual reporting systems to review progress from DEAD&P and it would therefore be necessary for SBM to similarly comply and a review of the OWDP should be undertaken to determine the implementation of the plan. Where projects have not been implemented within the given timeframes or the reduction targets set by national and provincial government have not been attained, reasons must be given. The annual progress report will be submitted to PGWC.

Monitoring activities that should be considered, include:

General Issues

- Rates of generation of waste, verified by the waste information system;
- Reporting to the Provincial Waste Information System;
- Legislation, regulations and by-laws are in place and ;
- Reporting of waste minimisation programmes and projects;
- Achievement of targets for prioritised waste streams.;

Organic waste diversion

- Annual reports on organic waste diversion programmes and projects;
- Information exchange between stakeholders;
- Management of private contractors

In order to implement this Organic Waste Diversion Plan and achieve its goals it is extremely important to understand that although the willingness to implement is evident, there are real constraints on a municipality to actually implement a plan successfully. The two underlying factors are;

- Limited finances for capital projects
- Human resources

The limited finances the municipality has are already funding critical service delivery such as water, sanitation, electricity and roads as well as housing and waste management is not always a priority. It will therefore be essential that funding is secured to implement the plan in order that the SBM can meet the national and provincial governments legislated mandatory organic waste diversion rates of 50% by 2022 and 100% by 2027.

The capacity of the resources available to the municipality, human and equipment, are generally stretched and the implementation of this Plan, as well as the SBM's IWMP will require additional resources for Special Projects, Awareness and Education and Data Management in order to succeed.

Finally, it will be important that this Plan is read with SBM's IWMP in order to ensure that they align with each other.